Study on Energy Taxation Indicators

FINAL REPORT

ECONOMISTI ASSOCIATI

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Final Report

Volume 1 Main Text

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Abstract

This Study was prepared for the European Commission – Directorate General for Taxation and Customs Union to assess the state of the art of indicators of energy taxation, and to formulate recommendations on how to improve them, in view of the European policy priorities (including the Green Deal) and the European Semester process. A number of energy taxation indicators have been developed over time, but their relevance and significance has been increasingly challenged by the emergence of new policies, and in particular on climate change. At the same time, the indicators in the latter area are more complex and debated. The Study also addresses four policy questions on the measurement of revenues from energy taxation, the most appropriate methodologies to identify effective tax rates, the role of energy taxation in sending carbon price signals, and the coherence of energy taxation with the other EU energy policy objectives (energy efficiency, security, affordability, and air pollution). A set of general recommendations for both short-term and long-term actions is then proposed, as well as more specific indications to address possible information needs within the framework of the EU Semester.

Resumé

Cette étude a été préparée pour la Commission Européenne - Direction Générale de la Fiscalité et de l’Union Douanière, afin d’évaluer l’état technique des indicateurs de taxation énergétique et de formuler des recommandations sur la façon de les améliorer, compte tenu des priorités de la politique européenne (Pacte Vert inclus), et dans le cadre du Semestre Européen. Un certain nombre d’indicateurs de taxation énergétique ont été élaborés au fil du temps, mais leur pertinence et leur importance ont été progressivement remises en question par l’émergence de nouvelles politiques, notamment en ce qui concerne le changement climatique. Dans ce domaine, les indicateurs sont d’ailleurs plus complexes et débattus. Cette étude aborde également quatre questions stratégiques concernant la mesure des recettes provenant de la taxation énergétique, les méthodes les plus appropriées pour déterminer les taux de taxation effectifs, le rôle de la taxation énergétique dans l’envoi de signaux-prix du carbone, et la cohérence de la taxation énergétique avec les autres objectifs de la politique énergétique de l’UE (efficacité, sécurité, coût et pollution atmosphérique). Un ensemble de recommandations générales pour des mesures à la fois à court et à long terme est ensuite proposé, ainsi que des indications plus spécifiques pour répondre aux éventuels besoins d’information dans le cadre du Semestre Européen.

Kurzdarstellung

Diese Studie wurde für die Europäische Kommission – Generaldirektion Steuern und Zollunion erstellt, um den aktuellen Stand der Indikatoren zur Energiebesteuerung zu bewerten und Empfehlungen zu formulieren, wie diese im Hinblick auf die europäischen politischen Prioritäten (einschließlich des Grünen Deals) und den Prozess des Europäischen Semesters verbessert werden können. Im Laufe der Zeit wurden eine Reihe von Energiesteuerindikatoren entwickelt, deren Relevanz und Bedeutung jedoch durch das Aufkommen neuer politischer Maßnahmen, insbesondere im Bereich des Klimawandels, zunehmend in Frage gestellt wird. Gleichzeitig sind die Indikatoren im letztgenannte Bereich komplexer und umstrittener. Die Studie befasst sich weiters mit vier politischen Fragen zur Messung der Einnahmen aus Energiebesteuerung, den geeignetsten Methoden zur Ermittlung effektiver Steuersätze, der Rolle von Energiesteuern bei der Aussendung von CO2-Preissignalen und der Kohärenz von Energiesteuern mit anderen energiepolitischen Maßnahmen der EU (Energieffizienz, -versorgungssicherheit, -erschwinglichkeit und Luftverschmutzung). Anschließend wird eine Reihe allgemeiner Empfehlungen sowohl für kurzfristige als auch für langfristige Maßnahmen, sowie spezifischere Hinweise zur Deckung eines möglichen Informationsbedarfs im Rahmen des EU-Semesters, vorgeschlagen.

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Abbreviations and acronyms

ACER/CEER	Council of European Energy Regulators
CPG	Carbon Pricing Gap
CO_2	Carbon Dioxide
CO_2eq	GHG impact equivalent to one tonne of Carbon Dioxide
DG ENER	Directorate General for Energy
DG ENV	Directorate-General for Environment
DG GROW	Directorate General for Internal Market, Industry, Entrepreneurship and SMEs
DG TAXUD	Directorate General for Taxation and Customs Union
ECP	Effective Carbon Price
ECR	Effective Carbon Rate
EDT	Excise Duty Tables
EEA	European Environment Agency
ETD	Energy Taxation Directive
ETS	Emissions Trading System
ETR	Effective Tax Rates (OECD’s indicator)
EU	European Union
EUA	European Union Allowance (the climate credit representing the unit of operation of the ETS)
GDP	Gross Domestic Product
GHG	Greenhouses Gas. Please note that, throughout the report, “carbon”, as in “carbon emissions” is used as a synonym to GHG, in line with the approach used by the sources consulted.
GJ	Gigajoule
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IMF	International Monetary Fund
IPPC	Intergovernmental Panel on Climate Change
ITR	Implicit tax rates
kJ	Kilojoule
kWh	Kilowatt-Hour
LPG	Liquefied Petroleum Gas
MWh	Megawatt-Hour
NACE	Nomenclature Statistique Des Activités Economiques Dans La Communauté Européenne
NO_X	nitrogen oxides
NTL	National Tax List
OECD	Organisation for Economic Cooperation and Development
PEFA	Physical Energy Flow Accounts
PINE	Policy Instruments for the Environment
PM	Particulate matter
PPP	Purchasing Power Parity
RES	Renewable Energy Source(s)
SO_X	Sulphur Oxides
TEU	Taxing Energy Use
TOE	Tonne of Oil Equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
VSL	Value of a Statistical Life
WB	World Bank

1. INTRODUCTION

Nature of the Report. This Report was prepared within the framework of the Study on Energy Taxation Indicators, based on the contract No. TAXUD/2019/CC/150 signed on 16 December 2019. The Report is submitted to the European Commission, Directorate General for Taxation and Customs Union (DG TAXUD or the 'Client') by a grouping of consulting firms led by Economisti Associati and including Nomisma Energia (hereinafter collectively referred to as 'the Consultant').

Purpose and Structure of the Report. This Report identifies, describes and critically appraises available indicators for assessing the level and design of energy taxation in the EU Member States. It describes their relative advantages and drawbacks and provides some elements of clarity on the underlying methodological concepts, and related strengths and limitations for policymaking purposes. This is done with particular regard to their possible future utilisation within the framework of the European Semester in a scenario of increased emphasis on climate change polices. In doing so, the limitations currently encountered in monitoring existing EU energy taxation-relevant policies from the viewpoint of data availability will also be described, as these represent an important source of information on existing data gaps.

The Report is structured as follows:

- Section 2 describes the methodology and the data collection strategies implemented during the Assignment;
- Section 3 depicts the policy context in which this Study and the interest on energy taxation indicators is embedded, and in particular the European Green Deal and the European Semester;
- In Section 4, the review of existing indicators is presented, by describing the main families of indicators, together with a summary review of their main features and related strengths and weaknesses. The review is based on the methodology and the appraisal frameworks described in Section 2;
- Section 5 introduces the definition of energy taxation and the limitations of the available data;
- Section 6 provides the answer to the four policy questions on revenue indicators, implicit and effective tax rates, carbon pricing, and indicators of coherence with other EU policy objectives (e.g. energy efficiency, security, availability, air pollution)[1].
- Section 7 recaps the existing information gaps, as discussed with stakeholders and in the literature, highlights likely future developments and draws proposals for possible future Commission action in this area.
- Section 8 summarises the Study conclusions and recommendations.

Two volumes are annexed to this Main Text. Volume 2 – Annexes, includes:

- The energy tax indicator factsheets, with their full appraisal, in Annex A;
- The assessment of national energy indicators, in Annex B;
- The detailed answer to the four policy questions, in Annex C;
- The list of references, in Annex D.

Volume 3 – Technical Annexes, includes:

- The list of interviewees and workshop participants, in Annex I;
- The documents for the workshop, in Annex II;
- The questionnaire for Member States, in Annex III;
- The synopsis of the written survey, in Annex IV.

[1] In line with these policy questions and the design of the Terms of Reference, carbon dioxide and other greenhouse gas emissions are treated under the area of carbon pricing, while other air emissions under the area of coherence with air pollution reduction.

2. TASKS AND METHODOLOGY

This study was articulated into four tasks:

1. the identification of existing energy taxation indicators,
2. their assessment via an appraisal framework,
3. a workshop with Member States representatives, and
4. a finalisation stage, including interviews with the main indicator producers.

To carry out these tasks, the study was based on a combination of four main methodological tools:

- extensive desk research,
- an interactive discussion with representatives from Member States via a workshop and a written questionnaire;
- targeted interviews with international and European organisations producing energy tax indicators, and
- a finalisation phase to assess the feasibility of amending existing indicators or of introducing new ones, also in view of the European Semester.

2.1. Indicator appraisal framework

Energy tax indicators have their purpose and were relevant when they were conceived. In some cases, they have been put in place with a large effort by the international statistical community and have then been developed and improved over a number of years. While taking this into account, ***this Study assesses the extent to which existing energy tax indicators are in line with the current evolving policymakers' needs***, and in particular can provide an analytical framework to assess whether and to what extent the fiscal system contributes to certain policy goals, namely those enshrined in the EU Green Deal[2] strategy.

To highlight information gaps from the policymaker's perspective in the light of the new policy needs, existing energy taxation indicators have been evaluated against a framework developed by the Consultants and refined based on the comments received from the Inter-Service Group and the reviewers. The appraisal framework was further validated during the workshop and the targeted interviews.

The appraisal framework is based on both policy and analytical principles. For the former, the criteria to assess the indicators have been selected in line with the ***policy priorities*** and ***policymakers' information needs****.* This allows verifying the potential or actual use of existing indicators in policymaking, and identifying information gaps, to be possibly filled in by additional indicators. The analytical criteria concern the ***soundness*** of the indicator and its usefulness in timely ***measurement*** of policy-relevant phenomena by providing complete and comparable information on them.

The proposed assessment framework has been built upon a model originally proposed by the Organisation for the Economic Development (OECD)[3], according to which indicators should be evaluated against three basic quality criteria, and further accounting for Eurostat's work on the subject[4]. These criteria are:

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[2] Communication from the Commission, The European Green Deal, COM(2019) 640, 11.12.2019; hereinafter 'European Green Deal'.
[3] OECD, *Towards Green Growth: Monitoring Progress*, Organisation for Economic Co-operation and Development, Paris, 2011.
[4] See among others Eurostat, *Towards a harmonised methodology for statistical indicators Part 1: Indicator typologies and terminologies*, 2014.

1. ***policy relevance***: indicators need to address issues that are (actually or potentially) relevant to policymaking;

2. ***analytical soundness***: indicators should be based on the best available statistical data and methodologies and should be robust to assumptions for them to be reliable and widely accepted;

3. ***measurability***: indicators need to reflect reality on a timely and accurate basis and be measurable at a reasonable cost. For use at the EU level, comparability and harmonisation aspects are also key as the definitions used and the data provided need to allow meaningful cross-country comparison.

The assessment criteria used for this report have been expanded to consider multiple judgment criteria, and several possible ways of measuring and ranking them based on a set of critical questions, as shown in the Table 1 below.

Table 1: General appraisal framework for energy taxation indicators

Key Indicator Features	Judgment Criteria	Ways of Measurement	Critical Questions
Policy relevance	What are the goals of the indicator? What does it aim to highlight?	Policy Relevance	▪ Does the indicator relate to important policy debates? Is there consensus among policymakers / stakeholders on the issues worth monitoring?
		Non-Ambiguity	▪ Are the concepts used clearly defined? Or are there areas of ambiguity in definitions?
	Is the indicator helpful to highlight a clear need for intervention or to monitor existing policies?	Responsiveness	▪ Does the indicator correctly reflect change in underlying policies? ▪ Is it possible to change the indicator (only) by means of policy action? ▪ Are there benchmarks / reference points available to define the adequacy of underlying policy?
		Comprehensiveness	▪ Is the indicator unambiguous in its interpretation about the existence / magnitude of policy needs / outcomes of existing policies? ▪ Does the indicator need to be integrated/complemented by other indicators to cover other concurrent aspects?
Analytical soundness	Is the indicator technically robust and based on reliable data?	Analytical Soundness	▪ Does the indicator directly measure the problem?
		Robustness in assumptions	▪ To what extent is the indicator sensitive to changes in underlying assumptions?
		Robustness over time	▪ Is the indicator consistent over time, and what is the resulting uncertainty? ▪ Is the indicator consistent with other similar indicators referred to the same period?
	Does the indicator have a transparent methodology?	Transparency	▪ Has the methodology been published? ▪ Is the indicator fully replicable by third parties based on available public data or does it depend on hidden/proprietary variables?
	Has the indicator been proposed by a reliable source?	Communicability	▪ Can a layman understand how the indicator has been built?
		Credibility	▪ Does the indicator come from a credible source?
		Independence	▪ Are the indicator inputs validated by an independent statistical entity or provided by Government sources?

Measurability	What is the geographical coverage?	Geographical Coverage Intra EU Comparability Extra EU Comparability	▪ Are all EU Member States covered? ▪ Is coverage homogenous between Countries or are there differences in indicator composition / data availability? ▪ Are comparisons available / possible with third countries?
	What is the timing and frequency of the indicator?	Frequency Timeliness Regularity Sustainability	▪ What is the time period of the indicator? ▪ How quickly can policy results be expected to materialise ▪ Has the indicator been released just once on a pilot basis, or is it published / updated at regular intervals? ▪ Can it be reasonably deemed that the indicator is sustainable and will be also available in the future?
	What is the scope of the indicator?	Completeness Level of detail Range of available versions	▪ Is it feasible to include in the indicator all the items that are deemed necessary? ▪ If not, what is the degree of coverage of the requested items? Is the indicator available at the requested level of disaggregation? ▪ Is the indicator available upon request in multiple versions (e.g. both with and without certain optional or controversial items?

2.2. Data collection strategies

Desk research. The desk research focused on the ***indicators produced at the international level*** by Eurostat and other Directorates-General (DG) of the European Commission, the OECD, the International Monetary Fund (IMF) and the World Bank (WB), as well as the indicators being developed by relevant EU-funded research projects. These institutions represent the most authoritative sources that usually produce and maintain indicators over time. As will be seen further in this report, the complementary work carried out by agencies like the International Energy Agency (IEA) and the Council of European Energy Regulators (ACER/CEER) has also been reviewed. The series of studies carried out over the last few years for the various DGs of the European Commission – including TAXUD - have been analysed in great detail, as they provide extensive information on *quasi-indicators* that were produced on an *ad hoc* basis to fill concrete information gaps and highlight the existing limitations in data availability from official sources. Evaluations and impact assessments of EU energy and climate policies have also been surveyed.

Energy taxation indicators are a subject that has attracted limited attention in the ***academic literature,*** in particular overlooking the use of those indicators in macroeconomic analysis[5], with the notable exception of carbon prices and their relation with energy taxation that has been analysed in more extensive detail. Therefore, most of the review of the existing literature has been used to comment on the relationship between energy taxation and other aspects of energy policies rather than as sources of information *per se* on additional indicators or for gathering ideas about proposals on the need for indicator refinement and improvement[6].

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[5] With notable exceptions, such as Costantini V. and M. Mazzanti, On the green and innovative side of trade competitiveness? The impact of environmental policies and innovation on EU exports, *Research Policy*, Vol. 41, No. 1, 2012.

[6] Over 150 documents have been consulted a complete list of reference is provided in Annex D.

Workshop and Member States survey. ***Two online workshops*** were organised on June, 5th 2020, to discuss the findings from the Interim Phase of the Assignment and collect data and information of the policy use of international indicators, perceived data gaps and needs, and use of national indicators. The two sessions were attended by more than 50 participants from 26 Member States, as well as by representatives from the European Commission[7].

To ensure the smooth functioning of the workshop and fruitful discussions, participants were provided in advance with a written policy brief[8], including: (i) the instructions for the workshop; (ii) the agendas; and (iii) the summary of the preliminary study findings and the issues for discussion. The policy brief was tailored to the different audiences composed of representatives from the Ministries of Finance in the morning sessions, and the Ministries of the Environment in the afternoon session. The workshop materials were provided jointly with a written questionnaire, which Member States could fill in and submit either prior to the workshop or afterwards. The questionnaire consists of 20 questions, grouped into seven sections[9]. The ***Member States survey*** remained open until July, 15th; 13 replies have been received, from 11 Member States[10]. Finally, between June and July, targeted interviews with European and international organisations producing international indicators were conducted. The aim was to validate the appraisal framework, gain additional information on the indicators produced, and critically assess some of the themes covered by the Assignment. The interviews covered the following institutions: (i) Eurostat; (ii) the OECD; (iii) the IMF; (iv) the WB; and (v) IEA[11]. The interviews were based on a semi-structured list of themes for discussion, which was tailored for each counterpart.

[7] Full list of participants is provided in Annex I.
[8] Provided in Annex II.
[9] Provided in Annex III.
[10] A synopsis of the survey is provided in Annex IV.
[11] The list of interviewees is provided in Annex I.

3. POLICY CONTEXT

This section briefly introduces the policy context in which this Study is embedded, i.e. the EU climate strategy, which determines the need to monitor the "greening" of the national fiscal system, and the European Semester, in which (part of) this monitoring process could be embedded.

3.1. The EU climate strategy

The importance of energy and climate change policies has been escalating rapidly in the agenda of the EU, with ambitious Greenhouse Gas (GHG) emission reduction objectives set in a number of policy initiatives, lastly culminated in the ***European Green Deal***. The European Green Deal is a "new growth strategy" to "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of GHG in 2050 and where economic growth is decoupled from resource use", while at the same time ensuring fairness and inclusivity[12]. The European Green Deal builds upon the existing vision and strategies, and in particular "A Clean Planet for All"[13], dating back to 2018.

The European Green Deal aims at designing and implementing a set of ***transformative policies*** focusing on the supply of clean energy across the whole economy, decrease energy- and resource-intensiveness of EU industries, reducing carbon emissions and energy consumption of EU households – in particular from buildings and transports, as well as from the agricultural sector.

Such a policy and economic rethinking requires significant investments, which will be supported by the Sustainable Europe Investment Plan and the European Green Deal Investment Plan[14], as well by a green reorientation of the EU budget. At the same time, ***the European Green Deal aims for the "greening" of national budgets while sending the "right price signals" for reducing carbon emissions***. The European Green Deal implies redirecting "public investment, consumption and taxation to green priorities and away from harmful subsidies". To assess "to what extent annual budgets and […] fiscal policies take environmental considerations and risks into account" and to "learn from best practice", the Commission is committed to work with the Member States to "screen and benchmark green budgeting practices". Taxation can also play a direct role in contributing to the achievement of climate change policies, targeting climate change and environmental degradation, by sending "the right price signals"[15] and providing "the right incentives for sustainable behaviour". This can be achieved by reforms that could remove subsidies for fossil fuels and shift the tax burden to pollution[16].

Energy taxation will thus be increasingly called to contribute to the achievement of climate change and environmental objectives, and in this respect the European Green Deal includes the revision of the Energy Taxation Directive[17] (ETD) among its implementing actions. The review process has started, and a proposal should be adopted by June 2021. Among the problems to be tackled, the Commission acknowledged that

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[12] *Ibid.* At p.1.
[13] Communication from the Commission, A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy COM(2018) 773, 28.11.2018.
[14] Communication from the Commission, Sustainable Europe Investment Plan European Green Deal Investment Plan; COM(2020) 21, 14.11.2020.
[15] In this context, the 'polluter pays principle', enshrined in Article 191 of the Treaty on the Functioning of the EU should also be mentioned; the application of the principle is currently being audited by the European Court of Auditors.
[16] European Green Deal, at p. 17.
[17] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. OJ L 283, 31.10.2003.

the ETD is not in line with the objectives of the European Green Deal, and more specifically with those of a number of policies in this area (the EU Emission Trading System – ETS; the Renewable Energy Sources - RES directive[18] the Energy Efficiency Directive[19]). The reasons for this misalignment include that the ETD does not adequately promote GHG emission reduction. Furthermore, the mandatory and optional reductions and exemptions and the out-of-scope uses currently included in the ETD result in fossil fuel subsidies, which again go against the letter and the spirit of the European Green Deal. Therefore, the first objective of the review includes aligning EU energy tax policies with the broader EU climate, environment and energy priorities, i.a. by revising excise rates, that could be linked to the energy or carbon content of the taxed products, as well as by disincentivising fossil fuels use by means of a review of the exemptions and reductions on it[20].

Another policy mentioned in the European Green deal that would contribute to green public revenue is the carbon border adjustment mechanism. This mechanism would be used to compensate differences in climate ambitions among jurisdictions, which translate into different carbon costs. As a consequence, the carbon content of imported goods is priced less accurately compared to EU production, with possible negative impacts both on the fight against climate change and the EU competitiveness. The Impact Assessment on this mechanism and its features is ongoing, and the legislative proposal should be published by the Commission in 2021.

Several other energy and climate policies in the EU encourage Member States to consider taxation and fiscal incentives to meet European or national targets. This is for instance the case for:

- the Effort Sharing Regulation[21], which sets binding national reduction targets for sectors not covered by the ETS (e.g. transport, buildings, agriculture, non-ETS industries, waste);
- the RES Directive, which provides for a binding EU collective target and requires Member State to set national contributions to meet it;
- the Energy Efficiency Directive, which provides for both a general binding EU collective target, as well as specific targets for governments and economic operators.

The European Green Deal and the consequent re-orientation effort of both EU and national policies can rely on an information system still characterised by a ***suboptimal set of energy taxation indicators***, that were often conceived for different purposes and are now fraught with some definition and comparability issues. This represents a challenge to steer the future policy debate in comparable evidence-based terms and by using a common data language. Most energy taxation indicators currently in use are still those developed over the last two decades in a different policy environment, to collect descriptive data with a limited linkage with the current policy objectives. Rigorous compatibility with the national accounts methodology and general taxation principles was given a prominent role, even though this eventually came to be to the detriment of subsequent practical suitability for a political or instrumental use of the indicators. This

[18] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. OJ L 328, 21.12.2018.

[19] Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. OJ L 315, 14.11.2012.

[20] European Commission, Inception Impact Assessment, Revision of Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, 04.03.2020.

[21] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending_Regulation (EU) No 525/2013. OJ L 156, 19.6.2018.

is clearly not the indicators' fault, but reflects the simpler revenue-raising objective that energy taxation was given in the past political climate in most Member States (which possibly remains relevant or very relevant in some of them); tracking revenue raised still remains the less problematic use of these indicators, though with a number of caveats described in the following Sections.

Therefore, thereis ***a clear policy need calling for a review of existing energy tax indicators*** that could be used to screen and benchmark national fiscal systems or to ensure that the right price signals for carbon-emitting activities are provided, bearing in mind that Member States remain free to set (most of) their own fiscal priorities and policies. Such a screening could be best placed within the existing European Semester monitoring process.

3.2. The European Semester

The European Semester is a framework for coordinating EU Member States economic policies. Its main goals include (i) ensuring soundness of public finances; (ii) preventing macroeconomic imbalances; (iii) promoting structural reforms; and (iv) boosting investment[22]. Through the semester, Member States progress towards Europe 2020[23] targets were also monitored. As of last year, tracking progress towards the attainment of the UN sustainable development goals has also been integrated among the Semester's objectives, as put forward into the European Green Deal.

The European Semester allows the Commission – in cooperation with the other European institutions and the Member States – to determine the priorities for the EU economic policies. ***The priorities are published each November in the Annual Sustainable Growth Strategy*** and encompass economic policies in their wider sense, as they concern both budget and fiscal policies, as well as e.g. labour or sustainability issues. This document is published in November, as part of the "autumn package". Within this package, the Commission also provides its assessment of the Euro area national draft budgets, and designates Member States targeted by the macroeconomic imbalance in-depth review.

Then, in February, the Commission publishes the country reports, including the analysis of each Member States' challenges, and its progress on the reforms to tackle them. This report also displays an array of indicators, including the share of environmental taxes over total tax; as from next year, an Annex will assess the performance against the sustainable development goals. In April, the Member States submit their National Reform Programmes, as well as the fiscal Stability or Convergence programmes. Those Programmes should reflect both the priorities set in the Annual Sustainable Growth Programme, as well as the challenges and issues identified in the country reports. The Commission reviews those programmes and can propose country-specific recommendations, which are endorsed by the European Council and adopted by the Council of the EU. Recommendations reflect the priorities set for the EU in November[24].

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[22] Cf. European Commission website on the European Semester, available at: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester_en (last accessed on October, 2020).

[23] Communication from the Commission, Europe 2020, A strategy for smart, sustainable and inclusive growth, COM(2010) 2020, 3.3.2010.

[24] Cf. European Commission, the European Semester, available at https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester_en (last accessed on September, 2020).

The European Semester, which was introduced in 2010 and revamped in 2015, builds on a number of pre-existing monitoring and governance processes, spanning from economic and fiscal policy, to employment and social coordination[25]. As a consequence, the Semester is used to monitor different policies. The Commission intends to steer its use more towards sustainability aspects, as witnessed by the inclusion of the sustainable development goals and its commitment to effectively use ***the European Semester tool to ensure coherence among national climate policies***[26].

A process has been established within the European Commission to discuss the indicators for monitoring aspects related to sustainable development goals. These discussions involve Eurostat, as the provider of official EU statistics responsible for the quality of the indicators and the data provided by the Member States, and the policy DGs, In certain cases, international organisations, such as the Organization for Economic Cooperation and Development (OECD) are also part to the process[27], as it has been the case for the definition of the Eurostat's Environmental Taxation Guidelines[28].

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[25] Cf. Verdun A. and Zeitlin J., The European Semester as a new architecture of EU socioeconomic governance in theory and practice, Journal of European Public Policy, Vol. 25, No. 2, 2018.

[26] European Green Deal, at p. 23.

[27] There are collaboration arrangements between Eurostat and other producers of international statistics, notably the OECD, in line with the mandates of the two organisations and facilitating the exchange of experience and data when relevant.

[28] Eurostat, Environmental taxes. A statistical guide. 2013 Edition, Eurostat manuals and guidelines, Publications Office of the European Union, Luxembourg, 2013. Hereinafter, 'Environmental Taxation Guidelines'.

4. EXISTING ENERGY TAXATION INDICATORS

This section summarises the main findings from the review of the ***energy taxation indicators available at European and supranational level*** identified from the desk research and through the interaction with the main indicator producing organisations. It is structured into three parts. First the main types of energy taxation indicators covered by the Study are described. Then a summary assessment of their main features based on the appraisal framework described in Section 2 above is made; this is summarised in a final table in which, for each indicator, the main strengths and weaknesses are discussed across the three key features: (i) policy relevance; (ii) analytical soundness; and (iii) measurability. Finally, conclusions are drawn. Annex A in Volume 2 provides for a detailed assessment of each indicator considered

4.1. Type of indicators identified

For this Assignment, 'indicators' have been defined as broadly as possible, to ensure that the Study covers all possible information bases relevant to energy taxation and related areas. Therefore, ***the review encompasses various information sources*** and tools: indicators *stricto sensu*, quasi-indicators, reports and databases, which provide quantitative insights on energy taxes and other quasi-fiscal measures, energy products and the externalities associated to their consumption, as well as carbon pricing.

The analysis includes 32 indicators produced by EU institutions, international organisations, or stakeholder organisations[29]. The Study also investigated additional national indicators via both desk research and a written questionnaire for Member States. While Member States do use some of these European and international indicators for policymaking purposes, no new national indicator has emerged from these sources. The results of the analysis are summarised in Box 1 overleaf.

The indicators reviewed have been grouped into six main families, four of which have been – sometimes recently - mainstreamed in the energy information systems so that they are now at times produced by multiple organisations:

1) Indicators to measure ***revenues from energy taxation*** and their weight on certain reference values (typically, GDP and total taxation revenues). Measuring total revenues in absolute and relative terms was the original intention behind the establishment of energy taxation as a statistical category and these indicators allow gauging the importance of energy taxes on the economy or as generators of public revenues.

2) ***Implicit or effective tax rates***, describing the actual rates of taxation on energy consumption. Implicit and effective tax rates aim at measuring the average tax burden, net of subsidies, for a country, industrial sector, type of energy use, or fuel. They can be expressed in either volumetric terms (EUR per tonne, per 1000 litres) as a share of the price (EUR tax per EUR price, or %), or in terms of energy content (EUR per TOE, GJ, MWh)[30]. This family also includes derivative indicators calculated as the difference between two effective tax rates.

3) ***Carbon pricing tools.*** Carbon price indicators attempt to measure the price associated with carbon emissions in a given country, sector or use, as resulting from the joint effect of both energy and carbon taxes and ETS allowances. Carbon price indicators are usually expressed in EUR ($) per tonne of CO_2 equivalent

[29] Compared to the Interim Report, the list was enlarged based on the suggestions retrieved via the interviews with European and international organisations.

[30] Tonne of Oil Equivalent (TOE), Gigajoules (GJ) and Megawatthours (MWh) are three units of measurment of energy. Implicit and effective tax rates measured on a per energy content been mainstreamed over the last two decades, also to pave the way for the subsequent calculation of carbon prices.

(CO_2eq).[31] From carbon price indicators, other tools can be constructed to monitor whether and the extent to which countries are pricing carbon emissions in line with climate change objectives.

4) Another family of complementary indicators do not measure taxes, strictly speaking, but ***subsidies***, i.e. foregone taxation revenues. Subsidies can be measured (i) top-down, based on the price-gap methodology, (ii) bottom-up, by compiling a list of direct transfers and tax expenditures, or (iii) based on a pigouvian rationale (as discussed in Box 1 below).

Box 1: Approaches to measure subsidies

To measure subsidies, the most common approaches are top-down and bottom-up; the pigouvian rationale of measuring subsidies against a benchmark represented by external costs has only been introduced by the IMF:

- ***Top-down approach***: in this approach, the subsidy is calculated as the difference between the price of an energy source (e.g. the international price of oil) and local tax-inclusive retail prices (e.g. the price of gasoline). When the local retail prices are lower than international prices, a subsidy is identified. This approach is of limited relevance in the EU, as tax-inclusive prices tend to be invariably higher than international benchmarks, and better capture subsidies in oil-producing countries and emerging economies.

- ***Bottom-up approach***: the subsidy is calculated as the sum of direct transfers granted to energy producers and consumers, and foregone revenues not levied. The scope of what is considered as an energy subsidy in this case in terms of costs far exceeds that of energy taxation in terms of revenues. While the calculation of direct budgetary support should be relatively straightforward[32], matters become more complex in the field of tax expenditures, because they can only be measured against a benchmark, which can be implicit or explicit, endogenous or exogenous. Work is currently going on at the UN level to agree a common definition of tax expenditure to come to a comparable and aggregable indicator on energy subsidies. Results are expected to be finalised in the next couple of years.

- A third approach, used only by the IMF, is ***pigouvian****.* In this case, subsidies are calculated as the difference between the estimated costs of all the environmental externalities generated by the consumption of the various energy products and the actual tax rate

Other energy taxation indicators that have been introduced on a more experimental or non-continuous basis, include:

5) Pigouvian indicators of ***corrective tax rates*** that would compensate for the environmental externalities of the different energy products, thus measuring the degree of internalisation of external costs via existing taxes and charges. These indicators usually account for the external cost of carbon (climate change externalities), other air pollutants, and, for transport fuels, the costs of accidents and congestion. Corrective tax rates have been mainly developed for fossil fuels, used for electricity production or as road propellants.

6) ***Indicators from models and correlations*** that more explicitly try to address causation questions and that broadly refer to issues related to the contribution of energy or carbon taxation to the achievement of certain policy objectives (e.g. the relation between energy taxation and energy efficiency[33] or carbon intensity).

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[31] Similar indicators could also be computed per unit of air pollutants (e.g. PM, SO_X, NO_X); while none of the indicators reviewed does it, some of the components of the IMF corrective tax rates are expressed in this unit of measure.
[32] It is worth noting that some OECD Countries have reported as direct budgetary support also the allocation of free allowances under the ETS.
[33] Indicators on energy efficiency, intensity, or productivity *per se*, i.e. when not explicitly related to taxation aspects, are not covered by the Study.

Finally, the review also includes two datasets on ***energy consumption*** which could be used to build other indicators (e.g. implicit and effective tax rates). The various families and the specific indicators are listed in Table 2 below.

Table 2: Indicators reviewed, by category, source, and type

Indicator	Source	Type	EU coverage
Energy taxation revenues			
1. Revenue from Energy Taxation as a % of GDP	Eurostat	Database	EU
2. Revenue from Energy Taxation as a % of GDP	OECD	Database	EU
3. Revenue from Energy Taxation as a Share of Total Revenues	Eurostat	Database	EU
4. Energy Taxes by Paying Entities and Industrial Sector	Eurostat	Database	EU
5. Transport Fuel Taxation as a % of GDP	DG TAXUD	Reports	EU
6. Transport Fuel Taxation as a Share of Total Revenues	DG TAXUD	Reports	EU
Implicit/Effective Tax Rates			
7. Implicit Tax Rates	DG TAXUD, Eurostat	Database	EU
8. Effective Tax Rate: Taxing Energy Use	OECD	Database	44 countries (22 MS)
9. Combustion Surcharge	OECD	Reports	44 countries (22 MS)
10. Diesel Differential	OECD	Reports	44 countries (22 MS)
11. Share of Taxes on Gasoline and Diesel Fuel Prices. Oil Weekly Bulletin	DG ENER	Reports	EU
12. RES - Effective Tax Rates	CEER	Reports	23 MS
13. Natural Gas and Electricity Prices	Eurostat	Database	EU
14. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries	DG GROW	Reports	EU
15. Energy Prices, Costs, and Subsidies	DG ENER	Reports	EU
16. Energy Prices and Taxes for OECD Countries	IEA	Database	EU
Carbon pricing			
17. Effective Carbon Price	IMF	Reports	Global
18. Effective Carbon Rate	OECD	Reports	44 countries (22 MS)
19. Share of Emissions Priced at a Given Level	OECD	Reports	44 countries (22 MS)
20. Carbon Pricing Gap	OECD	Reports	44 countries (22 MS)
21. Carbon Pricing Dashboard	WB	Database	Global
Corrective Tax Rates			
22. Corrective Tax Rates on Fuels	IMF	Database	Global
23. Corrective Tax Rates on Emissions	IMF	Database	Global
24. Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities	DG MOVE	Reports	EU
Correlation and Model-based Indicators			
25. Correlation Between Energy Tax Rate / Carbon Price and Energy / Carbon Intensity of GDP	OECD	Reports	44 countries (22 MS)
Assessment of Energy Subsidies			
26. Energy Taxation and Subsidies in Europe	International Association of Oil and Gas Producers	Reports	EU (no national data)
27. Europe's Fossil Fuel Subsidies	Overseas Development Institute	Reports	10 MS
28. Support and Tax Expenditures for Fossil Fuels	DG ENV	Reports / Database	EU
29. Inventory of Fossil Fuel Subsidies	OECD	Reports / Database	22 MS
30. Total Amount of Fossil Fuel Subsidies	IMF	Database	Global
Energy consumption			
31. Physical Energy Flow Accounts	Eurostat	Database	EU
32. Purchases of Energy Product	Eurostat	Database	EU

***Source**: Authors' elaboration*

Box 2: National energy taxation indicators

The Study also aimed to provide an overview of energy taxation indicators used by the Member States. This was done to obtain an understanding of the indicators eventually used by national administrations, as well as their application and usage in policymaking and the issues associated therewith. To this purpose, two main aspects were investigated:

1) whether and how the ***indicators produced at the European and international level reviewed by this Study are being used by Member States*** authorities for policymaking purposes; and
2) whether ***other national energy taxation indicators*** have been developed and used by the Member States.

To retrieve the information about the use of energy tax indicators covered by the Study and any additional indicators, two main sources have been used: ***Member States contributions to the Study*** via the workshop and the written questionnaire, and the ***National Energy and Climate Plans*** (NECPs) submitted by Member States within the Energy Union governance system.

The overall picture that emerged from their contributions is that Member ***States are users of the existing indicators rather than developers of additional indicators***, as there are very limited instances of the latter. The few additional national indicators or analysis on e.g. carbon pricing and energy subsidies explicitly take into consideration and build upon the existing indicators developed by EU or international bodies. On the compensation for climate change and other external costs, some works had been initiated among Scandinavian countries, but this was eventually discontinued because of the need to have indicators that could be used at the European or global scale[34]. The Bank of Italy, among others, proposed an assessment of the optimal taxation of transport fuels, building upon the corrective tax rate approach that was identified in the country's economic literature[35]. Finally, in related areas, several indicators of energy affordability have been developed at national level (and then subsumed in the EU framework via the European Energy Poverty Observatory); however, none of them consider taxation explicitly[36].

4.2. Existing indicators: main findings of the appraisal

The main findings from the general appraisal framework are summarised below. Per each judgment criterion, findings are discussed for the four main categories of indicators: energy taxation revenues, implicit and effective energy tax rates, carbon pricing tools, and subsidy estimates. Comments on the other families listed above are introduced whenever relevant.

4.2.1 Policy relevance

Policy relevance. Indicators on revenues from energy taxation have been developed to measure the 'importance' of energy taxation in the economic system, therefore generically assessing how 'green' a fiscal system is. They are still extensively used for this purpose. ***However, the scope and relevance of green taxation has evolved over time with the emergence of new policy priorities, and in particular climate change***, so that the related indicators have possibly lost some of their original relevance. The OECD has thus introduced the new category of "climate change" taxation revenues to better capture the new interrelations between taxation on the one hand and the new policy priorities on the other, but this has not resulted in any indicator yet. The emergence of new indicators on carbon pricing, externality-based corrective tax rates, and energy subsidies demonstrates where the policy relevance of energy tax indicators

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[34] Cf. Eurostat (2003). Energy Taxes in the Nordic Countries – Does the Polluter Pay? Luxemburg: National Statistical Offices in Norway, Sweden, Finland and Denmark, Eurostat.
[35] Faiella, I. and Cingano, F., La tassazione verde in Italia: l'analisi di una carbon tax sui trasporti, Questioni di Economia e Finanza Banca d'Italia, No. 206, October 2013.
[36] For instance, the double median, the ten percent rule, the minimum income standard and the most recent low income, high cost, developed in the UK. Other EU countries have implemented indicators with relative adjustments to each country definition of energy affordability and vulnerable consumers, and slightly diferent formulas and methodology.

currently lies. However, the possibility of using these new indicators in policymaking suffers from methodological issues that have not yet been completely addressed, concerning the definition of internal or external benchmarks, the modalities to combine the effects of different policy tools, or the classification and estimates of external costs.

Furthermore, the instrumental value for policymaking of classical energy taxation revenue indicators has been diminished by ***the emergence and growth of quasi-fiscal or non-fiscal measures within or near the field of energy taxes***. When these indicators were designed, quasi-fiscal tools, such as RES charges, other streams of public revenues linked to energy efficiency (e.g. green certificates), or ETS had not yet appeared on the policy scene. This is also partly the case for carbon taxes, whose importance and diffusion has grown significantly over the last decade, while they were limited to a few Member States before. As such, revenues from carbon taxes are often not separately identified for classification purpose in these indicators and datasets. Finally, the available data breakdown (per NACE-64 sector[37]) is less than ideal for comparison with energy consumption data, or too broad to capture energy intensive industries.

Compared to revenue indicators, implicit and effective tax rates have been introduced with the additional aim of measuring and comparing the average tax burden borne by energy users in a country, sector, or per type of fuel and uses. Therefore, they can be used to assess the extent to which energy tax policies affect the competitiveness of countries or industries, and the extent to which certain products or uses face lower or higher tax burdens. However, ***the use of implicit and effective tax rates in policymaking is hindered by the factors described above on the growing relevance of other policies and non-fiscal measures and, most importantly, the less-than-ideal availability of sectoral revenues.***

Non-Ambiguity. ***The new policies and tools that emerged over the last decade described above have affected the understanding of existing energy taxation indicators***, both revenue indicators and implicit tax rates, and created ambiguity in their significance. This is particularly due to two factors[38]:

- the modality through which quasi-fiscal measures, such as ***RES charges***, have been dealt with. In particular, energy tax revenues will be higher in countries financing RES deployment through taxes than in those classifying RES levies as non-fiscal measures, even when the measures are largely equivalent from a user's perspective. More recent studies and indicators[39] are attempting to introduce an *ad hoc* uniform treatment of these aspects, to make the findings less ambiguous.

- the current methodology for recording ***ETS revenues*** among energy taxes poorly lends itself to any practical use for policymaking purposes. On the one side, the fact that revenues from ETS should be recorded when the allowances are 'used' (i.e. surrendered)[40] makes it of limited relevance from a public budget perspective; on the other, there are significant differences in how the currently simplified data recording principles capture the consequences of intra-EU trade of EU Allowances (EUAs) in terms of real costs for businesses and real revenues for governments in the various Member States, which make comparisons poorly informative. This is further compounded by the fact that, in certain countries, such as Italy, free

[37] *Nomenclature statistique des Activités economiques dans la Communauté Européenne*. NACE-64 stands for the NACE classification which identifies 64 indutrial sectors (in the statistical jargon, 2-digit divisions).

[38] Both factors are commented in detail in Section 5 below.

[39] Cf. e.g. CEPS and Ecofys (2018), Composition and Drivers of Energy Prices and Costs: Case Studies in Selected Energy Intensive Industries, Report for the European Commission, October 2018, hereinafter, 'DG GROW study on energy-intensive industries'.

[40] Under the EU ETS system, an emitter must surrender a number of EUA corresponding to the tonne of CO_2eq emitted.

allowances can be included among environmentally harmful subsidies, an issue that poses policy and accounting questions, at last in the currently hybrid grandfathering – auction ETS environment.

Tax rate-based effective tax rates can be ambiguous, in that they can suggest that equalisation of energy taxation in terms of calorific content is a logical criterion for benchmarking and assessing discrepancies in fiscal treatment, which underlies a number of assumptions not always accepted by experts. Tax rates calculated as a share of energy prices or costs[41] provide clear information on the current level of taxation in absolute terms; however, their evolution over time is confounded by the fact that intervening factors (e.g. international energy prices) affect the denominator exogenously. This is also the case for subsidies calculated via a top-down approach. As for subsidy indicators, those relying on a bottom-up approach can be ambiguous across the various benchmarks, so that different methodologies result in estimates varying by as much as one order of magnitude. Finally, carbon prices and related indicators suffer from some ambiguities on how the effects of various policies are combined, and particularly in terms of their effects on carbon emission reductions.

Responsiveness. Since they have been conceived for informational, rather than policymaking-oriented, purposes, ***only some energy taxation indicators are designed to directly monitor changes in the underlying taxation policies***. In other cases, indicators might not always properly reflect green policies. For instance:

- Revenue indicators may decline either because energy taxes have been reduced, or because the increase in energy taxes has led to an erosion of the tax base[42]; the former signal that a fiscal system is becoming less 'green', while the latter could be the long-term consequence of its greening.
- Trends in revenue-based indicators and implicit and effective tax rates can provide distorted messages, as they also reflect variations in the energy mix[43], industrial base[44], or energy intensity[45] of various countries.

Problems in terms of responsiveness also exist for subsidies indicators built via a bottom-up approach. Since tax expenditures are usually estimated as the difference between the standard (or maximum) rate and reductions or exceptions, these indicators can sometimes react improperly to environmentally-friendly policies, such as the introduction of a carbon tax with some exemptions, or the increase in top excise rates. This is also the case for the tax differential or surcharge indicators built as differences between effective tax rates: an increase in the differential can either result from a reduction of the rates on the low-tax product, or an increase on the high-tax. Those two policies are obviously not the same from an environmental perspective, but those indicators cannot distinguish between the two.

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[41] Cf. Eurostat database of natural gas and electricity prices; Trinomics, Study on energy prices, costs and subsidies and their impact on industry and households, Final Report for DG ENER, 2018, hereinafter 'DG ENER study on energy prices and costs'; DG GROW study on energy-intensive industries *supra* note 39.
[42] Cf. Speck, S., Environmental tax reform and the potential implications of tax base erosions in the context of emission reduction targets and demographic change, *Economia Politica: Journal of Analytical and Institutional Economics*, Vol. 34, No. 3, p. 407-423, 2017.
[43] For instance, in a country more heavily reliant on hydro or nuclear power, average taxes per unit of energy consumption could be lower, but this would not signal that, overall, its policies are less green than similar countries more heavily reliant on fossil fuels.
[44] Countries with more energy-intensive and manufacturing industries, on which the tax burden per unit of energy consumed is relatively lower, will have lower implicit tax rates than countries with a more significant presence of light industries and services, even if energy tax policies were the same.
[45] E.g., countries with a higher tax rate are likely to have a lower energy intensity, which in turn reduces the amount of energy tax revenues while having a 'greener' fiscal system.

Other indicators purposefully introduce external benchmarks, such as top-down and pigouvian estimates[46], certain carbon pricing tools[47], and corrective tax rates. These indicators correctly respond to changes in policies, even though not all changes may be captured by them[48]. In particular, carbon pricing tools measuring progress towards the achievement of emission reduction targets (i.e. OECD's share of emissions priced above a certain threshold and carbon pricing gap), are available for policy use, even though they may fail to capture all policy interventions. Corrective tax indicators also represent a possible benchmark to assess the environmental appropriateness of energy tax rates, and hence highlight the need for intervention. However, these indicators do not attempt to assess the extent to which tax rates translate into a reduction of external costs. Some experts challenge this lack of a direct commensurability to policy action to question their overall rationale, as in their view, if a tax has no proven impact on any given externality, the tax cannot be related to that externality. Although the political use of corrective tax rates and effective carbon prices is clear in the agenda of the institutions that have proposed them, they face difficulties in being accepted for use for policymaking purpose because of their dependence on methodological assumptions and remain more similar to conceptual indicators, as they are not yet used to monitor energy taxation responses, as also confirmed by adopters at the Member State level.

Indicators to assess the contribution of energy taxation to the achievement of broader energy policy objectives, such as energy efficiency, carbon intensity, and energy security, and their coherence are generally underdeveloped or available in very simple forms, also because they face methodological difficulties and the lack of a common reference framework, as they should capture causation links that are known only with some degree of approximation, and for which, at times, there is even a lack of consensus in the underlying literature. Most of the information base in this area does not necessarily point to a clear policy need or lend itself to use in policymaking.

Comprehensiveness. ***Most revenue indicators cannot be considered as self-contained measurements*** of policy significant phenomena, as they would require complementary information, at least on a country's energy intensity, energy mix, and industrial structure (including the different weight of the sectors covered by exemptions), to be put into proper context. Implicit or effective taxation rates would benefit from comparison with an underlying inflation index of energy products that cannot be easily built due to the high variability of energy prices over time. When attempted for the ITRs, deflation by means of GDP or price indexes has led to conflicting results. Lack of contextual information on pass-on effects of taxation onto final prices is among the drawback for using tax burden indicators for competitiveness purposes.

Corrective tax rate and carbon pricing indicators are built as self-contained measurements and cover in a single indicator all fiscal policies explicitly affecting the external costs of energy consumption or the cost of emitting one tonne of CO_2eq. The comprehensiveness of subsidy repositories depends on their scope: they mostly focus on fossil fuels only[49], rather than energy products at large, and do not necessarily include tax expenditures administered as reimbursement from other forms of taxation (e.g. corporate or income taxes)[50], not to speak of explicit feebate schemes. Given the methodological issues of both the top-down and bottom-up approaches, subsidy estimates can hardly be used in isolation for policymaking purposes, requiring complementary information on tax revenues and rates.

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[46] Such as those produced by the IMF.
[47] OECD's share of carbon emissions prices above certain thresholds and the carbon pricing gap.
[48] For instance, the OECD's share of carbon emissions prices above certain thresholds records a change only when these thresholds are crossed.
[49] With the exemption of e.g. DG ENER study on energy prices and costs.
[50] This is e.g. the case of the OECD's inventory of fuel subsidy.

4.2.2 Analytical soundness

Analytical soundness. ***Most of the indicators covered here directly measure their analytical object***, provided that this is properly defined. This is typically the case for revenue indicators, studies on energy prices and costs, and share of taxes thereon, carbon prices, implicit and effective tax rates, and direct subsidies under the bottom-up approach. In other cases, indicators are proxies of what needs to be measured. This is the case for indicators trying to estimate net government revenues and tax expenditures, subsidies under the price-gap approach, the carbon pricing gap, or corrective tax rates. In these cases, a number of assumptions are relied upon to justify the soundness of the indicators, e.g. to define a benchmark, assess subsidies and harmonise revenue data accordingly, and to standardise national carbon taxes, ETS, their tax bases and overlaps.

Robustness of assumptions. Most of the information sources covered in this report are databases or result from non-complex methodologies. In both cases, the ***number of assumptions is limited, and this aspect presents no problems***. This is the case especially for revenue indicators and nominal implicit or effective tax rates (while assumptions behind real-terms indicators can be more controversial). Rather, as discussed above, methodological conundrums concern the proper definition and classification of the underlying tax data. Indicators not based on estimates, but on actual prices and revenues are typically robust enough to cope with different data collection methodologies (e.g. DG ENER Oil Price Bulletin) or with differences in sampling strategies at the national level (Eurostat's Electricity and Natural Gas Prices).

On the contrary, the ***indicators designed to estimate carbon costs or other externalities rely on a significant number of assumptions***. This is the case, for instance, of corrective tax rates that, to calculate externalities, have to simplify the description of the external costs and their causation mechanisms and monetise them. Results often crucially depend on the monetary value attributed to a statistical life and are sensitive to variations in the underlying assumptions. Carbon pricing tools and those indicators built on them also need a number of methodological assumptions to reconcile the existing database on taxes and tradable permits/allowances with the data on energy consumption and emissions per sector and country. When the indicator incorporates both the current carbon policies and their effects – as with the IMF's Effective Carbon Price – it needs to rely on a larger number of assumptions, e.g. on the elasticity of consumption of various energy products to variation in fiscal and other energy policies.

Finally, ***estimating subsidies requires a theoretical framework, whose assumptions are not yet agreed in the literature and for which there is no consensus among Member States***. Top-down estimates measure subsidies as the difference between international and local retail prices of energy products; this is contested, for instance, by energy producing countries in which local retail prices are lower than international benchmarks, but higher than production and transport costs. In contrast, when adopting the bottom-up approach, results are not robust to the definition of benchmarks; finally, for the IMF's pigouvian estimates of energy subsidies, the same considerations made above on the calculation of corrective tax rates apply.

Robustness over time. ***The indicators covered by the Study are generally robust over time***, and, when available, time-series can be used to identify trends, with only minor limitations. The methodology of newer indicators, such as carbon pricing tools and effective tax rates published by the IMF or the OECD, is still being refined, and their level of detail improved. When they have undergone a revision process, vintage versions have usually been recalculated to ensure comparability. As for revenue indicators, the NACE breakdown of energy taxation data calculated by Eurostat has also been long improved and refined over time, ensuring consistency[51]. DG TAXUD share of transport

[51] In particular, when the indicators switched from using NACE rev 1.1 to NACE rev 2.

fuel revenues indicators depend on how Member States make their estimates available and this might have changed over time, although this is not likely to represent a major issue. Several subsidy repositories (except for the OECD's) do not allow for a time analysis.

Transparency. ***Most public indicators are characterised by a notable degree of transparency*** in the methodology used for their calculation and in the availability of underlying metadata, although less so for those concerning RES charges. The IMF even shares the algorithm through which corrective tax rates are calculated, so that additional results can be estimated starting from different assumptions. In other cases, however, this information still has to be released. In its latest edition, the OECD published energy tax rates in a disaggregated way and in a modifiable electronic format; it should soon allow a customised refinement of its indicators, e.g. by excluding certain items. The transparency of indicators published by private organisations or contractors is subject to more constraints, as these are often based on proprietary databases and also rely on a certain implicit degree of expert judgment.

Communicability. ***Many of the indicators considered appear as relatively simple to communicate*** to the general public. This is, for instance, the case for revenue and subsidy indicators, tax rates, and the share of taxes on energy prices and costs. There are cases where the underlying methodology is complex, or the concepts used relatively sophisticated for the general public. This is one of the reasons why indicator producers tend to refrain from model-based indicators or from complex extrapolations. The way implicit tax rate for transport fuels is built cannot be easily understood, and concepts like externalities, carbon pricing gaps, or correlation values are not immediately easy to grasp for a non-specialist reader, thus reducing their communicability.

Credibility and independence. ***EU and international institutions, which are generally considered very credible, represent the most important producers of energy tax indicators.*** There can be cases when quasi-indicators are created by private consultants for public institutions based on their expert knowledge. This can typically happen for the estimates of subsidies of sectoral effective tax rates. Here, perceptions may differ between different typologies of readers, but privately produced sources are not necessarily less reliable than public datasets. The credibility of the sources decreases for the studies commissioned by private organisations for explicit lobbying purposes, but these have been relatively few, and mostly on subsidies.

Indicators produced by international organisations show a ***significant degree of independence from government influence***, as it clearly appears from the transparent peer review and, in some cases, 'naming and shaming' incorporated in these reports. Eurostat indicators are aligned with the independence status granted to national statistical offices within the EU and are validated in collaboration with them. There are no major concerns about biases due to lack of independence in the calculation of implicit tax rates for fuels for road transport or prices and taxes reported in the Oil Price Bulletin. Independence issues may arise in the data estimating the amount of fossil fuel subsidies or RES incentives that are provided by Governments without any external validation as, in certain cases, they may diverge from the amounts estimated by other sources.

4.2.3. Measurability

Frequency. ***The frequency at which energy taxation indicators are published is highly variable and depends on the underlying dataset***. Those drawn from surveys to monitor prices, such as DG ENER's Oil Bulletin, are updated very rapidly, even once or twice per month. Revenue indicators are usually released on a yearly basis both by Eurostat and the OECD. CEER reports on RES are published on a biennial basis with some more limited predictability.

The frequency of the carbon-relevant indicators published by the OECD and the IMF is slower and less predictable, with a release every two to three years. This also applies to indicators from studies commissioned by the different DGs, whose frequency may vary, or they may just be one-off exercises. On subsidies, OECD's inventory is updated yearly; this is not the case for most of the other sources.

Timeliness, **regularity, and sustainability**. ***Revenue and price indicators are regularly published, and usually available with a short delay***, i.e. within one year after data collection. ***Implicit and effective tax rates based on comparison with energy consumption data can usually be estimated after a two-year delay***, because of the latter database's time-lag. For instance, OECD's Effective Tax Rates (ETR) are based on fairly updated tax information, but their estimation relies on IEA energy consumption data referring to two or three years before, although this is not considered a big issue due to inertia in energy consumption. There are indications that this might be considered too long a time lag for use in policymaking. In this respect, progress is being made to make provisional energy balance data available one year in advance based on proxy sources. So, while a few months could be gained in this respect, at least for EU Member States' estimates, any further compression of the time delay would require using estimates rather than actual energy consumption data.

Among the sources of information on carbon pricing, the WB's Carbon Pricing Dashboard reports estimates of revenues for both the previous and the current year. On the contrary, ***OECD carbon indicators – both rates and gaps – make use of emission and tax data which can be as old as three years***. Again, while more recent tax data could be retrieved, it would be difficult to reduce the delay of emission data, which are published by international official data providers with about 21 to 24 months' delay. As for effective tax rates, estimates based on previous years data could be used to speed up the process, but this could be detrimental to the indicator's robustness. For subsidies, the age of data varies with the quality of the publication; OECD's inventory include data which refer to one or two years earlier.

Sustainability. As for sustainability, the publication of Eurostat indicators is usually based on a binding act, thus ensuring their long-term availability. This is also partly the case for DG TAXUD Excise Duty Tables (EDT): while Member States have a binding duty to report the levels of taxation[52], the means by which the reporting currently takes place is an informal agreement. In any case, the EDT result from a long-term cooperation with the national tax administrations and have been released for such a long time that appear sustainable. For all the other indicators, there remains some degree of uncertainty as to their future availability; this can however be considered very likely as long as climate change remains high in the policy agenda. This is not to be taken for granted for other Commission reports, e.g. those on energy-intensive industries, whose publication is sometimes regular, but more often ad-hoc.

Geographical coverage*.* Eurostat indicators are by default collected from all EU Member States and often for a number of other European countries. Few data gaps exist, e.g. on energy prices and price components for high-consumption industrial users, or data on energy taxes paid by non-residents[53]. Several OECD's indicators, such as on energy tax revenues, are available for all EU Member States. This is not the case, however, for ETR, carbon, and subsidy indicators, which cover only OECD members, and thus exclude six EU Member States. Covering the latter would require additional resources but would not prove practically or methodologically cumbersome. IMF and WB sources can assure the coverage of all the EU, although at time with some limited availability of data.

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[52] Cf. Art. 25 of the ETD, *supra* note 17.

[53] On non-residents, data availability and accuracy has been recently improved, so that it can be considered a marginal issue for most Member States, except the smallest ones (such as Luxembourg and Malta). Residual comparability aspects affect Member States' reclassification of non-residents' consumption to other NACE sectors, when an explict category is not envisaged.

Comparability. As it generally happens with policy indicators, ***comparability issues do arise with certain energy taxation indicators***, e.g. on revenues. This can be due to structural factors and the different understanding that Member States have of classification criteria, particularly, when it comes to RES support and other charges.

Top-down revenue indicators, be they from Eurostat or the OECD rely on the national definition of taxes, and since revenues are recorded according to the rules of in the System of National Accounts – which is designed for purposes other than measuring how green a fiscal system is – ***cross-country comparability of energy tax revenue indicators can be flawed***.

However, a bottom-up approach is by no means a guarantee of comparability. For instance, concerns emerged on the possibility to use the OECD's effective carbon rate for cross-country comparisons, as similar rates can result from very different carbon policies – e.g. a uniform carbon price for most of a country's emissions, or very high carbon price for transport emissions while no price at all for the other sectors. Therefore, similar levels of the effective carbon rate do not mean that two fiscal systems are equally fit to curb GHG emissions, while a higher rate may not necessarily identify the most effective fiscal system in this respect. Effective carbon rates can usefully be employed for time comparison, e.g. by identifying pricing trends in a country or region, but are less informative for cross-country comparisons or ranking purposes.

Except for definitional discrepancies, intra-EU comparability is ensured for Eurostat indicators, as well as with other European countries included in the databases. The comparability of Eurostat data series with other international jurisdictions can be more complex as it depends on the availability of similar data sources.

Finally, ***cross-country comparability is impossible or relatively meaningless for bottom-up subsidy indicators***, due to the variable, and often national, definitions of benchmarks. Different methodologies also present problems with time comparability. For instance, for fossil fuels, direct subsidies and tax expenditures reportedly decrease over the last years, following their reform in a number of developed and developing countries. However, post-tax subsidies – which, in the IMF jargon, identifies the difference between the local retail price and a price reflecting the external costs – were reported to increase in the same period. While work is ongoing at international level on this aspect, there are limited expectations that an agreed definition of subsidies can be reached in the near future.

Completeness. ***Most energy taxation indicators present some kind of limitations in their degree of completeness*** for different reasons, such as:

- Revenue indicators may not capture quasi- and non-fiscal measures whose importance have become central over the last decade;
- Implicit and effective tax rates and subsidy repositories, such as OECD's ETR, do not include all possible existing tax reimbursements, especially those administered as direct subsidies or via non-energy tax bases. The ETR cannot capture the impact of ETS as permit prices cannot be translated into their energy equivalent;
- Sectoral taxation data are often not available for non-residents. Indicators based on price surveys are typically available for certain products only, and namely most representative ones;
- Carbon pricing tools usually cover only those climate change policies for which an implicit or explicit carbon price can be computed, and typically exclude RES and energy efficiency support, though they also contribute to GHG emission reduction.

By their own nature, indicators drawn from studies tend to be completer and more exhaustive.

Level of detail. When used to measure high-level policies, e.g. revenues or implicit tax rates at economy-wide level, carbon pricing and fossil fuel subsidies, ***the level of detail provided by the current indicators is often sufficient***. However, ***there is an unmet demand of revenue and implicit tax rate indicators for more specific types*** e.g. to monitor competitiveness aspects, as they would require a disaggregation by energy product, use, or user which is currently unavailable. Specialised sources, such as the EDT and the Taxing Energy Use[54] (TEU) database, are the closest proxy available to fill this void at the product level, but this is possible only to the extent to which their classification and segmentation is compatible with other sources (e.g. the Energy Balance, the NTL). The demand for increased granularity spurs requests to have existing databases, such as the EDT, complemented with increasingly detailed information covering areas that currently raise limited revenues, but are for other reasons relevant for policymaking purposes. Examples may range from exemptions, reductions, and out-of-scope industrial uses, or the fiscal treatment of electric energy as a propellant. The level of details of subsidy repositories depend on whether the full list is published (as per DG ENV's and OECD's), or the underlying assumptions (i.e. the IMF's).

Range of available versions. ***Most indicators are presented in a single version, as they do not include controversial elements.*** Examples of indicators with multiple versions include:

- the OECD's Effective Carbon Price (ECP), which includes a version where biofuels are treated as carbon neutral, and another where they are not;
- Eurostat's and DG TAXUD's implicit tax rates in real terms, using different deflators; and
- the IMF subsidy and corrective tax rates estimates, are published together with the underlying spreadsheet, so that the indicator can be calculated in all its possible versions.

4.3. Indicator assessment

Before discussing a number of policy issues in the following sections, two summary assessment of the existing indicators are provided in the following pages_

- Table 3 provides the ***summary assessment*** for the four main families of indicators considered. They are scored over the judgment criteria included in the appraisal framework on a qualitative scale, from low to high[55]. The summary assessment provides one of the sources – together with the subsequent policy analysis and the feedback from Member States and international organisations – for identifying existing data gaps and possible ways forward.
- Table 4 provides a ***synthesis assessment*** per each indicator[56] (other than those on energy consumption) over the three key features listed in the appraisal framework: (i) policy relevance; (ii) analytical soundness; and (iii) measurability. This synthesis assessment has two purposes. First, it provides the detailed analytical elements on which the above analysis is based; secondly, by highlighting the strengths and weaknesses of each indicator – indicated respectively as '(+)' and '(-)', it provides a useful map on their possible uses and limitations[57].

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[54] OECD, Taxing Energy Use, OECD Publishing, Paris, 2019, hereinafter 'Taxing Energy Use (TEU)'.
[55] With the exemption of 'level of detail', for which the Table only shows which versions are or not available.
[56] When indicators are very similar (e.g. result from the same approach, or differ only by the denominator), a single assessment is proposed.
[57] No qualitative scoring ranking of the indicators is proposed, since the various tools pursue different objectives and have a different nature, so that they poorly lend themselves to such an assessment

Table 3. Summary Assessment of Existing Indicators

	Revenue Indicators	Implicit and Effective Tax Rates	Carbon pricing	Energy Subsidies
Policy relevance				
Policy relevance	**Medium.** Original relevance reduced by growing importance of quasi- and non-fiscal measures, climate policies	**Medium.** Original relevance reduced by growing importance of quasi- and non-fiscal measures	**High.** More and more important given climate policy agenda	**High.** More and more important as the reduction of subsidies became a climate policy
Non-ambiguity	**Medium.** Fail to capture uniformly and appropriately new policies (RES support, ETS)	**Medium** due to effect of exogenous factors	**Medium.** Relation among price components not fully established	**Low.** Different methodologies can affect results for bottom-up. **Medium** for top-down estimates
Responsiveness	**Low.** Environmentally friendly policies can erode tax base; do not reflect energy mix, industrial base, energy intensity	**Low.** They do not reflect energy mix, industrial base, energy intensity	**High.** Carbon Pricing Gap **Medium.** Effective Carbon Rate, Share of emissions above a certain threshold	**Low.** Bottom-up estimates may worsen when energy taxes are increased. Top-down approaches not suitable to track EU policies **High.** Corrective tax rates
Comprehensiveness	**Medium.** Require contextual information on the economy	**Medium.** Require contextual information on the economy	**High**. Include most important determinants of carbon price	**Medium.** Mostly focus on fossil fuels; require information on tax revenues and rates
Analytical soundness				
Analytical soundness	**Medium.** Number of issues with definition of energy taxes	**Medium.** As per the underlying revenue datasets (Number of issues with definition of energy taxes). **High** when calculated from rates (OECD ETR).	**Medium.** Issues with averaging out details of carbon policies; definition of external benchmarks	**Low.** Problem of benchmark definition; disagreement on methodology for top-down
Robustness of assumptions	**High.** No major assumptions required	**High.** No major assumptions required	**Medium.** Results depend on how various price components are harmonised / aggregated; model-based indicators less robust	**Low.** Issue with benchmarks, reliance on variable international prices, values of model parameters
Robustness over Time	**High.** Some issues only for sectoral revenue data	**High.** Some issues only with sectoral tax rates	**Medium.** New evolving methodologies.	**Low.** Most series have no time dimension

Transparency	**High.** Data and methodologies published	**High.** Data and methodologies published	**High.** Data and methodologies published (pending publication for IMF ECP)	**Medium.** Data and lists of subsidies not always published
Communicability	**High.** Easy to communicate	**High.** Data and methodologies published	**High.** Carbon Prices **Medium.** Policy indicators based thereupon	**High.** Subsidy repositories **Medium.** Corrective tax rates are more complex, though potentially helpful to identify local damages
Credibility and Independence	**High.** Collected / published by renowned institutions, independent from governments	**High.** Collected / published by renowned institutions, independent from governments	**High.** Collected / published by renowned institutions, independent from governments	**Medium.** Some repositories / analyses made by private organisations with clear agenda
Measurability				
Frequency	**High**. Mostly yearly data.	**Medium**. Mostly yearly / biannual data.	**Low.** Three years or irregular publications	**High.** OECD's inventory **Low.** Other repositories
Timeliness, Regularity and Sustainability	**High.** Usually available within one years. Regular and sustainable.	**Medium.** Available with two-year delay. Mostly regular and sustainable (except studies)	**Low.** Updated every three years / irregularly; seemingly sustainable	**High.** OECD's inventory **Low.** Other repositories
Geographical Coverage	**High.** Indicators cover all EU Member States	**High.** EU's and Eurostat's **Medium**. OECD's	**High**. IMF's **Medium**. OECD's	**High.** IMF's, DG ENV's **Medium.** OECD's, others
Intra- and Extra-EU comparability	**High.** Eurostat's data ensure intra-EU comparability, OECD's international comparability	**High.** Eurostat's data ensure intra-EU comparability, OECD's international comparability (designed for this purpose)	**High.** Designed for this purpose	**High.** Designed for this purpose
Completeness	**Medium.** Miss quasi- and non-fiscal measures	**Medium.** Difficult to capture all subsidies	**Medium.** OECD's indicators do not capture other policies (RES support, energy efficiency)	**Medium.** Difficult to capture all subsidies
Level of Detail	**Medium.** Missing data for some products / sectors	**Medium.** Missing data for some products / sectors / types of taxes	**High.** Carbon price data sufficiently disaggregated by policy / country / sector	**High.** OECD's public repository, DG ENV's, IMF's **Low.** Other
Range of Available Versions	No data on PPS	OECD's effective tax rate with and without biofuels	OECD's indicators with and without biofuels	IMF's estimates can be fully tailored

Table 4. Energy taxation indicators: Synthesis assessment

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
Energy taxation revenues				
1. Revenue from Energy Taxation as a % of GDP 2. Revenue from Energy Taxation as a Share of Total Revenues	Eurostat	(+) Provides information on the weight of energy taxes in an economy / fiscal system; widely used for policy purposes. (-) Suffers from discrepancies in definitions and recording of taxes and other measures (e.g. RES charges); may vary for exogenous reasons (e.g. changes to GDP, energy intensity, fiscal systems); diminished relevance due to change in policy focus; does not capture direct subsidies and those provided via other tax bases.	(+) Sound and robust in methodology and over time, based on actual revenue data, very easy to communicate, data and methodology fully transparent. (-) Lacks any analytical detail on tax composition	(+) Annual data, published in less than two years, sustainability ensured by Regulation. (-) Definitional discrepancies limit meaningful cross-country comparability; VAT not included.
3. Revenue from Energy Taxation as a % of GDP	OECD	(+) Provides information on the weight of energy taxes in an economy/fiscal system; widely used for policy purposes; (-) May vary for exogenous reasons (e.g. changes to GDP, energy intensity); diminished relevance due to change in policy focus; does not capture direct subsidies and those provided via other tax bases.	(+) Sound and robust in methodology, and over time, based on actual revenue data, very easy to communicate, methodological document not yet public; plans to increase level of analytical detail in the underlying dataset	(+) Annual data, published in less than two years (provisional data after six months), covers non-OECD EU Member States, certain breakdowns available (-) Cross-country comparability remains problematic for certain aspects, but effort to increase it.
4. Energy Taxes by Paying Entities and Industrial Sector	Eurostat	(+) Main information source to estimate energy taxes paid by type of payers / NACE-based industrial sectors (-) Suffers from discrepancies in definition and recording of taxes and other measures (e.g. ETS and RES charges); may vary for exogenous reasons (e.g. changes to GDP, energy intensity); does not capture direct subsidies and those provided via other tax bases; need to be complemented with sectoral data on prices and consumption.	(+) Sound and robust in methodology, and over time (NACE backward compatibility ensured), easy to communicate, data and methodology fully transparent. (-) Lack of correspondence with energy balance consumption data.	(+) Annual data, published in less than two years, mandatory collection process. (-) Taxes paid by non-residents affects comparability of data; no breakdown per energy product.
5. Transport Fuel Taxation as a % of GDP 6. Transport Fuel Taxation as a Share of Total Revenues	DG TAXUD	(+) Measures the economic and fiscal relevance of taxes on transport fuels, which represent the largest share of energy taxes; fuel tax definitions clear and harmonised across countries; limitedly affected by exogenous factors. (-) No information on carbon components / incentives for carbon reduction; would require additional data on biofuel taxation and subsidies; does not capture direct subsidies and those provided via other tax bases (e.g. freight transport).	(+) Sound and robust in methodology, and over time, based on actual revenue data from the ETD, very easy to communicate, data and methodology fully transparent. (-) No breakdown by type or mode of transportation (e.g. passengers vs. freight; road/rail/waterborne/air).	(+) Annual data, published in less than two years; most significant fuels covered. (-) Unlike Eurostat's indicators, not fully harmonised methodology may reduce meaningfulness of cross-country comparability.

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
Implicit/Effective Tax Rates				
7. Implicit Tax Rates	DG TAXUD, Eurostat	(+) Provides an assessment of the weight of taxes on energy consumption, and therefore on the impact of fiscal policy on demand for energy; can be used to assess relation between taxes and energy efficiency. (-) As it is based on revenue data, it suffers from discrepancies in definitions and recording of taxes and other measures (e.g. ETS and RES charges); may vary for exogenous reasons (e.g. changes to GDP, energy intensity); does not capture direct subsidies and those provided via other tax bases.	(+) Well established transparent methodology, based on actual revenue data, easy to communicate. (-) Values and rankings not robust to the different deflators, breakdown by type of energy tax not available.	(+) Annual data, published in less than two years, sustainability ensured by Regulation. (-) Definitional discrepancies limit meaningful cross-country comparability; VAT not included.
8. Effective Tax Rate: Taxing Energy Use	OECD	(+) Highlights consistency issues (similar taxation across sectors, fuels, countries); largely used in policy debate; bottom-up effort to reconstruct rates and harmonise definitions of taxes. (-) No coverage of RES charges, ETS; more suitable for ex ante assessment of tax burden consistency.	(+) Based on as many actual data as possible, limited assumptions and shortcuts; approach refined over time, backward compatibility ensured; graphical presentation increases communicability; transparent methodology, all data published in a modifiable format; focuses on Government intervention on consumption taxes. (-) As it is based on nominal rates, it cannot capture certain tax problems (e.g. tax evasion).	(+) Efforts to ensure cross-country comparability; published every three years, last update was annual; data are disaggregated per country, main fuels, and six economic sectors. (-) Does not cover non-OECD EU Member States; does not reflect certain subsidies, ETS costs.
9. Combustion Surcharge	OECD	(+) Provides an assessment of the tax differential between carbon-free and -emitting sources; directly responsive to variations in tax rates. (-) Policy responsiveness is partial as it is significantly driven by two factors: (i) high taxation of transport fuels; (ii) existence of electricity levy;	(+) Based on simplified assumptions to calculate tax rates; reported in a graphic format; all data published in a modifiable format. (-) It does not include RES charges, which impact mostly on carbon-free sources.	(+) Efforts to ensure cross-country comparability; wide fuel coverage. (-) Does not cover non-OECD EU Member States.
10. Diesel Differential	OECD	(+) Covers a highly debated topic, subject of policy reforms in various Member States: coverage of fuel taxes is very comprehensive, accurate; definitions of fuel taxes are harmonised. (-) Limited correlation between diesel differential and usage; no longer accounts for different carbon and energy content; indicator ambiguously responsive to policy reforms.	(+) More robust than overall ETR, since tax rates for transport fuels easier to estimate and not affected by e.g. RES charges or ETS; reported in a graphic format; all data published in a modifiable format. (-) It does not account for transport efficiency.	(+) Cross-country comparability ensured; published every three years, last update was annual. (-) Does not cover non-OECD EU Member States; does not reflect certain subsidies.

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
11. Share of Taxes on Gasoline and Diesel Fuel Prices. Oil Weekly Bulletin	DG ENER	(+) Provides information on tax burden on major fuels; increases transparency of fuel prices in the Internal Market; addresses policy debate on whether taxes should smooth price variability; decisions to modify tax rates are immediately captured. (-) Problems in the treatment of biofuels; need to be complemented with data on prices; no correction for energy product inflation is possible.	(+) Robust to variations in price; comprehensive methodological information available; very easy to communicate. (-) Data directly collected from energy companies, without statistical office supervision.	(+) Certain differences in national data reduce cross-country comparability, but they are transparently reported; weekly publication; separate data for VAT and other indirect taxes; sustainability ensured by Regulation. (-) It covers only mainstream fuels; little detail provided on market for biofuels.
12. RES - Effective Tax Rates	CEER	(+) One of the few sources for monitoring RES charges across Europe; provides an assessment of RES costs per unit of energy; ranking not distorted. (-) It should be complemented with information on who bears the costs (general budget vs. consumers) and weight of RES on energy consumption.	(+) Covers both direct subsidies and indirect costs; all data are published; easy to communicate for informed readers. (-) No information on how Member States collect / estimate costs, hence limited transparency.	(+) Data comparable across Member States; published regularly every two years; covers major RES support policies; details by country, support scheme, and RES technology. (-) Four Member States missing.
13. Natural Gas and Electricity Prices	Eurostat	(+) Most important repository of electricity and natural gas price statistics; regularly used in EU and national policymaking; total prices, components and consumption bands precisely defined; data provided over a number of policy-relevant and actionable dimensions. (-) Time trends heavily affected by the price of fossil fuels (exogenous factor).	(+) Actual data, easy to understand and communicate, fully transparent data and methodology. (-) Apparent lack of consistency on how Member States report tax rates	(+) Price comparability ensured, more difficult for components because of data gaps and national definitions; biannual price data, annual price component data; sustainability ensured by Regulation. (-) Coverage is partial for certain Member States (e.g. taxes on non-household consumers); no breakdown per NACE sector.
14. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries	DG GROW	(+) Attempts to fill data gaps in the area of energy costs and prices for energy-intensive industries; variables studied are properly selected and defined. (-) Energy costs, prices, and their components affected by exogenous factors.	(+) Based on plant-data and narrow homogenous sector definitions; methodology transparently described; being bottom-up, limited number of assumptions; data validated via energy bills. (-) Voluntary sampling; underlying data not disclosed because of commercial sensitivity.	(+) Data are comparable across EU regions, covers most of the relevant price and cost data. (-) National data only for selected Member States; unclear whether the publication will continue.
15. Energy Prices, Costs, and Subsidies	DG ENER	(+) Provides comprehensive valuable information on the price and cost of energy in the EU; most of indicators are clearly defined, policy actionable. (-) For subsidies, issues in the definition of benchmark, ambiguous policy response; drivers of industry energy costs remain unidentified.	(+) Collects and collates lots of top-down information; methodology is transparent and consistent across various editions; indicators are understandable to an informed reader.	(+) High cross-country comparability for product prices; very granular data availability. (-) Unclear whether the report will be regularly updated; data gaps in sectoral analysis.

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
16. Energy Prices and Taxes for OECD Countries	IEA	(+) Significant global repository of prices and taxes of fossil fuels and electricity; policies affecting energy prices are immediately captured; covers most important energy products and trade flows. (-) No distinct coverage of quasi- and non-fiscal measures (e.g. RES charges)	(+) Consistent transparent methodology, IEA ensures collection and validation of public and private sources; easy to communicate. (-) Analytical data collection in taxes has just started and categories are different from other tax repositories.	(+) Published four times per year, with no more than three-month delay: it includes a vast amount of price indicators for most fuels; regularly published since 1978, (-) It does not cover non-OECD EU Member States
Carbon pricing				
17. Effective Carbon Price	IMF	(+) Addresses very policy-relevant carbon pricing from a holistic perspective, covering carbon and energy taxes, and ETS; allows measuring the distances between a country actual policy and its Paris pledges; policy responsive. (-) Being model based, policymaking use may be more complex; additional complexity and differentiation very usual in a global context, but of limited relevance within the EU.	(+) Assumptions and parameters retrieved from the literature and transparently disclosed; data should be made available via a modifiable spreadsheet. (-) Spreadsheets not yet available; being model-based, require more assumptions than other carbon indicators (e.g. ECR); difficult to communicate.	(+) Covers 26 EU countries; cross-country comparability is ensured; it cover the most important carbon policy instruments and related policies. (-) One-off publication; lack of spreadsheet tool does not yet allow for customised analysis.
18. Effective Carbon Rate	OECD	(+) Addresses very policy-relevant carbon pricing from a holistic perspective, covering carbon and energy taxes, and ETS; policy responsive; built upon the ETR, effort to ensure harmonisation of tax definitions and estimates. (-) Does not cover direct subsidies and those administered via other tax bases.	(+) Methodology described in the first edition; country notes provide lot of information on national data; easy to communicate. (-) Measuring the average rate, it is affected by very high taxation of transport fuels	(+) Regular updates expected, data provided per country, energy products, and six economic sectors; two versions with different treatment of biofuels. (-) Cross-country comparability is possible, but its interpretation is affected by differences in national carbon policies; data not available for non-OECD EU Member States; long time-lag (current estimates use 2015 data). Non inclusion of VAT may hinder international comparison
19. Share of Emissions Priced at a Given Level	OECD	(+) Provides information on the share of carbon emissions with positive and non-negligible prices, as well as above consensus estimates on the level of carbon pricing needed to limit global warming; covers carbon and energy taxes, and ETS. (-) Policy changes between thresholds not captured; does not cover direct subsidies and those administered via other tax bases.	(+) Methodology described in the first; edition; consistent methodology country notes provide lot of information on national data; easy to communicate.	
20. Carbon Pricing Gap	OECD	(+) Provides information on the distance between national carbon policies and consensus estimates on the level of carbon pricing needed to limit global warming (EUR 30 and 60/tCO_2eq); covers carbon and energy taxes, and ETS; any change in policy reflected in the indicator. (-) Does not cover direct subsidies and those administered via other tax bases.	(+) Methodology described in the first; edition; consistent methodology country notes provide lot of information on national data (-) Technical indicator, more difficult to communicate.	

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
21. Carbon Pricing Dashboard	WB	(+) Very up-to-date global repository of explicit carbon prices (carbon taxes and ETS); can be used to build and update other carbon indicators. (-) Does not cover implicit carbon policies (e.g. energy taxes).	(+) Database and its sources transparently described. (-) Limited information on overlap between ETS and carbon taxes).	(+) Covers 46 national jurisdictions and 28 sub-national jurisdictions, including all EU Member States; policy changes reflected in the dashboard within 12 months. (-) Other implicit carbon policies only discussed in the accompanying report.
Corrective Tax Rates				
22. Corrective Tax Rates on Fuels 23. Corrective Tax Rates on Emissions	IMF	(+) Measures the extent to which fuel / energy taxes fully reflect external costs; reflects local fuel / energy externalities other than climate change; can be used to identify area for policy interventions (i.e. under taxation). (-) Use in policymaking made more difficult by complexity and uncertainty in parameters; no information on whether transport / energy externalities were already covered via other instruments.	(+) Clear and robust economic (pigouvian) rationale; data and methodology fully transparent; modifiable spreadsheet for customised analysis. (-) Estimates depends on the assessment of external costs, which in turn results from several estimated parameters (e.g. value of saved lives); more difficult to communicate.	(+) Coverage of all EU Member States and cross-country comparability ensured by design; very detailed range of costs considered; customised analysis possible. (-) Irregular publications and updates; no coverage of non-road fuels. No coverage of biofuels.
24. Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities	DG MOVE	(+) Measures the extent to which transport taxes, including on fuels, reflect external costs; reflects local fuel / energy externalities other than climate change; can be used to identify area for policy interventions. (-) Might not account for upstream taxes.	(+) Methodology describe and up to-date; all data available in a modifiable format. (-) The scope of analysis is broader and not always suited to cover energy taxes on transport fuels.	(+) Coverage of all EU Member States; cross-country comparability ensured by design; fully comprehensive coverage of taxes and modes of transport. (-) Unclear whether further updates will follow; revenues not available by type of fuel.
Correlation and Model-based Indicators				
25. Correlation Between Energy Tax Rate / Carbon Price and Energy / Carbon Intensity of GDP	OECD	(+) The indicator assess correlation between tax level and energy / carbon intensity, showing evidence that the higher the tax level, the lower energy / carbon intensity (-) Does not assess causation; dependent variables can be affected by exogenous factors.	(+) Easy to replicate based on the data made available. (-) Requires expert knowledge; some of the presentations are complex.	(+) Repeated publications, unlikely to be discontinued. (-) Does not cover non-OECD EU Member States; carbon data have a substantial time lag; no further breakdown in the dependent variable.
Assessment of Energy Subsidies				
26. Energy Taxation and Subsidies in Europe	International Association of Oil and Gas Producers	(+) Attempts to impact on the policy debate on fossil fuel subsidies by (i) measuring the net contribution to public budgets; (ii) including subsidies to RES. (-) Limited definition of subsidies (tax expenditures not included); it includes horizontal taxes, but only sectoral support.	(+) Comprehensive approach based on cash-flow assessment. (-) Unclear treatment of VAT for business entities; no data provided per country, nor list of taxes / subsidies, thus preventing replicability; difficult to communicate.	(+) The indicator covers five of the main energy value chains (oil, gas, coal, wind and solar). (-) EU covered, national data not available; no cross-country comparison possible; considerable time-lag (data refer to three years before publication).

Indicator	Source	Policy Relevance	Analytical Soundness	Measurability
27. Europe's Fossil Fuel Subsidies	ODI	(+) Builds upon existing repositories and extend it to two other area: public finance institutions and state-owned enterprises. (-) Definition of benchmarks greatly affect estimates of subsidies; increase in top tax rate can increase subsidies even when they result in a net positive environmental impact.	(+) Transparent methodology; list of subsidies published. (-) Most of subsidies covered taken from existing repositories; for public finance institutions and state-owned enterprises, estimates are based on nominal value rather than incremental effect.	(+) One-year time lag; covers several value chains (coal, oil, gas, electricity) and consumption activities (-) Data provided for 9 Member States only and two European Institutions (EBRD and EIB); sustainability uncertain.
28. Support and Tax Expenditures for Fossil Fuels	DG ENV	(+) Clear and broad definition of subsidies; use of an external benchmark ensures comparability. (-) Outdated benchmark; does not cover energy sources other than fossil fuels.	(+) Provides sensitivity analysis with other benchmark; comprehensive and transparent methodology; data published within the Study.	(+) Data are provided for all EU Member States; one- to two-year time lag; extensive coverage of produces and consumers' subsidies. (-) One-off study.
29. Inventory of Fossil Fuel Subsidies	OECD	(+) Provides estimates of direct subsidies and tax expenditures for fossil fuels; widely used in the international debate. (-) Definition of benchmarks greatly affect estimates of subsidies; increase in top tax rate increase subsidies even when they result in a net positive environmental impact.	(+) Direct measurement, bottom-up, of direct subsidies; transparent methodology; data and list of subsidies published; easy to communicate. (-) Measurement of tax expenditures based on benchmarks used at national level, possibly different.	(+) Comparability of direct transfers possible; one- to two-year time lag; regular updates; extensive coverage of fossil fuels and various forms of supports, which could be extended in the future. (-) Comparability of tax expenditures not meaningful.
30. Total Amount of Fossil Fuel Subsidies	IMF	(+) Clear and broad definition of subsidies; use of an external benchmark based on international energy prices and fuel consumption external costs ensures comparability; policy responsive as an increase in top tax rate does not increase subsidy estimates. (-) Depends on international fuel price (exogenous factor); questionable treatment of VAT within the benchmark.	(+) Clear and robust economic (pigouvian) rationale; data and methodology fully transparent; modifiable spreadsheet for customised analysis. (-) More difficult to communicate.	(+) Data provided for all EU Member States; time lag of two years, it covers most important fuels and factors influencing external costs. (-) Published twice so far, but uncertainty on further updates.

4.4. Conclusions

A number of indicators on energy taxation are available in the public domain, from both European and international organisations, as well as from private bodies. In this respect, there is no lack of information, as they cover many different and complementary aspects relevant for policymaking: amount of energy taxes and subsidies, implicit and effective tax rates, effective carbon prices, share of tax on energy costs and prices.

Considering the 'traditional' energy tax indicators, i.e. those measuring revenues and the implicit tax rates, they were designed to measure the extent to which extent fiscal policies pursued 'green' objectives. As a whole, their methodology remains analytically sound even today, and they present no or very limited problems of communicability, measurability, credibility, and transparency. However, their policy relevance has diminished for two reasons, namely the growth of quasi-fiscal and non-fiscal environmental measures generating public revenues (e.g. RES, ETS), and the shift of the policy agenda towards climate change objectives. Since their design does not explicitly account for these new tools and objectives in a coherent way, their policy relevance has diminished. Also, the addition of new forms of taxation and other measures and policy objectives strained the definition of "energy tax" on which those indicators are based, thus reducing their capacity to produce meaningful cross-country comparisons. Finally, these indicators are structurally unfit to capture the analytical dimension of energy taxation and measure sectoral energy taxation burden, especially if the focus in on energy intensive industries, and remain too broad to be used for specific policymaking purposes (e.g. the current revision of the ETD, or the assessment of the effects on competitiveness of national energy tax policies in the Internal Market).

On the other hand, there are two families of indicators whose policy relevance has grown over the last years: carbon pricing and subsidies. Namely, the shift in policy attention and the creation of these indicators created a virtuous circle which supported their growing policy relevance and led many organisations to develop those indicators. However, being newer, their methodology is not yet settled, they remain more complex to communicate, and their publication is less frequent, with considerable time-lag.

As for subsidies, two major repositories covering EU Member States currently exist, complemented by a number of other sources. The amount of information is thus large and growing, both in quantity of countries and measures covered, and quality of data. In this area, the crux is the measurement of tax expenditures, which strongly depends on the benchmark used. The OECD choice – to rely on national benchmarks – strongly impacts on cross-country comparability of data. Most importantly, subsidy indicators can sometimes respond in a distorted way to policy choices, as an increase in energy tax rates can result in both a 'greener' tax system when measured via revenue or implicit tax rate indicators, and in a less environmentally friendly policy network when considered from the subsidy perspective. On carbon pricing, the two leading indicators are currently published by the IMF and the OECD, measuring both the price as resulting from energy and carbon taxes and tradable permits/allowances policies, as well as the distance between national policies external benchmarks or nationally-determined Paris-pledges.

In conclusion, the change in policy priorities over the last decade reduced the policy relevance of traditional energy tax indicators with an established and clear methodology. Therefore, they should be revamped and adjusted to increase their instrumental use in policymaking. On the other side of the spectrum, new indicators emerged to address the new policy needs, but their methodologies are not yet consolidated. Importantly, and unlike traditional indicators, the EU is not among the main producers of these new indicators. The objective of improving, refining, and extending all families of indicators is thus meaningful and worth investing in, while acknowledging the limits of a pure quantitative approach. There appears to be no 'silver bullet', but some potential improvements and ways forward are explored in Sections 7 and 8.

5. THE EXISTING ENERGY TAXATION DATASETS

This chapter reviews the current definition of energy taxation underpinning the databases of energy tax revenues (in Section 5.1), and the limitations it poses for their use for policymaking purposes (in Section 5.2). This is followed in Section 5.3 by a review the salient features of three types of datasets: energy tax revenue, other energy taxation, and subsidy datasets.

5.1. The definition of energy taxation

According to Eurostat's methodology, ***energy taxation is defined as one of the four sub-categories of environmental taxation***, together with transport, pollution and resource taxes. It groups together revenues from different type of taxes, namely:

1) taxes on transport fuels (typically excises in the EU);
2) taxes on fuels for heating and stationary purposes (also excises);
3) taxes on electricity (also excises);
4) carbon taxes;
5) revenues from ETS; and
6) other indirect energy production taxes[58].

Taxes on air pollutants from energy production processes other than GHG (e.g. nitrogen and sulphur oxides – NOx and SOx) are not considered as energy taxes, but as pollution taxes.

Not all these taxes fall within the current scope of the EU *acquis.* ETS are governed by an EU Regulation; energy excises by a Directive, which set the minimum rates and certain rules about their working, while leaving Member States the possibility of setting the actual rates. The levels set by the ETD, however, currently do not necessarily reflect GHG/other pollutants content. Carbon taxes, as well as other indirect energy production taxes fall within the responsibility of Member States.

As a result of the current definition, EU energy taxes are ***largely dominated by excises on fossil fuels***, particularly transport fuels. This is followed by electricity taxes, although the bulk of the tax burden on electricity is usually represented by Value Added Tax (VAT) and RES charges that remain outside the scope of energy taxation; proceeds from ETS and carbon taxes, where these have been implemented, represent a minor share of the total, although bound to increase in the future. All the remaining energy taxes are composed of a plethora of specific and non-homogeneous production taxes generating very little revenues overall, but that can be significant in certain market segments.

While data reporting on fuel taxes – the first two categories above – is fairly straightforward, ***classification and interpretation problems do arise with the others***. For instance, taxes on electricity should not include levies charged to finance the cost of RES; carbon taxes also cover tax bases unrelated to energy production (e.g. on emissions of fluorinated gases). Then, not all taxes expressed in carbon terms are classified as energy taxes, but only those commensurate to carbon emissions from actual use[59]. To address this issue, the OECD is working on a reclassification of environmental taxes to identify the cross-cutting category of "climate change

[58] For instance, taxes on nuclear power plants, pipelines, hydropower water, or pylons.
[59] Hence, even if expressed in CO2eq terms, taxation of vehicle ownership is not considered as an energy tax, but as a transport tax. Similarly, congestion charges or city tolls that are also aimed at indirectly reducing air pollution can be treated differently from Member State to Member State, as charges or taxes, but in the latter case should eventually be accounted for as transport taxes.

taxation”[60]. Finally, revenues from EUA auctions are classified as energy taxes, irrespective of whether emissions are combustion- or process-related, as it happens in a few manufacturing industries (e.g. cement, lime, glass, ammonia). These issues are described in details in Section 5.2 below.

5.2. Limits in data use for policymaking purposes

The official statistical definition of energy taxation has been internationally agreed as a subcategory of environmental taxes conventionally defined to fit within the framework of the (environmental) national accounts. Energy tax estimates must therefore follow the same rules as national accounts, and are subject to the same accounting principles (accrual basis, territoriality, etc.) Hence, that energy taxation data might present ***some limitations in their concrete use for other more specific policymaking information needs***. In particular:

- When the aim of energy taxation data is to measure total tax expenditure from the final consumer’s viewpoint (the so-called “tax burden”), data should also include all taxes impinging on energy consumption and production, including quasi-fiscal measures such as RES charges, as well as non-reimbursable VAT. Furthermore, other taxes should be included among energy taxes to get a complete picture of revenue flows, and in particular: certain revenues from upstream energy operators, such as taxes on oil and gas production or on mining. However, as per the current definition, the ***scope of energy taxes is too narrow*** for these policymaking purposes. The issues with the current classification of treatment of certain taxes and charges is detailed in Section 5 below.

- Energy taxation data can be used as a tool to estimate the contribution of energy to the ***revenue generation***. However, this would require netting off all subsidies. Some databases and indicators do account for certain subsidies, but none can take into consideration the effect of ***feebates or direct subsidies or those granted via other tax bases***, i.e. those energy taxes that are paid, but are then deducted from income or profit taxes or reimbursed through other means. Their estimate would require separate information flows, including an estimate of the total tax amounts that can be deducted from other taxes.

- Though carbon taxes are more and more widespread across EU Member States, the current categorisation of energy taxes taxation is not particularly suitable to be identify those taxes specifically aimed at curbing carbon emissions. In particular, ***there is no separate identification of taxes directly expressed in CO2eq terms***. Also, the current definition includes both taxes on carbon emissions from energy consumption and those from other GHGs (e.g. fluorinated gas).

- As for ***ETS Revenue Reporting***, two main issues arise:

    - all ETS revenues are classified as energy taxes, even when they do not result from energy consumption, as there are a few industrial processes where part of the GHG emissions are process-related (e.g. cement, lime, glass, ammonia). This is discussed in Box 3 below.

[60] OECD climate change taxation overcomes the traditional subcategories of environmental taxation by grouping together carbon taxes, ETS, energy taxes, with taxes on road use, forestry taxes, etc. In about one third of Member States, including most of the large ones - the estimate of climate change taxation is still on a provisional basis. No indicator has been published from reclassified climate change taxation revenues yet.

- ETS revenues are recorded based on the number of EUAs surrendered in each country in one year, multiplied by the average EUA price in that year and accounting for the share of free allowances. This means that revenues are accounted when emissions take place, in line with international practices on environmental tax accounting, to ensure international data comparability. However, this also implies that ETS revenues hardly reflect the tax burden borne by the operator or the revenues accruing to public budgets in a given year. In fact, EUAs surrendered in year t could have been bought from auctions in previous years, or purchases in secondary markets, including from foreign entities. Even though EUAs can be traded within the EU, to comply with the territoriality principle, the current guidelines[61] allow ignoring the difference between EUAs auctioned and surrendered when the first quantity is lower than the second. This corresponds to the case where residents buy ETS allowances issued from foreign governments. In this case, 'taxes' paid to foreign governments cannot be recorded as such. So, at the Member State level, revenues from auctioning are correct, but the 'tax' burden for residents is underestimated. Conversely, when the amount issued is higher than that surrendered, the resulting record is correct from the point of view of the costs borne by residents, but underestimates the revenue for the government. The salience of the issue is bound to grow, as revenues from auctions are expected to increase in the future, and considering the increased ETS price[62].

- Finally most energy taxes, whether introduced on the basis of environmental considerations or not, aim to increase energy prices, and hence to compensate the environmental damage caused by energy consumption (the so called externalities). However, ***the current definition of energy taxes does not*** **include** ***all taxes resulting in a compensation for the environmental externalities related to energy consumption***. For instance, taxes on certain air pollutants (e.g. SOx, NOx) due to fuel consumption are accounted among pollution taxes, even when they are actually levied on the use of energy products.

Box 3: ETS process emissions

Certain industrial processes generate CO_2 other than from the combustion of fuels. This is for instance the case of cement production, when the decomposition of limestone in the clinker result in the emission of carbon dioxide additional to those generated by the combustion of fuels used for heating the raw materials. This type of emissions represents a significant share of carbon emissions in a limited number of industries. Other than cement – in which they represent about 55% of total emissions, they are significant in the production of lime (75%), ammonia (60%), and glass (about 26% for flat glass, between 10% and 15% for production of glass containers and fibre). As those emissions are not related to energy consumption, in principle the ETS revenues associated therewith should not be considered as energy taxes.

However, under the ETS framework, process emissions are defined more broadly. They include both emissions that result from certain production processes (reaction of metal compounds, removal of impurities from metals, decomposition of carbonates, use of carbon bearing substances for primary purposes other than the generation of heat), as well as the combustion of waste gases. Waste gases are however a source of energy, and hence in this case emissions related to their combustion could be considered energy-related, and the ETS revenues associated therewith as energy taxes.

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[61] This admittedly suboptimal compromise reached at the UN level was also justified by the fact that, at that time, most EUAs were released for free and the issue of estimating the international flows of allowances within the ETS was deemed too complex to justify the effort in terms of their financial significance.
[62] The difference between national account statistics and DG CLIMA data on ETS revenues has increased from EUR 3.7 billion in 2017 to 10 billion in 2018.Detailed data provided in Annex C.2.

Process emissions represent a large share of total industrial emissions covered by the ETS, and namely more than 35% in 2019, according to EEA data. However, it is not possible to distinguish the share of process emissions originating from the combustion of fuel gases. Therefore, it is not possible to verify whether estimates of ETS revenues are significantly altered by the inclusion of EUAs surrendered to emission which are not process-related[63].

5.2.1. The narrow scope of energy tax definition

The scope of energy taxation is too narrow, and therefore energy taxation data tend to underestimate the tax burden on energy users. From a quantitative perspective, in terms of tax burden and revenue generated, two methodological choices lead to a under estimation: the treatment of RES charges (which is particularly significant, even though less so in perspective), and the non-inclusion of VAT - that is less relevant but bound to increase in significance in the future together with carbon taxation. Then, other taxes should also be included to obtain a fuller picture from a budgetary perspective (e.g. oil and gas production, taxes on mining), though their revenue impact is generally more limited across the EU.

RES charges. ***Quasi-fiscal measures such as RES charges are not considered within the scope of energy taxation***. There are a number of theoretical reasons for this. First of all, these schemes may fall outside the scope of the budget[64]. This holds true even if the level of fees, reductions, and exemptions is decided by the government. Then, when these schemes do enter the general State budget, they are usually implemented just to pay for the cost of incentives for RES suppliers. Therefore, they do not usually meet the proportionality principle to qualify as taxes for statistical classification purposes.[65] Finally, from an environmental perspective these are not environmental taxes to compensate for externalities, but to promote technological innovation.

Irrespective of the considerations above, one could consider that when a RES charge results in higher energy prices, the resulting transaction could be classified into a 'normal payment', and an imputed 'tax' paid by the buyer and an imputed 'subsidy' received by the producer. This, however, presupposes that a 'normal price' to be used as a benchmark can be estimated, which can be tricky when support is provided to capital investment. Direct incentives to renewable energy producers are calculated through very different mechanisms across the EU, some of which can ***be very complex and difficult to classify into a normal price and an additional subsidy***. Moreover, values can change over time. This can give rise to arrears. For instance, the German tariffs after the legacy of the first feed-in system are now first calculated based on expected values of auctions and these are then compensated the following year based

[63] Cf. DG CLIMA, Guidance Document n°8 on the harmonised free allocation methodology for the EU ETS post 2020, European Commission Directorate-General for Climate Action, Final version of 14 February 2019; Canadian Ammonia Producers, Benchmarking Energy Efficiency and Carbon Dioxide Emissions, Canadian Industry Program for Energy Conservation, Canada, 2008; CEPS Task Force Benchmarking, "Benchmarking in the Cement Industry", presented by Claude Loréa, Technical Director of CEMBUREAU, at the 2nd meeting of the CEPS Task Force, Brussels, 8 July 2009; Ecofys, Fraunhofer Institute for Systems and Innovation Research and Öko-Institut, Methodology for the free allocation of emission allowances in the EU ETS post 2012 - Sector report for the glass industry, Report for the European Commission, November 2009; EEA, EMEP/EEA air pollutant emission inventory guidebook, sectoral guidance chapters - 2.A.2 Lime production, 2009.

[64] To enable Member States to reach the RES targets set by Directive 2009/28/EC (*supra* note 18), any support schemes can be used. These are defined as any instrument, scheme or mechanism promoting the use of RES.

[65] "The term 'taxes' is confined to compulsory unrequited payments to general government. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments". Cf. OECD, Revenue Statistics 1965-2017, Interpretative Guide, OECD Publishing, Paris, 2018

on actual results from auctions. There were cases in the past of important fiscal arrears in some Member States (e.g. Spain) due to underpayments of the RES taxes which further complicates compliance with accrual accounting principles. In some Member States RES taxes are construed as a support to RES investments rather than as consumption-related fees.

Eurostat, in its 2013 Environmental Taxation Guidelines, has fully acknowledged that, from an economic viewpoint, the additional price for consumers, the revenues for producers and the effects for the environment are identical under all the different possible RES incentive schemes. Still, ***the guidelines recommend being very restrictive about imputing RES charges as energy taxes***. This, however, remains at the level of recommendation, as in some Member States RES support is actually provided via taxes (e.g. via excise duties), or because RES charges have been traditionally considered taxes for national accounting purposes or bundled with electricity excises. In fact, to ensure correspondence between national and environmental accounts, the overarching principle remains that an environmental tax is considered as such when it is also reported as a tax in the national accounts, and this vertical consistency principle at the national level prevails on any further horizontal consideration that could ensure a homogenous data of energy tax data.

VAT on energy products. Since it does not influence the level of relative prices in the same way as environmental taxes, the consensus is that ***VAT does not represent a specific energy tax***. The international guidelines[66] only envisage the possibility that ***the non-deductible part of VAT charged as a surtax on energy taxes[67] could be considered as a component of energy taxation***. At the EU level, however, VAT is never included among energy taxes despite the fact that, differently from what can happen in other jurisdictions, its taxable basis includes excises and other energy taxes. This was mainly due to ***feasibility considerations*** due to the effort needed to estimate the amount of "surtax VAT" which is not deducted for the different products and uses.

Taxes on Oil and Gas Production. The Eurostat guidelines, in line with the internationally agreed principles on environmental taxation recommend that ***taxes on oil and gas production should be excluded from energy taxation statistics***, and even from taxation statistics in general, and classified as rents from Government property[68]. Other taxes on resource extraction including, for instance, coal mining of or extraction of forestry wood could be - at least theoretically - included in the list of environmental taxes as resource taxes, or discretionarily dealt with as rent from property income also depending on the size of revenues or other national accounting factors prevailing on harmonisation needs.

Taxes on Profits. The current Eurostat guidelines recommend excluding all ordinary and extraordinary profit taxes from energy taxation. The rationale behind is that they have a distant and uncertain effect on the price of the underlying tax base(s), as they might not translate into increases for the final users, which would at any rate be difficult

[66] UNSD *et al*., System of environmental economic accounting 2012: central framework, United Nations, New York, 2014.

[67] Out of analogy one would conclude that the VAT on ETS certificates that almost unanimously the VAT Committee has deemed due for both ETS certificate emissions (IT does not) and transactions - should be considered as a component of environmental taxation to the extent that they are conventionally assumed to have a pass-through effect on final prices.

[68] There are several reasons for this, and namely: (i) the revenue from these taxes is significant in just a few Member States so that comparison across them for benchmarking purposes would be distorted; (ii) the mechanisms in place to capture the extraction rent can substantially vary from Member State to Member State also due to government ownership of oil and gas production companies, so that the amounts of taxes paid in this area might simply reflect different ownership systems; (iii) tax revenue from oil and gas production can be fairly volatile over time, as it follows the prices of oil and gas. This would distort time series and the identification of underlying trends.

to demonstrate. So, they are conventionally assumed to have no such effect and remain outside the scope of energy taxation, So, for instance, the recent Latvian tax on extra profits from RES does not qualify as an energy tax.

5.3. Energy tax revenue datasets

Eurostat NTL-based Energy Taxation Dataset. The European Environmental Taxation dataset is a subset of the National Tax Lists[69] drafted for general national accounting purposes. The main advantage of this dataset is that it is fully compatible with the (environmental) national accounting principles (accrual values, territoriality, etc.) so it can be used to make direct comparisons with total taxation, GDP data as well as with the energy balances. It has two main drawbacks. First, ***only aggregate data per each Member State are available***[70]. For instance, there can be Member States reporting a single category for "excise duties", without differentiating between transport or heating fuels, or electricity. The result is that to calculate e.g. transport fuel taxes, the Commission must extrapolate values from other sources, such as the EDT. Revenues from ETS should, be recorded separately[71], but in practice this principle is frustrated by the fact that some Member States used to bundle ETS to other (even non-energy related) environmental taxes; this has greatly improved and the revenues from ETS are now separately reported in the NTL and labelled appropriately (with the exception of Greece). Much in the same vein, also intermediate energy production taxes cannot be distinguished by type of energy product targeted. Secondly, and possibly even most importantly from the policymaking perspective in terms of possible quantitative distortions, there are major problems with data comparability, because of the ***national definition of what a tax, or an energy tax is,*** as already discussed in the case of RES charges.

Eurostat Energy Taxation Dataset by NACE-64 industries and paying entity. Eurostat publishes the only existing energy taxation dataset with data breakdown at the sectoral level. ***Energy taxation revenues are classified by industrial sector, up to the level of NACE-64 industries, as well as by paying entity, including households and non-residents***[72]. As data are compliant with national accounting principles, they can be compared with other national account variables, such as added value. However, this determines the same drawbacks for data comparability discussed

[69] Energy taxes are identified based on a letter code as a subgroup of environmental taxes. This is because the European Environmental Taxation dataset was superimposed on the existing NTL one to reduce reporting burden on Member States, so only data classification based on the original NTL coding (production, consumption, wealth tax, etc.) is possible. These traditional tax classification categories, however, are of limited significance in the field of energy and have never been used for reports or quoted as relevant in the literature.

[70] Once compliance with national accounts is ensured, there is no binding criterion Member States must follow for tax reporting. This gives rise to a number of heterogeneous reporting practices that hinder subsequent data comparability. For instance, there are countries: (i) separately reporting excise duties by type of fuels and keeping track of the related carbon tax component even if the tax is formally the same (e.g. Denmark); (ii) bundling together in the same amount revenues from all fuel excises together with the carbon tax component (e.g. Sweden); (iii) bundling together all energy excises including electricity together with the carbon tax (e.g. Portugal); (iv) separately reporting system charges or public service obligations as a tax; (v) separately reporting RES charges as a tax (e.g. Belgium); (vi) bundling together electricity excises with RES charges (e.g. Italy, Croatia).

[71] This is because of the different nature of the underlying tax bearing a different classification code.

[72] Namely: (i) households, (ii) industry, (iii) construction, (iv) wholesale and retail trade and repair of motor vehicles, (v) transportation and storage, (vi) services, and (vii) agriculture, forestry and fishing.

above, and others specifically concerning the classification of revenues paid by non-residents[73] in a few Member States or the treatment of certain tax items[74].

OECD Energy Tax Revenue Statistics. Although it also uses the EU National Tax List as one of its main sources of information, until 2018 data the OECD energy taxation dataset has been slightly at a variance with Eurostat[75]. This appears due to two main factors: (i) revenues from ETS were not included; (ii) the OECD, instead of ensuring consistency with national accounts practices, follows its own Revenue Statistics methodology. As a result of this, the total amount of revenues from energy taxation was estimated generally lower in the OECD database[76]. The two datasets should increasingly be converging because ETS data will also be reported by the OECD and dialogue with Eurostat and national data providers on tax classification is ongoing.

The OECD has also been active in enhancing the level of ***data disaggregation available*** on energy taxes and recently embarked into a ***pilot exercise*** aimed at increasing the level of data disaggregation available on environmental taxation, thereby redressing some of the more significant logical inconsistencies and analytical data gaps for policymaking information needs that have increasingly appeared evident over time. The proposed OECD reclassification scheme would address most of the shortcomings highlighted in the paragraphs above, as it envisages[77]:

- the separate identification of transport fuel taxes;
- a clearer distinction between carbon taxes and ETS proceeds from energy-related emissions from those that are non-energy related (classified under pollution taxes);
- the separate identification of taxation of air pollutants (including NOx and SOx emissions) and ozone depleting substances (that would no longer be considered as carbon taxes) among pollution taxes;
- among the memo items included – i.e. items that remain officially considered outside the scope of environmental taxation – but are reported for comparison and completeness purposes the OECD has envisaged (i) the separate indication of taxes on oil and gas extraction, as well as of (ii) revenues classified as resource rent taxes including mining.

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[73] This generally regards transport fuel taxes paid by travellers and can be significant to estimate so-called fuel tourism. It is up to the Member States to provide separate data for non-residents, as this might represent an additional data collection burden for them. Eurostat estimates energy tax revenues from non-residents at around 2.5% of the total for the EU 27 overall. Nevertheless, in small countries (Luxembourg and Malta are the typical example) this share is more significant, as well is transit countries (e.g. Austria).

[74] Eurostat's questionnaire on environmental taxes by paying entities collects information on other payments included in national definitions of environmental taxes and other relevant environmental payments (such as fees) as memo items. For instance, Germany should be starting reporting RES payments under the latter memo item. Also, the treatment of relevant payments has been clarified in the Manual on Government Deficit and Debt and should therefore become more comparable across countries (e.g. last year Belgium revised its data in this context).

[75] The OECD has developed in parallel its own dataset on environmental taxes, the Policy Instruments for the Environment (PINE) database, originally in co-operation with the European Environment Agency (EEA) and then run as an entirely in-house exercise. The PINE database also has a separate section for earmarked taxes.

[76] A detailed comparison of the two datasets is reported in the Appendix to Annex C, Volume 2.

[77] The full classification is provided in Annex C.8. Cf. OECD, Revenue Statistics 2019: Annex 2.A. List of environmentally related tax bases, OECD Publishing, Paris, 2019, p. 54.

5.4. Other datasets on energy taxation

Oil Price Bulletin. The EU has two dedicated datasets specifically created to keep track of the prices of energy products, that can also be used for the estimation of the total tax burden. The first is the ***DG ENER Oil Price*** **Bulletin** covering mineral oil products. The dataset includes separate information on retail prices with and without taxes. The tax breakdown covers VAT and other indirect taxes; there is no separate indication of the excises or carbon taxes / components. Data are available for energy products with a European market dimension and include the main fuels for transport: gasoline, diesel, LPG, heating fuels (e.g. gasoil, but not kerosene), and as fuel oils for industrial uses with and without sulphur. Products with a local market (methane for cars in Italy, kerosene for heating in Ireland), are not covered. Since only aggregate data by product are published it is not always possible to fully appreciate the importance of rebates or exemptions linked to a product environmental features (e.g. blending with biofuels).

Eurostat Energy Prices Statistics. In the ***Eurostat statistics on the prices of natural gas and electricity for households and industrial users***, prices and their components are published by consumption band. Price components include taxes and other fees with a very detailed breakdown: (i) network costs; (ii) VAT; (iii) RES taxes and fees; (iv) capacity taxes and fees; (v) nuclear taxes and fees (for electricity only); (vi) other environmental taxes and fees; and (viii) other taxes and fees. Clearly, the focus is on estimating all the price components resulting from taxation or regulation, classifying the resulting burden by category and not based on the distinction between taxes and other quasi- or non-fiscal tools. Taxes and fees are included only to the extent to which they are imposed on the final gas or electricity price; taxes on their production (e.g. ETS) are not covered. The main issue with this database results from three big Member States – Italy, Germany, and Spain – which could not provide a separate breakdown for RES charges and other tax components and were thus granted a derogation, in one case even on a permanent basis[78].

IEA Energy Prices Statistics. Starting with the 2020 edition of its Energy Prices database, ***IEA has also started publishing information on the tax components of energy prices*** for a number of energy products such as coal, LPG, regular, mid-grade and high-grade gasoline, kerosene (excluding for air transport), automotive diesel, fuel oil, natural gas. These data are available for commercial, electricity generation, industry, residential and transport uses. Data breakdown on energy taxation envisages the separate indication of: (i) VAT; (ii) environmental taxes; (iii) RES taxes (defined as only taxes for RES investments), (iv) energy security taxes (strategic stockpiling, etc.) (V) social taxes (defined as those earmarked for social policy purposes) and (vi) other taxes. Again, the focus of these categories is not on the fiscal vs. non-fiscal nature of certain price components, but on the aim for which they are charged[79].

DG TAXUD Excise Duty Tables. A database exists on the ***energy excises***, that is the Excise Duty Tables (EDT) by DG TAXUD. The EDT dataset gathers information on the rates of and revenues from "taxes on consumption (excise duties and similar charges) other than VAT on energy products and electricity". Rebates are also notified, but the EDT are not necessarily exhaustive of all niche reimbursements, as well as direct subsidies or those not affecting the excise rate. The definition also includes carbon taxes when they are incorporated in the excise mechanism and collected together, but the data are not reported separately. The EDT are populated with information supplied by the Member States, which do not have to conform to national accounts methodology

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[78] Spain was granted a special derogation by means of an ad hoc Commission Implementing Decision because its price mechanism did not allow for a clear identification of all price components.
[79] IEA tax definition is provided in detail in Annex C.8.

(i.e. data are not necessarily on an accrual basis), without any centralised data quality and validation process as per Eurostat's database.

OECD Taxing Energy Use Database. Given the growing interest in having comparable data on the energy tax burden, the OECD has developed the ***Taxing Energy Use (TEU) database***. The database provides the energy tax rate applicable to various sectors, products, and energy uses, as resulting from the combination of fuel taxes, carbon taxes, and electricity taxes. This dataset is structurally comparable to the tax rate part of the EDT and actually extensively draws from it. Electricity taxes include only "compulsory, unrequited payments"; therefore, the TEU database so far has not included RES charges. It does not include information on VAT either.

The WB Carbon Pricing Dashboard. The WB Carbon Pricing Dashboard is an interactive online platform providing updated ***information on existing and emerging carbon taxes and ETS initiatives around the world***. It complements and builds on the data and analyses of the annual WB State and Trends of Carbon Pricing report. The dashboard provides information on tax rates, share of emissions covered, and is one of the few available sources on overlapping with ETS scheme[80], GHG conversion mechanisms[81] and revenues from taxation for both the latest year and estimates for the current year. A country factsheet provides some details on rebates and exemptions at the national level.

CEER RES Dataset. The biennial CEER Status Review of RES Support Schemes represents one ***of the main sources of information on the costs of RES***. It is populated by data provided by the Member States that can have recourse to heterogeneous underlying methodologies. The dataset provides information on total financial support by type of RES technology for 23 Member States[82]. Separate qualitative indication is given for the countries relying on general budgetary and extra-budgetary RES support. No breakdown of financing sources, even as a share of the total, is provided when Member States report both support from general taxation and recourse to dedicated levies (e.g. Luxembourg). An indicator of total RES support per unit of total electricity produced is published. A comparison of 2016 estimates with data published by other sources has revealed some discrepancies in data classification, which highlights a possible need for data reconciliation.

5.5. Datasets for estimating energy subsidies

OECD Inventory of fossil fuel subsidies[83]. ***The OECD inventory of fossil fuel subsidies is the largest energy subsidies dataset, covering both direct subsidies and tax expenditures.*** The former is estimated based on their costs for the public budget, while the latter based on national estimates, made comparing the reduced and a benchmark tax rate. By relying on national benchmark, the OECD circumvents its definition; it goes without saying that this limits the comparability of tax expenditures estimates. The subsidies covered include any "preferential treatment for

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80 Data on overlapping by Member State are shown in Annex C.6.

81 For instance, since 2019, Finland has changed the methodology to calculate the CO_2eq emissions for heating fuels and fuels for work machines covered under its carbon tax, and full lifecycle emissions of the fuels are now used instead of only combustion emissions. This was accompanied by a reduction in the tax rates.

82 Data are missing for: (i) Belgium, where RES support is managed at the regional level and the Federal Government provides data for federal schemes only (regional ones could be retrieved from the NTL); (ii) Bulgaria, where RES support is considered private company obligations; (iii)Slovenia that entirely manages RES through a State-owned company; and (iv) Slovakia, where issues exist on the connection of certain RES plants to the distribution grid because of concerns over grid stability and security of supply.

83 OECD, Companion to the inventory of support measures for fossil fuels 2018, OECD Publishing, Paris, 2018

fossil-fuel production or consumption relative to alternatives". Tax expenditures include rebates, exemptions and reimbursements or reductions on VAT and excise (on the consumption side), and on producers' taxes, such as corporate tax and royalties, on the production side. The fuels covered include both primary fossil fuels (e.g. oil, coal, natural gas), as well as secondary products (e.g. gasoline, diesel).

IMF Fuel subsidies[84]. ***The IMF estimate of fuel subsidies relies on an externality-based approach:*** the optimal tax rate is calculated, which should reflect all external costs generated by the fuel consumption plus the standard VAT rate[85]. Any rate lower than that is considered a subsidy[86]. Such a definition of subsidies is policy-actionable: if taxes increase, the amount of subsidies decrease *ceteris paribus*[87]. The IMF treatment of VAT does not account for the VAT surcharge, which would become relevant for final consumer. The classification of the VAT surcharge as an energy tax would call into question the possible under taxation of transport fuels experience in several EU Member States, as far as private transport is concerned.

The IMF publication represents a monumental effort to quantify those external costs, by collecting a plethora of economic, epidemiological, behavioural, geographical, and technical data needed to populate the model[88]. All data are published in a spreadsheet, allowing not only to estimate existing subsidies, but also to calculate, as a side product of the exercise, what the optimal rate of taxation should be, per country and per fuel, and how distant the current level is. The underlying theoretical justification is well-grounded in the economic theory; however, estimating those externalities, which are very diverse, represents a conspicuous challenge. In particular, the robustness of the methodology depends on various parameters, such as the value of life saved. The IMF has carried out this exercise for fossil fuels only, but is considering its possible extension to biofuels.

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[84] IMF working Papers, Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates, 2019.

[85] The 'exclusion' of the VAT burden from the optimal tax rate appears controversial. Indeed, one could argue that the total tax burden, including VAT, should be equal to the external costs. It is however justified based on revenue-raising considerations (reducing the VAT rate on those fuels would generate foregone revenues). Furthermore, the IMF methodology does not consider the VAT surcharge on energy taxes, and this can slightly distort international comparisons Cf. IMF, Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates, International Monetary Fund Working Papers, No. 19/89, May 2019.

[86] Namely, these are the so-called post-tax subisidies; pre-tax subsidies are are also calculated as the difference between retail and international energy prices, but these are of no relevanec for the EU.

[88] Assuming constant international energy prices.

[88] The database builds upon the resources and knowledge of the IMF and other institutions (e.g. IIASA), and a corpus of theoretical and empirical research carried out in the 2010s. Conceptually speaking, the policy relevance of this study is unique, as it is one of the few international studies allowing for a proper cross-country comparability of fossil fuel subsidies.

6. POLICY QUESTIONS

This chapter provides an answer to the ***four policy questions related to energy tax indicators***, and namely:

1) to what extent do public budgets rely on ***energy taxation as a means of revenue generation***?
2) what is the best methodology to define the ***effective tax rate*** on energy for a given sector, fuel or activity in a Member State?
3) to what extent does energy tax policy help provide a consistent ***price signal for GHG emissions*** reductions? and
4) to what extent is ***energy tax policy coherent*** with EU policy goals in the areas of energy efficiency, energy security and pollution reduction?

For each of these questions, the issue at stake is first defined and the main relevant indicators are presented; then, the policy significance and possible use for benchmarking purposes of the latter are assessed. Finally, the main findings are summarised in a short conclusion directly addressing the policy questions.

6.1. Indicators of energy taxation as a source of revenue generation

6.1.1. Existing indicators

Existing revenue-based indicators were mainly created to measure the overall ***'degree of greenness'*** of the tax system, i.e. the rough importance of environmental considerations in a tax system. The main available indicators calculated at EU level include:

- revenues from energy taxation as a share of GDP, and
- revenues from energy taxation as a share of total tax revenues.

These are the ***two reference indicators*** published by Eurostat and DG TAXUD (in its Taxation Trends Report) to comment on the Member States energy tax systems. A separate similar indicator measuring energy taxes over GDP is also calculated by the OECD[89]. The EEA has proposed a different indicator - the ratio of energy taxes on labour taxes – as one of their key environmental policy indicators in this area[90].

These indicators were adapted to a policy use in terms of revenue recycling purposes, mainly within the framework of the so-called "double dividend" argument. This is defined as "*an environmental reform of the national tax system where there is a shift of the burden of taxation from conventional taxes, for example on labour*[91]*, to environmentally damaging activities, such as energy use or pollution*"[92].

To highlight the importance of transport fuels on total energy tax revenues DG TAXUD also calculates separate indicators based on the EDT data, namely[93]:

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[89] OECD are lower than the EU ones in a dozen of Member States for the reasons discussed in the appendix to annex C in Volume 2.

[90] See https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/environmental-and-labour-taxation

[91] The EU Sustainable Development Strategy recommended that Member States should shift taxation from labour to energy and/or air pollution, to contribute to the EU goals of increasing employment and reducing environmental impacts in a cost-effective way. Cf. Commission Communication, A sustainable Europe for a better world: A European strategy for Sustainable Development, COM(2001) 264 final.

[92] See, EEA, Market-based Instruments for Environmental Policy in Europe, 2005, p. 158.

[93] Cf. European Commission, DG TAXUD, Taxation Trends Report 2019 Edition.

- transport fuel revenues as a share of GDP; and
- transport fuel revenues as a share of total tax revenues.

The use of EDT data as proxies – compared to the Eurostat statistical data collection process –, however, presents certain limitations in terms of quality control and data comparability across Member States.

Issues with existing indicators. Energy taxation indicators only partially capture all relevant elements to estimate the tax burden on energy consumption, or the net revenues generated. Namely:

Existing energy tax indicators are compliant with the statistical definition of 'tax' and do not include 'quasi-fiscal charges', because the latter do not represent additional net revenues for Government. The statistical definition of energy taxation – when correctly applied – is thus fit to capture the revenue dimension, with the caveat discussed below. However, as discussed in Section 5 above, it may fail accounting for the overall tax burden on energy consumption, which consist of both fiscal and related charges. In any case, it ensures that energy taxes, defined in line with the national account principles, are comparable with the denominators, in particular total taxes and GDP.

An important caveat on whether existing tax indicators can accurately capture revenues generated by energy taxation is due to the use of ***feebates***, ***direct subsidies or those granted via other tax bases***, i.e. those energy taxes that are paid, but are then deducted from income or profit taxes or reimbursed through other means. When subsidies and tax expenditures are not granted via the same tax basis, they are not accounted into energy tax revenue indicators, which therefore may not accurately represent 'net' revenues. Despite its recent growth, the weight of this phenomenon within the EU fiscal systems is hard to quantify due to lack of data.

As a consequence, energy taxation datasets and related indicators may mispresent energy tax revenues, both in absolute values and a share of other taxes / GD While they can reasonably highlight trends over time at the country level, they only limitedly lend themselves to cross-country comparisons for four main reasons[94]:

1) In some countries, RES charges are part of energy taxes, while in others they are considered non-fiscal or off-budget fees. Therefore, ***the cost of RES should be subtracted*** from the former countries' net revenues to come to comparable data. This also means that the amount of net energy tax revenues for the former countries is actually lower than it appears.

2) Energy tax revenues data are net of rebates and exemptions administered via the same tax base, but not of ***feebates[95], direct subsidies and subsidies granted via other tax bases (e.g. personal or corporate income taxes), which highly vary from country to country***.

3) Available energy tax revenues databases do not include non-deductible ***VAT on energy products,*** and not even the VAT surcharge on other indirect energy taxes. This is common to all Member States and leads to the underestimation of energy

[94] As discussed in Section 4.4 above.

[95] Feebates are simliar to emission (or efficiency) standards, but can better accommodate uncertainty (e.g. over future technologies and prices). For instance, a feebate would impose a sliding scale of fees on firms with emission rates above a certain threhold and corresponding subsidies for those below the threshold. Alternatively, the feebate can be applied to energy consumption rates rather than emission rates. Cf. IMF Policy Paper, Fiscal Policies for Paris Climate Strategies — From Principle to Practice, 2019, hereinafter 'IMF Fiscal Policies 2019'.

taxes[96]. Furthermore, paradoxically, when reduced VAT rates are introduced, this may result in a comparatively higher share of energy taxes on revenue indicator, even though lower VAT means lower taxation of energy consumption. Indeed, lower VAT revenues are not reflected in the numerator (i.e. amount of energy taxes) but lowers the denominator (i.e. total taxes). In certain Member States the size of the effect (as high as 0.25% of GDP) can be big enough to slightly distort trends overtime;

4) Because of compliance with national accounting principles, ***the proceeds from EUA auctions*** can be underreported in a number of countries (i.e. those in which companies surrender less EUAs than those issued). Therefore, at EU level energy tax revenues can be overestimated, while also affecting cross-country comparability. So far, the size of this distortion has been much lower than that of RES.

Box 4: Net energy tax revenues from a macroeconomic perspective

From a macroeconomic perspective, assessing net energy tax revenues requires not only the adjustment of the tax definition and coverage, as discussed above, but also an assessment of a counterfactual scenario in which these taxes do not exist. In other words, one should answer the question whether the elimination of energy taxes would result in lower tax revenues or in an increase in other taxes, such as personal or corporate income taxes. The latter effect is called "tax offset". Without accounting for the tax offset, nominal revenues overestimate net real revenues for governments. No indicators exist in this regard, because tax offsetting is a country specific phenomenon depending on local conditions. Actually, some maintain that the argument applies to high-income countries only, while in low-income countries with weak taxation systems and a widespread informal economy high energy tax rates are set to compensate for missing income or VAT taxes and actually entirely result in higher net total revenues for governments.

6.1.2. Benchmarking and policy significance

Benchmarking. As no external benchmark is available for energy tax revenues indicators, benchmarking is only possible by means of ***ranking***. As also commented by a number of stakeholders in both the workshop and the survey, however, this ***can be misleading for the public***.

The main issue is that ***any ranking is affected by the discrepancies in definitions and tax recording described above***. Some of these discrepancies are 'worth' billions of Euro, significantly affecting the final results. For instance, if a country finances RES via energy taxes, the share of energy tax over total GDP or total taxation will be higher than in another country providing the same amount of support but via non-fiscal charges. Though, such a different classification makes no difference in terms of environmental policies and impacts. Similarly, the fact that non-deductible VAT on energy products is not accounted for among energy taxes can be another distortive factor. A country with very high excises e.g. on electricity but reduced VAT rates would result in a higher indicator compared to a country with lower excises and standard VAT rates, even if the total tax burden and government revenues were the same. Secondly, ***exogenous factors also affect the indicator***, so that it only spuriously represents the greenness of the fiscal system. Among those factors, energy efficiency, energy intensity and the industrial structure will determine the amount of energy consumed in a country. As noted by workshop participants, a country that consumes more energy, e.g. because it hosts comparatively more energy-intensive industries (e.g. manufacturing vs. services), will obtain higher energy tax revenues all other things

[96] Ad-hoc studies try to measure the amount of non-deductible VAT borne by final consumers. Cf. European Commission DG MOVE, Study on Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities, Publications Office of the European Union, Luxembourg, June 2019.

being equal (e.g. fiscal policies, energy tax rates). A country whose economic structure is characterised by a substantial weight of industries whose energy use is covered by mandatory tax exemptions[97] will get lower ones.

Policy significance. The theoretical framework behind what 'aggregate environmental taxation' should mean has hardly been defined other than for statistical purposes. Unless corrections are introduced, ***current statistical data and related indicators do not represent an entirely reliable measurement of net revenues for the general budget, particularly in comparative terms***. Moreover, aggregate energy tax revenues are only a partial proxy of the importance attributed to energy taxation in terms of environmental policy. Successful fiscal incentives to product substitution granted by exempting RES or biomass, while at the same time increasing the ordinary level of taxation, result in the indicators actually decreasing rather than increasing, as demonstrated by the Swedish example (see

Box **5** below). This is actually the mainstream rationale of using environmental taxation to bridge the gap between the price of fossil fuels and RES substitutes, and encourage technological innovation accordingly. By definition, these indicators cannot be used to assess the rationale of the underlying environmental policies which lead to certain taxation levels. Hence, recent studies and environmental reviews on the reduction of carbon emissions from certain typologies of consumption, notably heating, have concluded that, with present technological constraints, the contribution of energy taxation reform would be minimal in certain countries[98]. Other countries, more extensively relying on district heating, can obtain emission reductions via carbon taxation, as the recent German example shows

Box 5: Trends in aggregate energy taxation revenues in Sweden

Sweden has access to sizeable RES from forestry as well as to nuclear energy. Natural gas only plays a marginal role as source of energy. After the oil crises, the country heavily promoted district heating also by means of co-generation as a way of reducing its dependence on oil. Fiscal policy in Sweden is generally deemed to have played a major role in the decarbonisation of both heating and transport. Indeed, environmental taxation has been at the centre of the Swedish fiscal policy debate since the early 1980s and already at that time the Government used energy tax revenues as a means of reducing taxes on labour. In 1991, Sweden pioneered the introduction of a carbon tax, with a limited number of industries exempted from the tax and a widespread scope for reimbursement to reduce tax offsetting. At that time, the carbon tax alone accounted for about 2.4% of total tax revenues and energy taxation was constantly increasing, providing incentives for product substitution particularly for heating and transport purposes. However, Sweden isone of the few Member States where energy taxation did not increase in absolute terms between 2007 and 2018 and does not rank particularly high by energy tax revenues indicators. Nevertheless, the country is singled out by the IEA and other institutions among the best environmental performers, in terms of both GHG reduction and energy efficiency. This has been ultimately achieved without increasing energy tax revenues, but by using carbon taxes to modify the relative level of prices and provide incentives to favour RES. First, RES from biofuels and biomass are exempt from the carbon tax; when this is not sufficient to bridge the price gap, additional measures (e.g. green certificates) are also introduced. The more the energy system is pushed towards RES, the lower the amount of energy tax revenues. Furthermore, to keep revenue neutrality, increases in energy excises have been compensated by the abolition of non-carbon-related taxes, such as taxes on nuclear or hydropower capacity. As decarbonisation has been largely based on the use of forestry resources and black liquor from pulp and paper factories, it is possible that this shrinking has also been (partly) compensated by forestry levies and income from State-owned forests. According to the IEA, the tax base for energy taxes is actually expected to further shrink as a result of decarbonisation.

[97] As per the ETD, supra note 14.
[98] A 2017 study on the role of fiscal policy in relation to the decarbonisation of heating in the UK concluded that the role of taxation would be ancillary rather than central. "This would not deliver the scale of emissions reductions to which politicians were committed". Robinson, D., Fiscal policy for decarbonisation of energy in Europe*,* The Oxford Institute for Energy Studies, Paper 22, 2017.

6.1.3. Conclusions

The existing energy taxation datasets do not entirely allow to properly answer the question on the extent to which public budgets rely on energy taxation as a means of revenue generation. As extensively described in the previous chapter, the ***existing energy taxation datasets suffer from some drawbacks which limit the accuracy of the revenue estimates, and further result in limitations to cross-country data comparability.*** This is mostly due to differences in the national definition of energy taxes, including the distinction between fees and taxes, and the prevalence of the national accounts principles. These differences result in shortcomings in the underlying tax revenue data, particularly as far as the accounting of RES charges, ETS proceeds and VAT is concerned. These shortcomings represent the main constraint to the adequacy for energy policy purpose of the revenue indicators, both in absolute terms and as a share of total taxes, labour taxes, or GDP.

Still, these indicators are the only available to measure the relative importance of energy taxes in national fiscal systems, and therefore are commonly used at national level. Results from the survey confirm that these have indeed been adopted and are being used by some Member States for their internal budgetary analysis. Unsurprisingly, this is particularly so when Member States are confident that the underlying national data accurately reflect the various national energy policies. At any rate, cross-country comparability limitations remain so significant that the use of these indicators for this purpose is severely questioned.

Moreover, the indicators on energy taxation over total / labour taxes remain ***the only readily available tool to monitor the double dividend argument and revenue recycling***. Those aiming to emphasise the "double dividend" argument compare this indicator with the share of labour taxes and social security contributions on total taxation revenues to highlight trends[99]. The comparison between these two indicators can be communicated in a fairly intuitive way, and remains accurate and straightforward, but should be used with caution for more fine-tuned policy considerations, because it can mispresent distributional impacts, since the impacts from recycling via in income or labour taxes, or social security contributions are not equivalent. Following the recent emphasis on carbon taxation, more attention has been paid to monitoring more in detail Member States' ***revenue recycling and earmarking practices.*** These are not neutral in influencing the achievement of environmental taxation objectives [100]. So far, however, this monitoring has consisted in *ad hoc* studies, and no regular indicator has been published yet to highlight differences in revenue recycling patterns, including to finance the cost of RES[101].

Although extensively used in practice, ***energy tax revenues as a share of GDP indicators are of not fully accurate in assessing energy tax revenue generation and can be ambiguous for other policy purposes.*** This is clearly the case, for

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[99] In particular, while labour taxes tend to be progressive, energy taxes tend to be regressive, because the share of energy expenditures over total consumption is higher for the poorer strata of the population. This can be tackled by two policies: (i) other taxes are modulated to make energy tax revenues neutral; and (ii) taxation revenues are recycled to compensate for the distributional impacts of energy (or carbon) taxation.

[100] Cf. IMF Fiscal Policies 2019, *supra* note 95.

[101] Such an indicator would allow to monitor the degree of compliance with the policy stance that the extra revenues to finance RES should always come from the general budget and be eventually funded by means of ordinary energy or carbon taxation, rather than from charges on electricity consumption. Newbery, for instance argues: *"It thus follows that the revenue needed to finance renewables and other public goods should come from general taxation raised in the least distorting ways consistent with distributional objectives – either through income taxes or a uniform rate of VAT, and not by selectively charging single products like electricity".* Newbery, Reforming UK energy policy to live within its means, Cambridge Working Papers in Economics, 2015.

instance, when non-fossil fuels are not taxed: while widening the "combustion surcharge"[102], i.e. the tax gap between carbon-emitting and –free sources, this policy results in a decrease of tax revenues indicators. Similarly, if certain energy taxes are transformed into e.g. transport taxes pursuing similar environmental objectives (e.g. if excise duties per litre of gasoil are transformed into a tax on the car mileage), the indicator will lower and therefore the tax system will be perceived as 'greying'. The trend towards higher combustion surcharge and clean energy tax preferences in other non-energy related tax bases (e.g. taxes on carbon emissions for vehicles) is one of the driving forces behind the OECD search for new tax revenues classification schemes.

6.2. Effective tax rates at sectoral, fuel or activity level

6.2.1. Definition and existing indicators

Implicit or effective tax rates aim at ***measuring the average tax burden on energy consumption***. The two terms – implicit and effective – are used interchangeably, although a difference exists in other areas of fiscal studies.

Measuring the 'average' energy tax burden requires consolidating revenues data over different tax bases. Differently from personal or corporate income taxes, energy taxation faces data aggregation problems, as the tax basis can be expressed in different units (e.g. per litre, MWh, kJ). At product level, expressing the tax burden in monetary terms and calculating the share of energy taxes on prices is always possible[103]. The aggregation in an implicit or effective tax index would be possible, as ***the share of taxes on product prices could be weighted by the monetary value of that product consumption***. This has never been implemented in practice, however, because of feasibility constraints[104]. Namely, collecting detailed data on each energy product, even only for household consumption, appears too cumbersome to justify the effort[105] and possibly only the IEA, or the OECD in the future, could be in a position to dare build such an index based on their enhanced existing databases[106].

Alternatively, the ***energy content*** (measured in e.g. TOE or GJ) has been used as a common denominator to aggregate different tax rates[107]. Therefore, ***implicit and effective tax rates can always be expressed in terms of energy content,*** but differ as to their main sources of information and level of granularity, and in particular as to whether they are calculated based on ***tax revenues data or tax rates***. The two methods are not equivalent: the former accounts for the impact of tax evasion, or the amount of unpaid taxes or arrears; the latter, which usually requires a bottom-up collection effort, gets rid of the definition and recording problems discussed in Sections 5 and 6.1 above (also by not considering RES and ETS), but does not account for non-deductible VAT either. In any case, both methodologies cannot take into consideration the impact of ***feebates or subsidies which are administered directly or via other tax bases,*** in the first case because they do not affect revenues and in the second

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[102] As measured by the OECD, Cf. TEU, *supra* note 54, Figures 2.5 and 2.6.

[103] In Section 5, existing datasets a ttempting to do this on a number of energy products are briefly described together with their main current limitations in data quality.

[104] Such an aggregate indicator would be useful, for instance, to measure the total energy tax burden on household consumers in a given country as a share of their disposable income.

[105] The value of expenditures in certain products for which an international reference price exists, e.g. oil, can be retrieved from various sources, but this cannot be applied to the totality of energy products consumed in the economy. For energy sources or vectors for which price series exist, e.g. natural gas and electricity, prices are provided per type consumption band, and by means of information on the weight of each band, an average price could be calculated.

[106] IEA, Energy Prices and Taxes for OECD Countries, International Energy Agency Statistics.

[107] This does not mean that different energy products can be perfect substitutes once accounting for their calorific content, due to their other technical features.

because they are not captured by tax rates[108]. To account for them, a repository of those subsidies should be compiled to complement and correct these estimates.

Commission's Implicit Tax Rates. DG TAXUD defines the Implicit Tax Rate (ITR) on energy as ***"the ratio between total energy tax revenues and final energy consumption"***[109]. The latter is measured by means of Eurostat's energy balance and consists of different energy products, which can be 'summed' based on their energy content[110]. Energy consumption is considered at ***final consumer level*** and does not include energy consumed for energy transformation[111].

The Commission currently publishes ***three implicit tax rate indicators for the economy as a whole***:

1. the Nominal Implicit Tax Rates, by TAXUD;
2. the Implicit Tax Rates on energy (deflated with the GDP implicit deflator, base year 2010), by Eurostat; and
3. the Implicit Tax Rates on energy (deflated with the final demand deflator, base year 2010), by TAXUD; however, from the 2020 edition onward, the deflator has been aligned to Eurostat's.

The first indicator is expressed in nominal terms, while the other two are calculated in real terms and deflated to account for the overall price trend via different deflators. ***The ITRs are not robust to the various deflators*** and the two real indicators provide different values and trends over time. The use of different deflators is likely to depend on the fact that no specific deflator for energy price exists. The World Bank, in its periodical tracking of international energy prices[112], uses another deflator, the Manufacturers Unit Value, which is the unit value index in US dollar terms of the manufactured goods produced by 15 among the main world economies. By tracking the global real value of US dollars over time, this indicator can be used to deflate energy prices from a measure of global inflation. However, for deflating ITRs, an index which could deflate tax revenues from changes in energy prices would rather be needed, and it is not available at the moment.

The Commissions ITR's measures the average tax burden imposed on energy consumption in the various Member States. It provides two kind of information:

- in absolute terms, the energy tax level in a country: the higher the ITR, the higher the fiscal burden;
- in relative terms, the extent to which a country taxes energy consumption more or less than other Member States.

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[108] For instance, the OECD Country Factsheets, effective tax rates in Italy do not take into consideration subsidies to freight transportation and effective tax rates for agriculture in Germany, where reimbursements are granted through another tax base, show some limitations.

[109] DG TAXUD, Taxation Trends Report 2019 Edition. Annex B: Methodology and explanatory notes, Publications Office of the European Union, Luxembourg, 2019.

[110] As per the Eurostat definition, '[f]inal energy consumption is the total energy consumed by end users, such as households, industry and agriculture. It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself. Final energy consumption excludes energy used by the energy sector, including for deliveries, and transformation. It also excludes fuel transformed in the electrical power stations of industrial auto-producers and coke transformed into blast-furnace gas where this is not part of overall industrial consumption but of the transformation sector.' Cf. Eurostat, Statistics Explained, Glossary: Final Energy Consumption, available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Final_energy_consumption (last accessed on June, 2020).

[111] Transformation of energy from one vector to another typically taking place in the energy industry, e.g. natural gas to electricity, is not considered as final consumption.

[112] World Bank, Commodity Markets Outlook, Washington, D.C., 2020.

is the ITRs are built top-down, starting from energy tax revenues, and thus, in line with the definitions described above, including all energy taxes (including on upstream production and the ETS). That way, a full pass on of these taxes on final users' prices is assumed. Being built upon revenue data, the main limitations of these ITRs are those of the underlying dataset, and namely:

1. energy taxation data as a rule do not include quasi-fiscal measures, such as RES charges, reducing the accuracy of the tax burden estimate;
2. issues with data comparability can emerge due to different reporting practices, particularly again as far as RES charges are concerned; and
3. while providing data which are coherent with the current recording of energy taxes, the way ETS are accounted for underestimates their costs in certain Member States.

The policy interpretation of the ITRs is seemingly straightforward: the higher the fiscal burden, the 'greener' the national tax framework. However, this is not necessarily the case. As for the absolute value of the ITR, lower values can be due to successful green fiscal policies. Higher taxation of 'dirty' energy sources should push consumers to use carbon-free sources in the long-term; as a consequence, the ITR should be higher in the short-term as a consequence of the green taxation, and then lower when the substitution takes place. In relative terms, any comparison is of limited value because of the cross-country discrepancies of the treatment of RES, ETS, as well as because of the different industrial structure and energy mix. As for the latter, countries with a higher than average proportion of energy intensive industries – which typically enjoy a higher number of exempted uses or reduced rates – may have lower ITRs, without this providing any information on the greenness of their tax system.

As mentioned in Section 6.1 above, Eurostat also publishes a breakdown of ***energy taxation data for NACE-64 industries,*** representing the only existing disaggregated energy tax revenues dataset at sectoral level. However, no sectoral ITR has been calculated from these data.

The OECD's Effective Tax Rates. The OECD ***Effective Tax Rates (ETR)*** was first published on an experimental basis in 2013. The OECD methodology has been developed to overcome the limitations of energy tax revenues data discussed above by using a different harmonised definition of what 'energy tax' is and validating the tax rate data collection process accordingly. This approach has also proven instrumental to then build a carbon rate indicator.

The methodology followed by the OECD has been refined over time with the introduction of new classification categories and revised vintage versions, but draws on one fundamental idea: it is the ***tax rates at a given date that are translated into rates per unit of energy (€/GJ)[113], accounting for rebates and exemptions,*** as reported in the OECD databases.

As anticipated above, while the Commission's ITRs start from energy tax revenues, the OECD first identifies the ***tax rates*** applicable to the various energy uses at a given moment in time[114] and then aggregates these rates based on the share of consumption

[113] The ETR calculation uses conversion rates when taxes are expressed in volumetric terms rather than per energy content and exceptionally collects information on prices only when *ad valorem* taxation applies (as is the case for certain taxes in Spain).

[114] As a consequence, any major subsequent changes in tax rate levels affecting revenues over the year cannot be captured.

to which they are applied. Energy consumption is retrieved from the IEA's Extended World Energy Balances[115].

Differently from the ITR, the ***ETR does not include all taxes*** on energy products or production. Based on a marginal criterion, it includes only direct consumption taxes on energy uses, considered as the taxes "that alter the relative price of energy use and that can in principle be used to reflect marginal environmental damages"[116]. Those taxes are:

1) carbon taxes[117], i.e. taxes whose rates are explicitly linked to the carbon content of energy products;
2) excises on fuels other than carbon taxes, including on fuel used to produce electricity; and[118]
3) excises on electricity.

In following this marginal definition of energy taxation, the ETR by-passes the problem of estimating the pass-through of indirect energy production taxes on final prices. To ensure internal consistency with this choice, ***ETS revenues are not included.*** This is also due to the fact that it would not be practically possible to convert EUA prices in their energy content equivalent, as it would depend on the installation for which the EUA was surrendered. The marginal approach makes the non-inclusion of feebates and direct subsidies less problematic, as they do not affect the marginal tax rate in terms of price signal.

In the last edition, the ETR was available with the following sectoral breakdown:

1) road transport;
2) off-road transport (including railways, pipeline transport, and maritime and aviation uses);
3) agriculture, fishing and forestry;
4) industry[119];
5) the residential and commercial sectors; and
6) electricity.

The OECD provides an estimate of the ETR also per fuel. Fuels covered are those accounted for in the IEA energy balance and that represent at least 2% of the final energy consumption. These are oil products, including diesel and gasoline, natural gas, coal, biofuel and waste. As data are made available online, both tax rates and energy consumption, ***ETRs can be calculated for any of the products and sectors listed above, or any combination thereof***.

Two indicators are derived from the ETR, as reported in Box 6 below, and namely ***the combustion surcharge and the diesel differential***. Both indicators are based on the implicit assumption that differences between ETRs bear policy significance as a

[115] These are practically equivalent to Eurostat Energy Balances. To ensure consistency, the ETR adopts the same classification of economic sectors and does not provide an estimate for types of consumption which are not covered or disaggregated by the IEA. A time-lag between tax and energy data exists, the latter referring to one to two years before. However, this is deemed of limited relevance, since energy consumption is relative stable over this period of time. IEA, World Energy Balances *2019*, OECD Publishing, Paris, 2019.
[116] TEU, *supra* note 54, at p. 14.
[117] To ensure the internal consistency of data with carbon pricing purposes, the OECD removes the carbon tax from industries where this is not compatible with the ETS at national level. The carbon tax is considered where it is not mutually exclusive with the ETS.
[118] Carbon and fuel taxes on fuels used to produce electricity are however marginal, cf. TEU, *supra* note 54, Figure 2.9.
[119] Starting with the second edition of the TEU dataset, industry also includes taxes for the auto-generation of electricity that were previously included as part of electricity.

consistent tax system would provide the same rate on a per energy (or carbon) content. This view is challenged by the supporters of the alternative corrective tax rate approach, according to which tax rates should and can vary in function of the cost of the underlying externalities and thus could differ among different energy products and uses. That said, these differential indicators provide an assessment of the tax incentives for consumers to switch between different energy sources, namely combustible and non-combustible fuels, and diesel and gasoline engines.

Box 6: OECD Combustion Surcharge and Diesel Differential

First published in 2019 and based on the data used to calculate the ETR, the OECD computes the ***combustion surcharge.*** This indicator measures the extent to which countries tax combustibles (mainly fossil fuels) more than non-combustibles (e.g. wind, solar and hydro). The indicator suffers from the non-inclusion of RES charges, which would reduce the tax advantage of non-combustibles; the OECD is working to expand the scope of its database with a view to a possible inclusion of RES charges in the future.

The ***Diesel Differential*** measures the difference between gasoline and diesel ETRs. This subject has recently raised considerable attention in the policy debate. The OECD first measured the difference between the two ETRs in terms of energy or carbon content; in the latest edition, the indicator measures the 'simpler' difference in terms of EUR per litre (resulting in a smaller price differential). In this version, the indicator appears mainly descriptive, gauging the diverging or converging tax rate trends between the two fuels over time and across countries.

6.2.2. Benchmarking and policy significance

Benchmarking. ***When an ITR is calculated based on revenue data, benchmarking has limited significance***, as the exercise suffers from most of the limits described above with regard to the comparability of data, due to the national definitions of energy tax. Overcoming these limits in terms of cross-country comparability requires the direct collection of information about energy taxes and rates in each country, and the validation and harmonisation of the data obtained. ***This is the OECD's approach to the ETR, which is designed to allow to compare effective rates across countries and sectors***. Hence, the ETR is better suited for policy benchmarking purposes, in particular if the assessment of the impact of indirect production taxes and the ETS is not of particular interest.

Policy significance. ***ITRs per se have a limited policy significance when calculated for the economy as a whole***, given their limitations. To better reflect the current tax burden on energy consumption, the definitional issues discussed above should be solved, in particular concerning the harmonised coverage of RES charges and a revised accounting of ETS costs.

Once the underlying datasets were better harmonised, ***NACE-64 ITRs based would be much more fit than the ETR to compare the overall tax burden across sectors***. However, this would require matching a 'denominator' in terms of energy consumption per industrial sector for the existing sectoral revenues. Two candidates could be:

1) Eurostat's PEFA, to build an ITR expressed in terms of EUR/GJ (toe); and
2) Eurostat's Purchases of Energy Products[120], available only for certain sectors (i.e. manufacturing and construction), to build an ITR expressed as a share of taxes over total energy costs.

[120] Part of Eurostat's Structural Business Statistics - Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E).

However, building such an indicator would require assessing whether the additional granularity is well supported by the quality of existing data, or whether this would require an additional data collection.

Furthermore, the Air Emissions Accounts by NACE-64[121] could also be put to good use by linking the tax burden on certain pollutants to their emissions per sector, thus possibly calculating an implicit tax rate. This database provides detailed data per the various industries on the emissions of a number of pollutants, including CO_2 and other GHG, as well as other air emissions (e.g. SOx, NOx)[122]. However, this would require a better breakdown of existing energy taxes, and in particular singling out carbon taxation, something that Eurostat is currently implementing on a pilot basis[123].

A practical advantage of using the ITR and ETR for tax rate benchmarking purposes is that they are based on ***observational data***, while alternative externality-based approaches would have to be ***model-based***. Results from these models tend to differ based on the assumptions on how externalities are calculated. Therefore, supporters of the ITR and ETR approach take these uncertainties and inconsistencies in the various estimates as an indication that a number of externalities cannot be addressed by energy taxation and should not enter into any benchmarking of related tax rates.

6.2.3. Conclusions

All in all, ***no perfect implicit or effective tax rate indicator exists,*** as none can take all relevant aspects into due consideration. The ITRs calculated from revenue data could, in principle, provide information on the impact of taxation on a country's or sector's competitiveness, but this would require (i) more consistency in the definition of energy taxes, in particular of RES charges; (ii) accounting of feebates and direct subsidies and those resulting in reductions of non-energy taxes; (iii) a recording of ETS revenues which more closely matches costs for taxpayers; and (iv) the development of sectoral ITRs, either by using the existing sources or expanding the data collection process.

Conversely, the ***ETR – starting from energy tax rates rather than revenues - seems better suited to capture the specific dimension of taxation as a tool to increase energy prices and thus reduce energy demand.*** The reasons are the following: (i) it includes only taxes under direct government control and does not encompass the ETS, whose prices depend on the market; (ii) the non-inclusion of feebates and certain subsidies, not interfering with the marginal price signal, is less relevant; and (iii) it allows gauging, to a certain extent, when tax revenues or the ETR in certain sectors decrease because of tax-induced product substitution. However, as it does not cover VAT, it cannot capture certain policy decisions (e.g. the introduction of reduced VAT on energy products, which could even compensate for higher-than-average excises).

Based on these findings***, the two methodologies currently employed to calculate implicit and effective tax rates can both be considered appropriate, provided a number of caveats:***

- Revenue-based ITRs, such as the ones published by the Commission, are easier and quicker to calculate. Their use is recommended only to the extent to which

[121] Eurostat's series Air emissions accounts by NACE Rev. 2 activity.
[122] Namely, carbon dioxide without emissions from biomass, carbon dioxide from biomass, nitroux oxide, methane, perfluorocarbons, hydrofluorocarbons, sulphur hexafluoride including nitrogen trifluoride, nitrogen oxides, non-methane volatile organic compounds, carbon monoxide, particulate matter < 10µm and< 2,5µm, sulphur dioxide, ammonia; in certain cases, ari pollutants are expressed in equivalents of another air pollutant. Cf. Eurostat's Air emissions accounts and intensities, Reference Metadata
[123] As discussed in Section 7 below.

the problems with the underlying datasets (and in particular, the definition of what an energy tax is) are solved. Otherwise, they risk being excessively misleading, especially when used for cross-country comparisons. Importantly, and as discussed more in details in Section 8 below, such ITRs provide information on the relative tax level across countries (and, possibly, fuels and sectors), but their use to track green fiscal policies over the long-term is discouraged, since a successful greening of the fiscal system will eventually lead to a decrease of average energy tax burden, due to the promotion of greener sources.

- Rate-based ETRs, such as the one published by the OECD, do not suffer from the problems of the energy tax datasets. At the same time, they require an effort to collect (and update regularly) applicable rates, reductions, and exemptions, across the various uses and users, in all Member States. While this approach is more resource-intensive, and provided that the data collection is accurate, the resulting indicator is likely to be more informative for policymaking. As discussed more in details in Section 8, the Commission could therefore consider either creating its own tax basis, possibly starting from the excises governed by the Energy Taxation Directive, or supporting the OECD in extending its current indicator to all EU Member States.

Finally, ***a word of caution is needed on the extensive use of the ITR and ETR as a tool to highlight inconsistencies in the different fiscal treatment of fuels, sectors or activities***. The issue is not settled among experts and there is no such thing as a consensus on which to base a recommendation from a methodological point of view. In particular, when tax systems or rates are to be considered as consistent remains unclear, e.g. whether rates should be set at a level corresponding to the externalities generated, or at rate per energy or carbon content. Current practices of benchmarking the ITR and the ETR with reference to the energy content lead to opt for the latter definition of consistency, but this should not be taken for granted. Hence, while the ITR and the ETR can be used to highlight macro-disparities, a more fine-tuned recourse to these indicators to judge on the appropriateness of tax rates should be accompanied by a number of caveats. So far, different DGs within the Commission have commissioned studies adopting a different view on what a consistent tax rate is and how it should be defined, confirming that consensus is lacking on this aspect. The Consultants share the view reported by several interviewees that there is little ground in the environmental economic theory of energy taxation to maintain a priori that tax rates should be equalised in terms of energy content, while also noting the difficulties in estimating corrective tax rates. However, the main issue concerning the use of ETR and ITR remains the fundamental ambiguity as to how energy taxation has been defined and certain taxes, subsidies and non-fiscal measures are recorded. Taken together, all these issues are mutually and logically inconsistent and lead to not entirely suitable indicators for their different possible purposes and point to possible improvements.

6.3. Carbon pricing

6.3.1. Definition and existing indicators

The idea that ***'putting a price'*** on carbon can reduce GHG emissions, has gained widespread consensus over the last decades. As a consequence, carbon pricing policies became one of the policy tools deemed to have the greatest potential to encourage the transition from high- to low-carbon energy sources, thus fighting climate change.

Alongside many alternative policy measures[124], ***carbon pricing is considered effective and efficient*** for three main reasons, all related to its market-driven rationale, and namely:

1) abatement decisions are decentralised, i.e. taken by the polluter, thereby reducing the regulators' information asymmetry;
2) in equilibrium, the carbon price is equal to the marginal cost of abatement, ensuring allocative efficiency; and
3) continuous incentives are provided to reduce emissions, thereby stimulating innovation[125].

Two explicit carbon pricing tools are more commonly used[126]:

- ***Carbon tax***, that is a tax whose rate "explicitly states a price on GHG emissions", or, much more frequently, "that uses a metric directly based on carbon"[127]. With a carbon tax, the price of carbon is fixed, while the reduction of emissions is uncertain.

- ***ETS***, where an authority identifies a number of emitters and sets a ceiling (cap) on total emissions. Then, the same authority issues tradable allowances up to the emission ceiling. Emitters covered by the ETS must surrender one allowance for each unit of emissions and can freely trade allowances among themselves. Allowances can be allocated for free or against a payment (e.g. via an auction), or they can be bought from other participants (secondary market)[128]. Under an ETS system, the price is variable and depends on the demand and supply of allowances, while the reduction of emissions is certain and set by the cap.

Implicit carbon pricing tools comprise policies that increase the cost for emitting one tonne of CO_2eq without stating an explicit price or rate on their emissions. For instance, energy taxes increase the costs of burning fossil fuels, thus of carbon emissions, even though the applicable rate is expressed per fuel volume or energy content. The assessment of their carbon price effects is based on the commensurability between carbon emissions and the energy content of fossil. Accordingly, energy tax rates can be translated into EUR per tonne of CO_2eq terms by means of a conversion factor, defined per each fuel. For other implicit tools, such as RES support or RES charges – which put a cost on carbon by reducing the relative price of carbon-free sources – such a conversion is not possible[129].

Relation between energy and carbon taxes. Though energy taxes can be transformed into an equivalent carbon tax, the ***effect on consumer decisions is not***

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124 Other mechanisms include, among others, command and control regulation, standard setting, energy efficiency measures, support to low-carbon technologies and energy sources, or behavioural measures (e.g. nudging, awareness campaigns).
125 Cf. OECD, Effective Carbon Rates, Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris, 2018, hereinafter, 'OECD ECR 2018'.
126 Other market-based tools have been implemented, with a much more limited emission coverage at global level, such as offset mechanisms, and results-based climate finance.
127 Conway, D. *et al*., Carbon Tax Guide: A Handbook for Policy Makers, PMR Carbon Tax Guide - Translations. Washington, D.C.: World Bank Group, 2018.
128 Kerr, S. *et al*, Emissions trading in practice: a handbook on design and implementation, Washington, D.C.: World Bank Group, 2016.
129 In a scholar contribution, Marcantonini and Ellerman analyse the "cost of reducing CO2 emissions in the power sector through the portion of wind and solar energy for the years 2006 and 2010". In doing so, they estimate a RES carbon surcharge and the implicit carbon price associated with RES incentives. The carbon surcharge measures the ratio between the net benefits due to wind and solar RES and the CO2 emissions savings generated. Cf. Marcantonini, C. and Ellerman, D., The Implicit Carbon Price of Renewable Energy Incentives in Germany, The Energy Journal, Vol. 36, No. 4, October 2015, pp. 205-239.

the same. Namely, the incentives to reduce emissions in the short-term are equivalent, those to switch to low-carbon technologies in the long-term are not. For any given technology, e.g. a diesel car owned by a household, an increase in energy taxes or the introduction of a carbon tax have the same short-term effect: the price of fuel will increase, and the demand for fuel, i.e. the amount consumed, will decrease[130]. The equivalence, however, is not given in the long-term, that is when the economic agent can make investment decisions. In the long-term, a carbon tax will steer investment decisions towards low-carbon technologies, as this will reduce the tax burden. Differently, an energy tax may not provide incentives for consumers to select the least emitting source, since the tax rates do not reflect carbon emissions. It will provide a partial incentive only to the extent the reduction in carbon emissions depends on increased long-term energy efficiency, and not because of product substitution. This could for instance be the case in the EU, where minimum tax rates, when expressed per tonne of CO_2eq, are very different across fuels[131].

Overlap between carbon taxes and ETS. Overlaps of carbon and energy taxes increase the price of carbon emissions on businesses, and, by reducing emissions, reduces their demand for allowances, therefore indirectly affecting the price of the ETS. This is the main justification why, in most systems, installations covered by the ETS are shielded, in full or in part, from carbon (and energy) taxes. In the EU, such overlaps exist, but are limited[132]. Five Member States exclude emitters covered by the ETS from carbon taxes[133]. In Finland, the share of emissions covered by carbon taxes which are also covered by the ETS is 37%, and 40% in Ireland. No data is available concerning Spain, Estonia, Denmark and Sweden; such overlap is reportedly very limited in these Scandinavian countries. All in all, the overlap between ETS and carbon tax should amount to between 2% and 5% of EU total emissions[134].

Main carbon pricing indicators. At the international level, two providers have produced a comprehensive carbon price, covering both explicit tools and energy taxes:

- the OECD, measuring the ***Effective Carbon Rate***[135] (ECR) for about 40 jurisdictions;
- the IMF, measuring the ***Effective Carbon Price*** (ECP) and the impacts of various carbon price levels for 135 jurisdictions.

The OECD ECR is defined as the value expressed in CO_2eq terms resulting from ***three main instruments: energy taxes, carbon taxes, and emission permits***. The ECR is expressed in €/tonne CO_2eq[136] and is calculated both with and without emissions from

[130] OECD, Taxing Energy Use 2015: OECD and Selected Partner Economies, OECD Publishing, Paris, 2015.
[131] *Ibid.*
[132] Many of the sectors specifically covered by the EU ETS correspond to uses which are excluded from the ETD. This is not the case, however, for the pulp and paper industry and part of the chemical industry. Furthermore, the two Directives overlap in other sectors (other than electricity production), such as the production of heat from installations with a capacity of more than 20 MW. This may include non-energy-intensive sectors, such as mechanical engineering, textile companies, and food processing; no quantitative estimate of such an overlap exists. Cf. ETD Impact Assessment, SEC(2011) 409 final.
[133] Spain, France, Latvia, Poland, and Portugal.
[134] Cf. World Bank Carbon Pricing Dashboard, OECD, Taxing Energy Use, 2019.
[135] OECD ECR 2018, *supra* note 125; OECD, Effective Carbon Rates, Pricing CO_2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, 2016.
[136] By being measured on a per tonne CO_2eq, basis rather than per MWh, the indicator is not affected by the impact of ETS on the marginal electricity generator (i.e. that when the marginal plant is carbon free, no ETS revenues are raised from energy production) since, generally, no carbon emissions are generated by all plants with a lower merit order.

biomass[137]. It results from the sum, or more correctly the aggregation, of these market-based instruments. The ECR draws estimates of carbon and energy taxation from the OECD TEU[138]. Therefore, on the positive side, it is based on bottom-up data collected for ensuring cross-country comparability; as for drawbacks, it does not cover the items not encompassed by the TEU, such as RES charges and non-deductible VAT. Differently from the ETR, the ECR includes ETS prices. In line with the ETR marginal approach, the ECR does not use EUA average prices and does not rely on the national accounts methodology for ETS proceeds; rather, it considers the ETS average auction price in a year and does not account for the share of EUAs provided freely.

The ECR at the country level is not published by the OECD as such, because it would be hardly significant from a policy perspective and possibly misleading. For instance, a relatively high ECR could result from a very high rate of transport fuel taxes while most carbon emissions are not priced at all. Instead, two other indicators, considered more informative for these horizontal comparative policy purposes, have been published by the OECD based on the ECR, and namely:

- the ***share of emissions above a certain threshold*** computes the share of carbon emissions priced above the following prices: EUR 0, 5, 30, and 60 per tonne of CO2eq[139].
- the ***Carbon Pricing Gap*** (CPG) measures the extent to which national policies price carbon below two external benchmarks, EUR 30 and EUR 60 per tonne of CO2eq. The CPG is measured both at country and sectoral level.

The IMF has been developing a tool to help countries evaluate their progress towards meeting the GHG emissions mitigation pledges undertaken within the framework of the Paris Agreement. While the dataset has not been made public yet, the indicator has been described and its results have been included in recent IMF publications[140]. Based on a forward-looking model, the carbon price is defined as the ***equivalent carbon price achieving the Paris pledges at different time horizons, taking into consideration the current fiscal and economic structure and the relative effectiveness of carbon pricing and other policies.*** The other policies covered are (i) coal tax, (ii) ETS, (iii) electricity output tax, (iv) electricity CO_2 tax, (v) road fuel tax, and (vi) energy efficiency combination; it however does not account for RES support, a policy which however interacts with the implicit and explicit carbon pricing tools. The resulting indicator, the ECP, is expressed in US$/tonne of CO_2eq[141]; as the OECD's ECR, it comprises energy and carbon taxation, and ETS prices. Differently, the IMF's ECP is model-based with a lower reliance on observational data. In particular, the components

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[137] The OECD provides two versions of the indicator. Main results are provided including emissions from the combustion of the biomass in the emission base, i.e. emissions from biomass are treated as equivalent to carbon emissions from fossil fuels. An alternative approach is to consider biomass as carbon neutral in line with the Paris Agreement requirements, since, from a lifecycle perspective, when burnt, plants emit the carbon that they have absorbed during their life. This approach has, however, been increasingly challenged in the scientific literature. Significant differences between the two versions appear for some Scandinavian countries.

[138] OECD ECR 2018, *supra* note 125, at p. 16.

[139] The EUR 0 threshold is used to estimate the share of emissions priced at all in a country or sector, while the EUR 5 threshold can be used to estimate the share of emissions with a non-negligible price. EUR 30 is the low-end estimate for carbon costs in 2020; EUR 60 is the mid-point estimate for 2020 and the low-end for 2030, as per the existing literature estimates. Cf. High-Level Commission on Carbon Prices (2017), Report of the High-Level Commission on Carbon Prices, World Bank, Washington, D.C.

[140] Parry, I. et al., Mitigation Policies for the Paris Agreement: An Assessment for G20 Countries by Ian Parry, International Monetary Fund Working Paper N° 18/193, August 2018; IMF Fiscal Policies 2019, *supra* note 95; IMF, *Fiscal Monitor, October 2019: How to Mitigate Climate Change*, International Monetary Fund Fiscal Affairs Department, 2019.

[141] IMF Fiscal Policies 2019, *supra* note 95, p. 33.

are weighted by their relative effectiveness in reducing carbon emissions; this is, in turn, determined by their price responsiveness, as measured by carbon elasticities (i.e. the carbon reduction that can be achieved by the various policies). Furthermore, the IMF provides estimates of the impacts of various ECP levels on each country, in terms of both carbon emission reduction, as well as other economic impacts (e.g. tax revenues, GDP, distributional effects). However, the ECP, based on the estimates currently published, does not provide for sectoral data.

6.3.2. Benchmarking and policy significance

Benchmarking. During the discussions with indicator producers, two main issues have arisen concerning carbon pricing and related benchmarking

1) As the ECR results from a weighted average of existing carbon pricing policies, the value of the indicator may hide significant information about the underlying carbon policies. Namely, similar ECRs may result from very different carbon policies, e.g. in terms of emissions covered and rates applied to various types of emissions and sectors which in turn may have different effects on carbon emissions[142]. Accordingly, any ranking based on the ECR may not reflect the effectiveness of GHG emission reduction effort by means of taxation. To overcome this problem, the OECD developed two other indicators, namely the share of emissions priced above a certain threshold and the CGP, which are not affected by the very high tax rates applied to road transport emissions[143]. In particular, the CPG measures the 'distance to target' from climate change objectives and it is not affected by very high carbon prices (e.g. on transport fuels). Accordingly, compared to the ECR, the CPG is considered a better tool to monitor national climate change policies, also because any small change to carbon policies is properly reflected in the indicator.

2) Both the share of emissions price above a certain threshold and the CGP include external benchmarks. This creates the typical trade-off, by which external benchmarks allow cross-country comparability, while resulting in a one-size-fits-all approach, in which all countries are 'called' to achieve the same carbon price level. Furthermore, it is also underlined that the 30 (60) EUR tonne/CO_2eq – i.e. the carbon pricing level that the international literature considers necessary to limit global warming – are expressed as explicit carbon prices, while they are then confronted with the ECR, combine both implicit and explicit tools.

The latter limitation cannot be addressed unless the OECD indicator is transformed into something different, i.e. a model-based indicator, with all the caveats that this implies. While the OECD could in the future consider complement its ECR with estimates on the impact of carbon pricing on emissions reduction – as mediated by carbon price elasticities, its indicator is expected to remain observation-based. To the contrary, such a limitation is overcome by the IMF's approach that identifies the carbon price gap as the difference between the current price and what would be required for a given reduction in carbon emissions. However, such a model-based approach introduces other limitations, and namely its dependence on ***the robustness of the analytical parameters and assumptions***.

Policy significance. Some different opinions exist on whether a single indicator can encompass both explicit and implicit pricing tools. In particular, it is questioned whether energy taxes should be converted 'in full' into their carbon tax equivalent, considering

[142] This would be the case in comparing two countries, one of which has a very high taxation of transport fuels and no carbon pricing policies for other emissions, and the other which prices all emissions with a lower rate.
[143] More in detail, it cancels the effect of any tax rate higher than the thresholds or benchmarks.

that they (i) have been introduced for various aims, not all related to environmental objectives or the fight against climate change; (ii) they might compensate also for other externalities (e.g. air pollution, road use and congestion).

Such a critique is partly justified, but it does not affect the validity of the existing indicators:

- From an economic perspective, the aim of a tax (or a price) is irrelevant for the economic actor. Taxes on fuels increase the cost of carbon, and therefore reduce carbon emissions, regardless of whether the tax was introduced to e.g. fight climate change, reduce the use of private cars, increase public revenues.
- In the short-term, the demand effect – i.e. the reduction of demand and consequently of carbon emissions due to an increase in the price of carbon – of energy and carbon taxes is equivalent. Therefore, they are both appropriately included in carbon pricing indicators.
- However, such an equivalence is partly lost in the long-term. As a consequence, while carbon pricing indicator provides information on the short-term incentives to reduce emissions, they may not fully capture the incentives for long-term investments in low-carbon technologies. For instance, energy taxes do not provide incentives for technologies which reduce carbon emissions without intervening on the use of fossil fuel, such as carbon capture technologies.
- Also, from a policy perspective, explicit carbon prices signal a higher political commitment against climate change and this can create a ripple effects towards other jurisdictions.

All in all, on the one side ***the carbon price methodologies currently employed which aggregate explicit carbon tools and energy taxes are correct*** in terms of capturing the current price of carbon and thus the short-term effect on emissions. However, this does not imply that explicit carbon policies and energy taxes produce the same effects in terms of long-term emission reduction or have the same political value. Explicit carbon policies, such as ETS and carbon prices, are more effective in reducing carbon emissions in the long term and in signalling the political commitment in the context of the Paris Agreement. Finally, to better account for the various aims of the energy taxation and for the various externalities that should be compensated over and above carbon emissions, the corrective tax rates approach represents the only available reference framework as discussed in Section 82 below. Such framework also puts into question the argument that energy taxation should be equalised in terms of energy or carbon content, as other externalities would become relevant in the determination of the optimal tax rate.

As for ***the different approaches adopted by the OECD and the IMF***, they serve different purposes. The OECD ECR takes a snapshot of how the market-based carbon instruments are applied in the jurisdictions covered. This approach, built by analogy with the OECD ETR, does not provide indication on what the level of carbon price should be to achieve any objective in emission reductions. The IMF adopts a different approach, trying to determine which is the future price of carbon in each country *ceteris paribus* and which is the rate needed to achieve any country's Paris pledges, also taking into consideration the effectiveness of other policies. Such an approach accounts for the wide differences that exist in carbon policies and economic structure at global level, a significantly minor concern should the indicator be applied to a group of more homogeneous countries such as the EU. However, this indicator, once properly tailored, could be used to measure, on a country basis, the distance between current carbon policies and EU or national climate change targets.

6.3.3. Conclusions

Any increase in price – even when artificially imposed on non-market goods such as GHG emissions – reduces demand. Various tools exist to increase the price of GHG emissions, both explicit (ETS and carbon taxes), and implicit, such as energy taxes. Therefore, energy tax policy helps in providing a price signal for GHG emissions, but it is only one of the policies at play, and the consistency of such a signal is less than perfect:

- As for the policy mix, energy taxes interplay with a number of other policies, such as ETS, carbon taxes, energy efficiency, which in turn interact among each other. In some cases, the relation creates synergies, as, for instance, higher energy taxation on fossil fuels both reduces energy consumption in the short-term, and provide incentive for the whole economy to become less energy intensive in the long-term. In other cases, such as between carbon taxation and ETS, the policy mix can reduce overall benefits, for instance because an increase in energy taxes reduces demand for GHG allowances, thus negatively affecting its price.

- As for consistency, energy taxes, as structured today, do not provide consistent price signals for GHG reduction, since their tax base is 'energy' (defined in terms of either volume or content) and not carbon emissions. Therefore, the effect on consumers' behaviour is different. In particular, both energy taxes and carbon-explicit policies – such as a carbon tax – provide incentives to reduce GHG emissions in the short-term. However, only carbon-explicit policies also provide incentives to switch to low-carbon technologies in the long-term. If this inconsistency is to be remedied, the taxable basis of energy taxes should more and more account for the carbon content of the various sources.

In an attempt to comprehensively account for the various fiscal tools discussed above, different indicators have been developed to measure the carbon price across various jurisdictions. The choice among these different indicators and methodologies depends on the policymakers' objective. If the objective is to measure the relative effects of various carbon policies (though excluding RES support) to achieve the pledged targets, the ***IMF ECP is possibly the most suitable methodology.*** However, as the ECP is model-based, its robustness to assumptions should be tested (once data are fully released); furthermore, model-based indicators tend to be perceived as more controversial and difficult to communicate. However, by accounting for the possibility of reaching emission reduction targets by means of different policies defined at national level, the indicator is neutral to Member States' policy choices and in line with the subsidiarity principle and the overall governance structure of the Energy Union. In any case, it is difficult to draw firm conclusions on the policy use of this indicator before the IMF is able to fully share its data and estimates, and this represents an innovative approach for which little lessons can be drawn from past uses. The indicator does not cover overlapping with RES as no estimates are available of the extent to which these are additional to the ETS price signal.

Other indicators such as the OECD ECR lie on much safer methodological ground as regards robustness and reliability for policymaking uses, as they are based on observational data. However, it is affected by two issues. First, the underlying carbon policies and resulting prices are not fully equivalent, as they can be differently concentrated across sectors; secondly, similar ECRs may reflect very different national carbon policies, with different effects in terms of emission reduction. As a consequence, any benchmarking remains fraught with some potential ambiguity and ECR can be effectively used more as a tool for advocacy purposes and for monitoring time-trend in a country or group thereof, rather than for peer-review exercise across different jurisdictions. To this purpose, the CPG (or, alternatively, the share of emissions priced above a certain threshold) may be a more suitable instrument, especially when considering that within the EU context a single external benchmark could be agreed by the Member States. In any case, none of the existing carbon pricing indicators account for whether implicit and explicit pricing tools have been introduced for climate policy or other purposes.

6.4. Coherence of energy taxation with other energy policies

6.4.1. Definition

Energy taxation may have different impacts on other EU energy policy goals depending on various features, such as the rates, design, exemptions and rebates. Issues of coherence may arise because of the overlap of energy taxation with other policy interventions aimed at the same goal, i.e. 'double counting'[144] or 'crowding out' effects. These consist in the possibility that ***energy taxation and other policies achieve the same outcomes, so that the net impact is lower than the sum of each***. Two examples can be made in this respect:

- as just mentioned in the section above, ***carbon taxes might have some degree of overlap with the ETS which could cause emission reduction benefits to net off***. This is because, when an economy works at or near the ETS cap, national carbon taxes cannot give rise to any additional carbon emission reduction, but only affect prices[145].
- ***RES subsidies, by fostering RES adoption reduced demand for emission allowances and therefore impacted the price signal for carbon***. As a consequence, an increase in public revenues due to RES charges contributed to a parallel decrease in revenues from ETS. Also, the carbon emission savings achieved under the RES Directive[146] may interact similarly with the ETS programme, so that the impact of these two policies, at least when both targeting industrial consumers, may net off.

In other cases, the lack of coherence can result from conflicting objectives between energy taxation and other policies. Examples include:

- ***Carbon taxation can reduce domestic coal and peat consumption and improve GHG emission reduction to the detriment of energy security*** when imported natural gas is used as a substitute. Conversely, the introduction of a carbon tax with substantial exemptions granted, for instance, to domestic high-carbon fuels (e.g. peat) provides conflicting incentives, as it provides incentive to increase their use and thus emissions;

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[144] Examples of possible double counting are well known in energy efficiency policies and have been considered for the calculation of the achievement of the objectives of the related EU Directive. Taxation rates beyond the ETD minimum ones were listed among the tools to achieve the objectives of the Energy Efficiency Directive in the 2014-2020 period according to art. 7(b) provisions. This opportunity was actually exploited by seven Member States. Sweden, for instance to comply with mandatory energy saving targets under the Directive, used energy taxation as the sole proposed policy instrument and refrained from proposing other actions. Conversely, other Member States that have differentiated areas covered by taxation from those covered by other policy instruments for the same reason.

[145] This was noted by IPPC with reference to the UK. The issue applies to the United Kingdom's efforts to reduce emissions through a carbon tax on the power sector (electricity generators). The generators are required to pay the tax on every unit of carbon emission while also being subject to the EU ETS cap on over- all emissions. While the tax may lead to greater reduction in carbon emissions by the generators in the UK, the impact on overall emissions in the EU might be negligible, since overall European emissions are largely determined by the Europe-wide cap under the EU ETS' See IPPC WG3, AR5 Climate Change 2014: Mitigation of Climate Change, available at: https://www.ipcc.ch/report/ar5/wg3/ (last accessed on September, 2020).

[146] *Supra* note 18.

- ***Tax subsidies to biomass can contribute to GHG emission reductions, but negatively affect the air pollution targets***, e.g. by increasing, for instance, particulate matter (e.g. from wood);
- ***Diesel tax advantage*** can improve transport efficiency at the expense of air pollution and GHG emissions;
- ***Concessional VAT rates and rebates on heating fuels*** can improve energy affordability, but to the detriment of both energy efficiency and GHG emissions reduction.

6.4.2. Indicators linking energy taxation and efficiency

Energy efficiency policy goals are defined in terms of reduction of both energy consumption and energy intensity.[147] Energy taxation directly affects energy efficiency by increasing energy prices, and therefore providing incentives for a reduction of consumption. However, this is not well captured by any of the existing monitoring indicators. Two indicators[148] have been proposed by the OECD; ***the correlation between energy intensity and carbon intensity indicators and effective tax rate and effective carbon rates*** (see Box 7 below). So far, the analyses focused on national economies, rather than discussing the same correlation in more detail e.g. in specific sectors; however, the OECD plans to expand the scope of their correlation-based indicators in the future.

Box 7: OECD correlation indicators with energy/carbon intensity of GDP.

OECD calculates the relation between ***effective tax rates and energy intensity*** in GDP terms. A strong inverted correlation between the level of energy taxes and energy intensity can be found for about half of Member States. Similarly, it also calculates the relation ***between the carbon pricing gap and the carbon intensity of an economy*** (in turn decomposed in the carbon intensity of energy and the energy intensity of GDP). Again a strong negative correlation exists between carbon pricing policies (i.e. a low carbon pricing gap) and the carbon intensity of an economy.

Other examples of impacts of taxation policy on long-term energy efficiency outcomes have been described mainly in the field of transport, with reference to vehicle fuel consumption per 100 km[149]. In other areas, no indicators monitoring the relationships between energy taxation and energy efficiency gains have been identified. The OECD is considering expanding this information base by investing in the energy efficiency indicators developed by the IEA.

6.4.3. Indicators linking energy taxation and security

Energy security, or energy availability, is usually defined as the share of domestic sources over total energy consumption; conversely, this depends on a country's imported energy sources. To improve energy security is one of the explicit objectives of the EU Energy Union Communication. There are various mechanisms through which energy taxation can impact on energy availability: (i) higher taxation on imported energy products; (ii) rebates or exemptions targeted on domestic fossil fuels; (iii) RES incentives (which are almost by definition targeted to domestic producers). ***No indicator linking energy taxation and security currently exists,*** and no effective

[147] I.e. energy consumption per unit of GDP.
[148] See Factsheet #25 in Annex A.
[149] Cf. IEA, Energy Efficiency Market Report, 2016. For instance, as a result of its long-term policy of heavily taxing fuels IEA has highlighted that Italy still has one of the highest relative propensities in the world to buy low consumption vehicles, as also confirmed by a study by the Bank of Italy. I. Faiella, F. Cingano, La tassazione verde in Italia: l'analisi di una carbon tax sui trasporti, in Economia pubblica: mensile di studi e d'informazione del Ciriec October 2013.

tax rate on energy imports as compared to domestic sources appears to be measured for the time being.

Furthermore, there is still uncertainty in the economic literature as to whether energy availability should be considered as an externality, and this would have major consequences on the rationale behind certain energy taxation indicators. For instance, most experts suggest that this is not the case, and therefore they maintain that energy security should not be accounted among the externalities from energy consumption (see Box 8 below) considered in the calculation of corrective tax rates. Moreover, for consistency purposes, any attempt at measuring the trade-off in the impact of energy taxation on energy security on government revenues would also somehow presuppose that the scope of energy taxation should be expanded to cover energy production taxes (e.g. on natural gas, oil, coal). Since these data are not available in any of the existing energy taxation datasets, *ad hoc* indicators would have to be built based on data reclassified on purpose, which would make the exercise cumbersome and time consuming.

Box 8: Energy security as an externality

It has been long debated whether energy security can be considered a price volatility-based externality thus be covered by an environmental tax. Setting an equalisation tax on imported energy would 'internalise' this negative externality[150]. This seems to be the prevailing position within the UNFCC that however has never managed to devise a methodology to calculate the amount of this externality. Others maintain the opposite position that there cannot be any such thing as an energy security externality at the global level, and that energy imports only create a distributional effect between energy exporters and importers[151]. Reducing imports would therefore do little to reduce price shocks in efficient energy markets. As a consequence, energy security, from a purely economic viewpoint, would only depend on reducing energy consumption rather than imports and would become tantamount to energy efficiency

6.4.4. Indicators linking energy taxation and affordability

Energy affordability is defined as a household's ability to pay for the necessary energy consumption. In this area, ***indicators with an explicit taxation dimension have already been adopted at the EU level***, to measure the impact of taxes on energy prices and have been included in the monitoring system of the Energy Union. Their policy significance, however, has been challenged in recent studies on energy affordability based on apparent lack of correlation[152] between affordability and these indicators. This line of argument would lead to deny any relevance to energy taxation rates as a determinant of energy affordability, but eventually as a disposable income constraint for which no indicator currently exists. These indicators have been drawn by existing EU statistics on energy prices, and namely:

- ***Taxes and fees in household electricity prices,*** measured via Eurostat's share of taxes and levies in the electricity price[153]. This indicator shows the increase of such a share and is used to identify Member States where the share of taxes is very high or rapidly increasing. Data breakdown so far has demonstrated that (i)

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[150] This is clearly not the rationale behind those taxes on energy security taxes on stockpiling or energy reserves that some Member States have introduced to pay, among others, for their IEA energy security obligations and are closer to charges in nature.
[151] Cf. Metcalf, G. E., *The Economics of Energy Security*, Working Paper 19729; cf. also US National Research Council. 2009. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*. Washington, DC.
[152] Flues, F. and Van Dender K., "The impact of energy taxes on the affordability of domestic energy", 2017, OECD Publishing, Paris, OECD Taxation Working Papers, No. 30.
[153] Paid by household consumers in consumption band DC (2 500 - 5000 kWh per year).

VAT remains the main tax component in retail electricity prices; (ii) RES fees increase; and (iii) other taxes and fees decreases as a share of final price.

- ***Taxes and fees in households natural gas price***, measured via Eurostat's share of taxes and levies in the natural gas price[154]. Also, in this case the indicator was used to identify the Member States where this is very high or rapidly increasing.

- ***Share of taxes in retail heating oil prices*** from the Weekly Oil Price Bulletin. No breakdown by type of tax is available. A large dispersion in the excise duty rates for heating oil and the weight of indirect taxes is noted, and the number of Member States where such a share is increasing is recorded.

These indicators have been separately reported and no attempt has ever been made to aggregate them in an overall energy taxation index capturing the impact of energy taxation on parallel indicators of energy consumption on available income or household total consumption, also because this would appear controversial to some, as the EU definition does not cover transport fuels as a necessary good for living, so the index would have to cover a subset of household energy consumption only. The IMF indicators separately and explicitly cover affordability aspects to the extent they translate into concessional VAT rates and are accounted for as related VAT subsidies. These are, however, calculated on the industrial price only.

6.4.5. Indicators linking energy taxation and air pollution

Taxes on air pollutants are not classified as energy taxes. They are grouped together with other environmental taxes on water emissions, fertilizers, pesticides, waste, under the common label of taxes on pollution[155]. No formal separate categorization has been, however, proposed for the taxation of air pollutants from energy consumption and this is a practical reason that hindered the development of energy taxation indicators on the subject. *A fortiori*, ***no indicator exists on the link between energy taxation and air pollution.***

Despite the technical difficulties in measuring emissions at the plant level a number of Member States have introduced taxation of NO_X and SO_X emissions from the combustion of fossil fuels, that is typically aimed at power generation plants[156]. Sometimes these taxes are to generate price signals only and designed not to ***raise any revenue at all***[157]. In any case, taxes on pollutants are more complex to design and administer, because it is more difficult to estimate conversion factors for the various types of pollutants and fuels, and, most importantly, because the amount of emissions depend on the combustion process in addition to, rather than, the fuels used, and on the installation of pollution-reduction devices. A more refined analysis is therefore often needed to establish a link between the air pollution externality and the level of energy

154 Paid by household consumers in consumption band D2 (20GJ - 200GJ per year).

155 As mentioned in Section 5, the OECD has been working on a more granular classification of these taxes and has created the sub-category of "pollutant emissions to air" as recently reported also in their 2019 Revenue Statistics OECD, Revenue Statistics 2019: Annex 2.A. List of environmentally related tax bases, OECD Publishing, Paris, 2019, p. 54.

156 Because of the variability of their features and related difficulties in quantifying emissions over time, these taxes often apply to fossil fuels only, while biomass-based plants are exempt.

157 In Sweden total revenues from the NO_X tax are redistributed to the group of taxed plants to reduce any potentially negative impact on competitiveness and raises no net revenue for the Government. The reimbursement mechanism is based on how energy efficient the plants are. This is tantamount to an incentive scheme financed by participants themselves. Similar reimbursement mechanisms are in place also elsewhere. "This means that firms emitting low volumes of NOx per unit of energy produced are net beneficiaries of the scheme – only firms with large NOx emissions per energy unit are net tax payers". OECD (2013) The Swedish Tax on Nitrogen Oxide Emissions. Lessons in Environmental Policy Reform. OECD Environment Policy Paper, December 2013 no. 2.

taxation, as the two are not directly commensurate. This lack of commensurability leads some to believe that energy taxation cannot logically account for air pollution externalities.

Supporters of the corrective tax rates approach conversely consider that air pollution is one of the major externalities from energy consumption, which thus should be covered by energy taxes[158]. Indeed, the calculation of the externality costs of ***air pollutants is one of the main elements of IMF estimates of corrective tax rates*** (and, conversely, of energy subsidies) and several estimates are provided by degree of compliance with combustion best practice technologies. Most of these externalities result in health-related negative effects, whose monetisation requires estimating the Value of Statistical Life (VSL) – and OECD's estimates are used to this purpose[159], and related estimation methodologies. The IMF has published the corrective tax rates in US$ per tonne of fuel for air pollutant emissions, including CO_2, SO_2 and $PM_{2.5}$. Emission-related externalities are calculated following a health-based rationale by estimating excess mortality in different countries due to different pollutants. The robustness of these estimates depends on the availability of databases on sources and emissions of air pollutants and epidemiological studies in the different Countries and, crucially, on assumptions on the VSL. The latter, in particular, can heavily influence final results. These analyses have more value added when focused on homogenous regions; furthermore, in the EU, several data sources are available, in particular through the EEA[160]. So far, most of the research effort on corrective tax rates for energy-related air pollution has focused on fossil fuels. ***The IMF is considering extending the scope of the exercise to biofuels and biomasses*** that are well-known sources of PM and SO_X emissions, but this will ultimately depend on the availability of the underlying parameters (e.g. emission factors, negative effects). Other likely developments include the substitution of the uniform carbon cost with the national carbon price.

6.4.6. Conclusions

There is no such thing as an agreed reference framework that can capture all aspects of how energy taxation impacts on other energy policies, and therefore on their coherence. In theory, this could be done through both a classification of existing taxes and subsidies by objective and a corrective tax rate approach. For instance, a matrix could be built to calculate both the share of fiscal resources devoted to the different policy objectives and the amount of resources pursuing conflicting targets. The matrix could be simplified by indicating only the primary objective pursued (and thus incentive provided) by the different measures. This could result in a broad overview of the degree of coherence of the different national energy policies, as well as in the identification of the existing trade-offs. For the time being, however, there is no underlying agreement on how energy taxes and subsidies could be allocated across various objectives, e.g. when they claim a specific objective, but then also serve others. Furthermore, there is no agreement on how the benchmarks could be defined to estimate subsidies.

In contrast, ***corrective tax rates are well placed to deal with air pollution aspects, but cannot cover the energy security dimension*** as this is not considered

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[158] IMF estimates show that, on average, taxes on coal compensate about 50% of the externalities generated, while those on road fuels about 80% (and more than 100% in many western European countries, particularly if the VAT surcharge is considered). IMF estimates also include climate change externalities (estimated at a price of 35 US$/tonne of CO_2eq).

[159] Estimates of corrective tax rates for coal, natural gas for power generation and gasoil are particularly affected by VSL parameters, while those for gasoline and natural gas for heating are hardly affected.

[160] Cf. EEA, Air quality in Europe – 2019 report, European Environmental Agency Report No.10, 2019; EEA, EMEP/EEA air pollutant emission inventory guidebook 2019, European Environmental Agency Report No.13, 2019.

as an externality. Furthermore, they capture energy affordability aspects only in terms of reduced VAT rates, with the caveat that the IMF considers VAT rates as ‘additional’ to the optimal tax rate that should cover consumption externalities. Also, corrective tax rates fail to account for energy efficiency, though it could be defined as the surplus between actual and optimal tax rates (as it would be the case on road fuel taxes in several EU countries).

7. INFORMATION GAPS AND RATIONALE FOR COMMISSION ACTION

This chapter summarises the main information gaps and highlights the need for possible new indicators or improvements to existing ones. It is structured over five sections. Section 7.1 discusses the demand and possibilities for improving the existing energy taxation datasets, and then sections to 7.5 discuss the themes covered by the policy questions addressed in the Study, as well as additional issues that emerged from stakeholders and the desk research, and namely: (i) energy tax revenues; (ii) implicit and explicit tax rates; (iii) carbon pricing; and (iv) indicators on coherence, subsidies, and corrective tax rates.

For each section, emerging information gaps are described first, as resulting from the desk research and then confirmed by various consultations activities (i.e. the workshop, the Member State survey, and the interviews with indicator producers). While the sample of stakeholders consulted cannot imply any statistical significance, the findings give a ***good qualitative flavour of the main data requirements among policy users of energy taxation indicators*** and provide useful ***insights on the perceived needs and priorities for further actions***. Then, the likely future developments, as reported by the indicator producing organisations are summarised, together with a review of the main feasibility constraints, both in terms of resources and methodology based on the feedback received from indicator producers themselves. This leads to a final section where the rationale for possible further Commission action is analysed, both to address stakeholders' requests and for an eventual use of the indicators within the framework of the European Semester; this is complemented by an assessment of complementary long-term interventions. Recommendations are addressed to the European Commission as a whole, and could be implemented by relying on its internal organisation, as well as on the capacity and expertise of other international organisations.[161]

For their use within the European Semester, it is assumed that indicators should be instrumental to policy monitoring purposes and the formulation of recommendations targeted at the achievement of the objectives of the European Green Deal. Therefore, the focus is on the identification of indicators that could be both policy-actionable and correctly responsive to environmental policy interventions.

7.1. Improving the quality of existing datasets

7.1.1. Information gaps

Desk research. The current energy taxation datasets are characterised by uneven reporting practices as far as revenues from RES and ETS[162] are concerned; irrespective of any further consideration on whether non-deductible VAT should also be considered for final household consumers, ***this puts into question whether these datasets***

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[161] In certain cases, international organisations, such as the OECD and the IMF, already possess the methodological design and part of the information base required (e.g. in the countries which are both EU and OECD members), so that reliance on their capabilities reduce the feasibility constraints linked to the improvements of the existing indicators. In other cases, Eurostat has already taken certain steps which reduce the feasibility constraints (e.g. in the area of environmentally-damaging subsidies). In any case, the adaptation and refinement of existing Eurostat statistics need to take into account the EU formal decision-making process, which, in certain cases, may represent a constraint for immediate short-term revisions, while being realistic for more long-term recommendations.

[162] In the case of the ETS, this depends on the official statistical treatment of government revenues, which is regulated at UN level and translated into the EU by means of the European System of National Accounts methodology.

fully capture the current tax burden on energy and hinders the policy significance of any cross-country comparison.

Furthermore, data are available only at ***aggregate level and with limited possibilities for data breakdowns*** by type of tax or energy products. For instance, very limited information exists on comprehensive revenues from carbon taxes in EU Member States. Data from the EDT could be used to estimate taxes on a per product basis, but have, in turn, their own limitations as the data collection and compilation is based on administrative sources only and is not supervised by Eurostat and national statistical institutes.

The current EU datasets on energy prices and related taxation components have been improved over recent years, and specific data on taxes, RES charges and other regulatory costs in electricity and natural gas prices have been collected as of 2017. Still, the comparability of taxation data is affected by how various Member States classify their own national price components, and this limits the usefulness of the database. This is compounded by the broader lack of an inflation index of energy products, that could be used to assess impact of energy taxation on the level of energy prices.

Stakeholders' feedback. The survey results and the feedback from workshop participants confirm that the ***improved availability of comparable and disaggregated data by type of tax and energy product*** is considered among the most important information gaps in this field. This is further confirmed by a strong demand for data disaggregation and breakdown by tax at the sectoral level and for the separate availability of information on revenues from taxation of environmentally-friendly products, such as biofuels. The lack of separate information on RES and ETS is not perceived as a problem *per se*; rather it contributes to information gaps when estimating of the average tax burden, also at the sectoral level, as described below.

Insufficient information on taxation of environmentally-friendly products is further confirmed by some Member States, openly challenging the reliability of the EU Oil Price Bulletin data on biofuel-blended diesel products, and the market representativeness of these data. Also, complaints concern the lack of transparent information on how biofuel tax rates translate into retail blended fuel prices. Even indicator providers openly acknowledge that this is a weak point of the current energy taxation information system, irrespective of the data source used[163].

At a more technical level of transparency issues, the workshop discussion has highlighted how the ***criteria used to calculate ETS revenues at the Member State level remain opaque in comparative terms***, particularly as far as the calculation of how free allowances enter the process and influence results. More data sharing on the assumptions and the data used in this respect to come to an average price of surrendered EUA would benefit trust in data comparability. It is worth noting, however, that not all Member States agree with the current inclusion of ETS proceeds among energy taxation revenues, because some Member States do not consider them as taxes.

7.1.2. Likely developments

Eurostat, together with the Member States, has started considering a revision of the Environmental Taxation Guidelines with a view to expanding the scope of data collection to *de facto* "energy taxes" not classified as such for national accounting purposes. ***The ambition to come to a more homogeneous classification of RES charges***

[163] For instance, tax rates at the national level may differ between regular and premium gasoline or depend on biofuel blends, but the energy balance databases provide consumption data for gasoline or diesel as a whole. To some extent this can be mitigated through recourse to local antennasproviding sufficient details on actual consumption patterns.

between Member States is one of the key drivers for action. Eurostat has also proposed a separate indication of revenues from carbon taxes and from EUA auctions to fill in information gaps:

- data on carbon taxes have already been collected, on a pilot basis, making reference to the statistical definition of carbon tax[164].
- the separate accounting of revenues from ETS seems to have elicited support among partner national statistical institutes.

Discussions on these proposed reforms are reportedly at an early stage; as this is likely to require additional data collection and the need to deploy additional resources may generate some resistance. There are no plans to gather data on non-deductible VAT or VAT surcharge, considering that the role of VAT in affecting energy prices is different compared to other environmental taxes.

Few synergies emerge between the recently published OECD environmental taxation reclassification framework and Eurostat proposals, partly because the first appears based on an internal "tagging" process of environmental taxes, rather than on additional data requests from the Member States. In any case, ***Eurostat and OECD energy taxation data are expected to become increasingly aligned*** in the near future, reducing existing and past discrepancies. This is also because, from this edition onwards, OECD energy taxation revenues will include ETS proceeds. The OECD is in principle not going to include RES charges within environmental tax statistics (although this may be done in the context of a revised and expanded TEU dataset as explained below).

IEA has started to cover energy taxes as a part of their database on energy prices, but this is still at an exploratory stage. The need to match energy consumption data with energy taxation revenues has not entered discussions on the reform of energy balance statistics, and the priority there remains to shorten the period before data can become available, largely by relying on supply-based estimates.

The OECD has been considering recourse to TEU and ETR data to estimate revenues starting from energy tax rates and consumption data. Table 5 below reports a simulation of the results of such estimation at the country level. As can be seen, ETR-based estimates tend to be lower than the revenue estimates, as they do not include ETS and certain indirect taxes on energy production. In that, these estimates come much closer to DG TAXUD EDT revenue data.

Table 5: Comparison between estimated and actual revenues (2018, EUR bn)

	OECD Revenues	OECD ETR Estimated Revenues	Eurostat revenues	EDT Revenues
Austria	5.46	5.76	5.46	5.43
Belgium	6.49	6.06	8.81	6.22
Czech Republic	4.28	3.37	4.22	3.62
Denmark	5.88	4.80	5.89	4.68
Estonia	0.62	0.62	0.62	0.58
Finland	4.57	5.06	4.57	4.66
France	42.27	39.43	46.71	43.26
Germany	49.44	46.79	49.48	47.74
Greece	5.35	4.57	5.35	4.26
Hungary	2.66	2.05	2.37	2.27
Ireland	3.15	2.65	3.14	2.60

[164] Cf. Annex C.2 for details.

Italy	46.28	33.88	46.30	32.31
Latvia	0.75	0.51	0.84	0.57
Lithuania	0.81	0.85	0.81	0.81
Luxembourg	0.95	0.82	0.95	0.93
Netherlands	14.48	18.19	14.49	14.35
Poland	11.33	8.71	11.79	8.71
Portugal	3.82	3.35	3.80	2.40
Slovakia	1.54	1.43	1.97	1.30
Slovenia	1.65	1.24	1.36	1.10
Spain	18.27	15.57	18.25	15.34
Sweden	7.64	7.28	7.51	7.11

Note: *Non-OECD EU Member States not covered in TEU 2019.*
Sources: *OECD revenues from environmentally related tax revenue; Estimated revenues based on OECD: effective tax rate and consumption reported in TEU 2019; Eurostat revenues from environmentally related tax revenue; EDT total revenues from all oil products and electricity - EDT July 2019.*

Another priority aspect taken into consideration by Eurostat's proposed reforms is ***to shorten the current 21-month time lag in the availability of energy taxation statistics***, as data from the NTL could be made available earlier. Notably, energy tax data by economic activity is already available in December of the following year (i.e. t+12) for many EU Member States; however, these early estimates are forecasts based on other data sources, which are often subject to later revisions. If approved by Member States, Eurostat proposed reforms are likely to materialise in the medium-term.

7.1.3. Feasibility constraints

Any request to have official statistical data at a more disaggregated level is always accompanied by ***resource-related resistance***. Some workshop participants, however, highlighted that national administrations often possess, or can more easily obtain, certain disaggregated data that could be used as proxies for official statistics. This particularly concerns revenues from carbon taxes and ETS. Other Member States, conversely, insisted that they may not be in favour of improvements requiring additional data collection or reporting, including on non-deductible VAT.

Furthermore, since the publication of energy taxation statistics are enshrined in a binding legal act, certain changes, including the availability of more granular data, may have to go through a formal review process, including consultations with Member States and Commission services, that would require a substantial amount of time.

Stakeholders are not aware of whether a revision of the ETS accounting principles is on the agenda of the UN Working Group[165], also because the issue was considered as rather marginal until recently. It is noted that finding a solution is made complicated by its touching upon the territoriality criteria of taxation. At the moment, given existing national account rules, statistical institutes have limited room for manoeuvre, since consistency must be ensured in how public revenues are accounted for. Overall, there seems to be limited awareness, even among experts, of how distorting the current ETS accounting practices can be. Widespread availability of data on auction revenues by country possibly contributes to this limited perception.

7.1.4. Rationale for further commission action

Stakeholders' requests. ***Data from the EDT***, if provided in a more standardised and harmonised format and eventually subject to some validation process, ***could usefully complement energy taxation data by*** providing estimates for a specific type of tax (i.e. excises) and on a per product basis. As a minimum, this would require:

[165] The UN International Standards Working Group for National Accounts.

- disentangling RES charges from electricity excises when the two are jointly reported;
- having a separate indication of revenues from carbon taxes.

This could be achieved by strengthening data reporting provisions within the framework of the revised ETD, and ensuring consistency with any further work on Eurostat's side. Such a review of the EDT framework could be pursued together with a revision on how tax rates on environmentally-friendly products (e.g. biofuels, fuels for public transportation) are reported, to address another stakeholders' demand.

Also, ***estimates of ETS revenues could be refined by departing from the methodology through which they are calculated within NTL,*** including an improved identification of energy from process emissions data via more consistent reporting among Member States. Such a revised estimate could then be used to produce a modified version of the energy taxation datasets for policymaking purposes. While no longer compliant with European System of Accounts methodology on this specific limited aspect, it would provide more useful information to energy policymakers.

The European Semester. At present, environmental taxes as a share of total taxation revenues is the only indicator monitored for European Semester purposes. ***This could be usefully complemented by an estimate of energy taxes on total taxation and a number of policy-relevant breakdown,*** such as:

- fossil fuel taxes other than carbon taxes;
- carbon taxes;
- electricity taxes net of RES charges;
- other energy taxes net of ETS

These data, possibly also drawn from enhanced ETD sources at least on a temporary basis, should be complemented by (i) data on RES support, including whether it is financed via charges or other tools; and (ii) estimates of proceeding from ETS auctions and any earmarking thereof. This information could be produced in collaboration with EEA and CEER and by triangulating existing sources to minimise reporting burden on Member States. However, energy taxation data are currently only available after 21 months; and this is not compatible with the timing of the European Semester. Should it not be possible for Eurostat to shorten this time lag, other complementary revenue data, such as the EDT, should be used on a permanent basis.

Long-term issues. While the previous Commission actions could be considered as short-term high rank urgent priorities, other medium-to-long term lower rank objectives that naturally takes longer to be achieved could include:

- a proposal for revision of the Environmental Taxation Guidelines with a view to making separate reporting of ***revenues from environmentally friendly products*** mandatory;
- ***a better alignment of the tax components reported in existing EU energy price statistics on electricity and natural gas with those used for energy taxation***, including improved methodological transparency on how these data can be reconciled with known tax rates; and
- sponsoring ***a methodological revision of the way ETS proceeds*** are accounted for ***at the UN level***, particularly regarding cross-border trade of EUAs, as well as recommendations to increase transparency on how free allowances are accounted for.

7.2. Indicators to measure energy tax revenues

7.2.1. Information gaps

Desk research. Should the information gaps in energy taxation revenues mentioned above be eventually addressed, the main remaining weakness to be tackled before coming to produce more accurate estimates of energy taxation revenues is the ***comprehensive identification and quantification of feebates and all subsidies on energy taxes***, including carbon taxes. On top of that, better information, and eventually an indicator, could be established on ***revenue recycling***, together with an appropriate methodology for its classification.

Stakeholders' feedback. Survey results show that the indicators on energy taxation revenues as a share of GDP and total taxation have been mainstreamed into current policy practice and have become widely used, including when calculated for transport fuels only. Opinions diverge on the usefulness of the indicator, and thus on whether information gaps exist. While the majority of survey respondents seem to make extensive recourse to these indicators[166] for both internal and comparative purposes and perceive limited need to fill information gaps, a limited number of sophisticated users have complained about ***insufficient harmonisation of the underlying tax bases and lack of comparability*** that, for instance, precludes their use in the form of rankings.

Also, there seems to be a limited awareness of whether ***direct subsidies or those granted via another tax base***[167] represent a potential or actual problem for the accuracy of existing indicators. Some stakeholders contend that, in developed economies, those subsidies represent a small share of total revenues. In other cases, this information gap is pointed out as potentially significantly reducing the reliability of this indicator, and that the lack of data on this aspect constitutes a serious problem, also considering the overall political commitment towards the reduction of fossil fuel subsidies.

Finally, ***the lack of indicators on revenue recycling and earmarking practices is also perceived as potentially acute***, even though the concrete level of interest and the willingness to invest resources in this subject are far from universal. Some are unconvinced about the rationale behind earmarking, while others see it as important to justify otherwise unpopular taxes. Other positions are more nuanced and possibly depend also on the degree of familiarity with the subject matter and the degree of concrete practical involvement in carbon taxation policies. Stakeholders from Ministries of Environment of Member States that have implemented a carbon tax have confirmed that revenue recycling can be a key aspect to monitor not only for the ETS, but also for carbon taxes. This was reported as a major policy decision impacting on both the economic and the environmental impacts of carbon taxation.

7.2.2. Likely developments

Though the OECD has recently published a study on revenue recycling, this is unlikely to be replicated in the near future to become a regular indicator because of the substantial effort required. Currently, data from the OECD PINE database would be insufficient to provide a good coverage of revenue recycling practices within the EU and *ad hoc* data collection would be required.

[166] In one case, environmental taxation on total taxation revenues was reportedly used as an official reference benchmark in the context a political agreement between parties.
[167] E.g. as deductions or discounts on corporate or personal income taxes.

In terms of timeliness, Eurostat's energy tax revenue indicators (share of GDP and share of total revenues) could eventually benefit from earlier publication of energy taxation data, as discussed above.

7.2.3. Feasibility constraints

The collection, verification, and estimation of data on subsidies (feebates, off tax subsidies) currently not tracked and possibly affecting the accuracy of revenue data would require additional specialised data collection effort, as this would go beyond the information currently stored in the most used subsidy repositories. The effort could start from considering the subsidies already identified in a number of sporadic ad hoc studies[168]. The same goes for revenue recycling. According to the OECD, the recurrent analysis of this policy would require highly specialised staff time, as these data are not necessarily already available at national level.

Unlike tax expenditures, the estimation of the amounts of subsidies granted as feebates or via other tax bases should not pose any major methodological difficulty, as these are usually known via public budgets and other government documents. A difficulty could concern the classification of certain subsidies which are not directly linked to energy taxes or consumption and could thus fall within a grey area (e.g. consumption to certain economic activities which result in higher energy consumption). As for earmarking, it could be difficult to draw a line between ***formal earmarking and political commitments to recycle taxation revenues for given purposes,*** and this aspect would require methodological guidelines to come to harmonised reporting.

7.2.4. Rationale for further commission action

Stakeholders' requests. More information on ***feebates and additional subsidies*** is unlikely to be obtained within the framework of the EDT, e.g. as information complementary to tax rates and reductions, since it has already been very difficult to obtain comprehensive data on the rates applied to the various energy uses and the associated consumption. Therefore, such information could come from Eurostat, by including these subsidies among those to be reported under a new or improved subsidy data collection module[169]. In any case, the cost and benefit of such a data collection should be first assessed by launching a number of pilot studies in a number of countries, aimed at estimating whether those subsidies are substantial enough to compromise the accuracy of the existing indicators.

European Semester*.* If carbon taxation is mainstreamed into the tax systems of Member States, and given that ETS revenues are likely to continue increasing, the European Commission could consider monitoring how these revenues are earmarked or recycled into the public budgets over and above what the EEA already does for ETS revenues only. While, strictly speaking, this has little to do with energy tax revenues and the marginal effects of these tools on carbon emissions, it is a relevant aspect for policy reasons. In particular, these data would allow assessing to what extent an increase in green taxation leads to a reduction of other taxes or an increase in certain public investment. It would also allow to better monitor application of the Polluter Pays Principle in the individual Member State. As the current relevance of these tools remain limited, this could be first dealt with via a series of small ad hoc studies, rather than by means of a regular indicator.

Long-term issues. If there is political interest in also capturing the supply-side dimension of energy taxation, additional indicators could be designed, based on a wider definition of ***energy taxation, inclusive of oil and gas production taxes, as well***

[168] E.g. DG ENER study on energy prices and costs, *supra* note 41; DG GROW study on energy-intensive industries, *supra* note 39.
[169] Cf. Section 7.5 below.

as of resource rents from carbon mines. To this aim contact could be established with the OECD, that has already carried out the internal reclassification of environmental taxation revenue data.

7.3. Implicit and effective tax rates

7.3.1. Information gaps

Desk research. Revenue-based ITRs suffer from the limitations of the underlying revenue data. From the perspective of calculating an accurate 'average tax burden' which could be used to compare energy tax policies across the EU Member States, as a minimum the revenue data should (i) account for RES charges, which represent a significant and growing share of the energy prices, especially for electricity; (ii) adopt a method for calculating ETS costs which come closer to the burden actually borne by companies.

Furthermore, ITRs are available mostly at the economy level, and their policy significance suffers from the lack of sectoral breakdown. In particular, ***no ITR has been produced from industry-level (NACE-64) revenue data*** despite the fact that after major data reconciliation efforts only minor comparability issues apparently remain. The OECD's ETR is available for six sectors, which correspond to categories of users and uses rather than industries. Also, no agreement exists on how an ITR should be deflated, since there is no price index for energy products, although the price of oil could be considered as a rough proxy.

Stakeholders' feedback. There appears to be a ***very strong demand for disaggregated energy tax burden indicators at all levels***, from products, to sectors and energy intensive industries in particular. This demand is largely unmet. Survey results have also highlighted the limited usefulness of economy-wide ITR, because of the lack of comparability of revenue data and the influence of exogeneous factors (e.g. a country's economic structure).

Contributions to the workshop further confirmed the deep interest in enhancing detailed comparative knowledge of the tax burden at the sectoral level and for final household consumers. Both survey results and feedback from the workshop also show that ***the NACE 64 breakdown of energy taxation data is among the least well known, and possibly most underused, energy taxation datasets***. So, it is difficult to judge how a dataset hardly anybody knows might eventually contribute to fill the reported information gaps. Anyhow, the current structure of this dataset, the problems with the definition of energy taxes and thus with revenue data, and the lack of a sectoral ITR built upon it, would require this dataset to be improved and refined in order to address the information gaps and policy needs reported.

There also seems to be a strong interest in further developing the understanding of how ***tax rates translate into actual price increases***, since most of the available sources either assume a full pass-on (i.e. that all taxes are transferred into final prices), or do not at all assess the impact that taxes have on prices. Some Member State representatives have explicitly regretted the lack of information on how the OECD ETR – an indicator that they extensively use - actually impacts on final energy prices and sends a price signal in the different energy markets, and would like to see more comparative information on this aspect. As also confirmed by some interviewees within international organisations, the impact of RES charges on the structure of final electricity prices has mostly be covered by *ad-hoc* studies so far and is hardly included in databases and indicators, thus limiting the possibility of drawing cross-country comparisons. .

From survey data, there appears to be a slightly lower interest for deflated ITR indicators, possibly because of lack of a reliable energy price index. Some Member States, however, consider the calculation of real (i.e. deflated) tax rates and burdens as a priority. Finally, especially from Member States which are currently not covered, there is a demand for the ETR to be extended to all EU Member States, to ensure full intra-EU coverage and comparability.

7.3.2. Likely developments

The calculation of ***sectoral ITRs from Eurostat NACE 64 energy taxation dataset*** does not rank high on Eurostat's agenda, since it has not received any feedback from Member States that stakeholders might be interested in this kind of data. As discussed above, this may be due by the limited awareness of this issue.

Driven by data users' requests, ***the OECD is considering enlarging the scope of its TEU database into other price components***. This implies the possibility of extending the OECD ETR methodology to cover other quasi-fiscal policies, such as RES and other regulatory charges. Unlike the IMF, the OECD does not have plans to track VAT impacts systematically in the future but will continue doing so on an *ad hoc* basis.

As for a possible improvement of existing indicators, revenue-based ITRs necessarily follow the schedule of the underlying energy tax data. As for the ETR, its timeliness is only constrained by the availability of IEA energy balances; its publication could thus become quicker if energy consumption estimates where used rather than observational data. While increasing time-to-market, this would pose methodological challenges.

7.3.3. Feasibility constraints

The improvement and refinement of sectoral energy tax data could require increasing the granularity of existing data. ***Generally speaking, any increase in the data granularity bears the risk of lower reliability***, not to speak of confidentiality issues when data disaggregation level is too high. Accordingly, some experts warned that calculating sectoral ITRs based on PEFA energy consumption could be risky, especially if the latter results from sectoral extrapolations of existing energy balance data. The same is likely to apply to the calculation of sector ITRs on GHG or other air pollution emissions by relying on the Air Emission Accounts by NACE-64.

If the information base on sectoral energy taxes does not meet minimum data quality requirements, especially in small Member States or for small industrial sectors, the development of Eurostat's database would require additional data collection resources at national level. The deployment of these resources would be justified only if a clear interest from Member States emerged in this respect, particularly on the fact that this database could help reduce the information gaps in the area of sectoral energy tax data.

Resources would also be needed should the OECD decide to extend the coverage of the ETR to all EU Member States and to other quasi-fiscal measures, such as RES charges. However, here the issue is not in terms of Member States needing to run additional (or more detailed) data collection modules targeted at energy users, since the OECD relies on statistical information collected by other agencies (e.g. IEA). Rather, this would require "only" additional analytical resources to retrieve information on tax rates in the additional countries to be covered and on quasi-fiscal charges, together local contacts and links with the public administrations and country experts. The amount of resources is clearly lower than those needed to refine Eurostat's sectoral dataset. In terms of methodology, covering additional Member States would pose no problems. Covering quasi-fiscal charges would, however, require the OECD to determine the criteria to identify which one should be covered, how they should be measured, and how differences in national policies would allow data comparability in terms of homogeneous rates. This is, however, already done by Member States to contribute to the CEER review and therefore should not pose major methodological difficulties, but for those Countries claiming no such calculation is possible (e.g. Spain). The methodology for extending the ETR to non-deductible VAT would be fairly simple –as there is no issue about defining what the VAT is and when it is deductible; at the same time, its estimation and data collection may be complex, considering that this requires determining the share of energy users which are not able to deduct VAT.

7.3.4. Rationale for further commission action

Stakeholders' requests. To ensure cross-country comparability, the ITR/ETRs ***need underlying revenue data to include RES charges*** in a homogenous way, given the weight they have today and the increasing role they have played as components of electricity prices for various types of consumers. Regardless of whether they are defined as taxes or not, when charged on energy products or consumption, RES charges should be considered as part of the average tax burden on energy products. Only when RES support is provided (partly) via general budget, this should not be considered as energy taxation, because in that case there is no clear link between RES support and the energy tax burden. If revenue data cannot separately account for RES charges, the Commission could encourage and support the extension of the TEU to these quasi-fiscal charges (and to the other EU Member States).

Another potential added value of a revised ITR is that – unlike the OECD ETR – it could capture the increasing weight of ETS as an energy cost component. ***This could be possible only with an ITR methodology in which ETS are separately accounted, and recorded in a way that more closely matches the amount of money spent by economic operators***[170]. The Commission and the Member States have at their disposal a vast amount of data and information on the working of the ETS mechanism, including auction prices and revenues, market prices and transactions, EUAs freely allocated and EUAs surrendered; therefore many methods could be chosen to achieve this aim. If the method chosen is not compatible with the National System of Accounts standards, then the current method should be maintained for national accounts purpose, while the new method should be used to calculate a revised version of the energy tax revenue and ITR indicators (and differences between the two versions should be clearly explained).

In theory, the Commission could already combine the sectoral energy tax dataset with the PEFA sectoral estimates of energy consumption to publish a sectoral ITR, or with the Air Emission Accounts as far as the average taxation of GHG emissions per industry is concerned However, it is advised to discuss with Eurostat the feasibility and merit of this approach, and also consider alternative approaches (such as relying on the sectoral disaggregation of Eurostat's energy balance[171] or on other sources for GHG emissions). If not possible at the moment, it should be discussed with Member States, once the underlying dataset is better known, whether such an indicator is in demand, for all sectors or only part of the economy (e.g. the manufacturing industries), even though this would most likely require additional data collection resources at national level.

European Semester*.* Some Member States consider that it is particularly important to have indicators on the level of energy taxation monitored within the framework of the EU Semester, particularly in the coming times of economic recovery from the COVID epidemic, as this would allow better understanding of the interactions with other consumption subsidies. Using the current ITR is however not advisable, given its

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[170] As a first proxy, the easiest way is most likely to consider the amount of EUAs surrendered in each year in a country and the EUA market price. This would approximate the opportunity costs borne by economic operators in that year. This should be then corrected by the amount of free allowances granted in the same year. Such as solution may not be elegant, as EUAs surrendered may have been purchased or obtained for free in previous years, while free EUA concern a different time period, but this is a possible proxy of the 'net economic opportunity cost' of ETS for economic operators.

[171] Cf. Annex C.8.

limitations; its use would require, as a minimum, the improvements described above, and possibly a further reconsideration of the role of VAT among energy taxes.

Alternatively, the OECD's ETR could be used, provided that its coverage is extended to the whole EU, and that the timeliness of the indicator is made more compatible with the Semester process. The main advantage of the OECD indicator is that, being bottom-up, it is designed to ensure cross-country comparability. Moreover, its methodology is designed to capture direct taxes only under immediate Government control, and therefore appears more suitable for such a peer review process and for broad recommendations addressed at the Government level without entering the unnecessary level of detail. The Commission, to enhance data comparability, could also consider discussing the possibility to include non-deductible VAT, as this would represent a cost-effective way of getting systematic information on this aspect.

Long-term issues.

- The demand for more information on pass-on factors and impact of taxation on prices is something that would require complex model-based indicators. The Commission could follow developments on this respect at both the OECD and IEA level to understand whether this could be eventually attempted in the future. This also includes availability of datasets on non-deductible VAT on energy products.

- Should a price index for energy products, became available the Commission could produce a new deflated ITR. In the meantime, the decision to publish only one deflated version of the ITR, based on the GDP implicit deflator, seems the most theoretically solid option.

- If interest in NACE 64 based indicators is confirmed, minor methodological improvements in how this is done could be warranted in order to address distortions caused by different practices in allocating consumption by non-residents.

- Since energy price monitoring, including regulated prices for electricity and natural gas, is the primary responsibility of other DGs a recommendation can be made to regularly continue the publication of studies in this field, as this was appreciated by several stakeholders. In particular, it is very likely that any sectoral ITR would not be granular enough to provide a clear assessment of the situation for energy intensive industries. To this purpose, ***DG GROW's periodical assessment of the energy costs and prices for energy intensive industries*** has two main strengths: (i) energy-intensive industries are defined very narrowly, so that only homogenous entities are compared; (ii) plant-level data are used. This publication should be maintained, and, where possible, its main limitation, that it uses voluntary sampling, could be addressed in cooperation with Eurostat and the national statistical institutes.

7.4. Carbon pricing

7.4.1. Information gaps

Desk research. Several types of indicators are available in the area of carbon pricing: those determining the actual carbon price as resulting from the combination of energy and carbon taxes, and the ETS; those determining the optimal carbon price that a country should introduce to meet certain objectives; and policy-monitoring indicators that, starting from the actual carbon price, measure the distance to a pre-determined target. Information gaps concern the quality and amount of information conveyed by these indicators. In particular, the actual carbon price – such as the OECD's ECR – may not be the perfect tool to monitor energy tax policies, especially in the long-term, because just converting full tax rates into their carbon equivalent, without accounting for other aims of taxation, and because those rates ”hide” significant information on the fiscal treatment of various types of emissions. Policy-monitoring indicators try to overcome the latter challenge, while the use of optimal carbon prices - such as the IMF’s ECP – has not yet been established in policymaking and may not be robust enough to overcome bias in the underlying assumptions and parameters.

Stakeholders’ feedback. Survey results confirm the existence of ***considerable uncertainty as to the methodological assumptions underlying carbon pricing and its policy significance***. The need both to better practically distinguish between carbon taxes and excise duties, and improve the analysis of the overlap between the ETS and carbon taxes is considered a significant information gap in this area. Carbon taxation and carbon pricing represent a relatively recent policy innovation which is unevenly spread across Member States, so that not all respondents are aware of the way these indicators address information needs. The fact that the IMF’s ECP methodology has still to be published in full detail adds to this situation. Criticism of the OECD ECR indicator relate to both its late appearance, for early adopters of carbon taxation policies, and its limited ability to capture supply-side incentives to technological substitution. Notably, despite the indicator producers’ efforts in this respect, a distinction at sectoral level between the impact on carbon pricing of ETS on energy-related and process-related CO_2 emissions does not rank high among respondents’ priorities across the board.

In addition to mainstreaming carbon pricing as a tool to curb demand for fossil fuels, other specific uses of these indicators were reported. During the workshop one Member State showed interest in an indicator capturing supply-side aspects to assess how the degree of attainment of certain carbon price levels enables the deployment of low-carbon technologies. Other Member States reiterated the importance of having two versions of the indicator, with or without biofuels, which is possible with the OECD’s ECR, but not the IMF’s ECP.

One Member State explicitly stated that the preferred methodology should also account for the fact that energy taxes ***also cover externalities other than carbon emissions.*** The same Member State reported to already use corrective tax rates for internal policymaking purposes, although not for setting tax rates. The limitations that the IMF corrective tax rates might have in accounting for VAT surcharges have hardly been mentioned, as if there were limited awareness about this aspect. Finally, contrary to the OECD reservations in this respect, one Member State suggested that a country-wide ECR estimate should be published.

7.4.2. Likely developments

As for the ***likely evolution of the existing carbon pricing indicators***[172]:

- the dataset and model underlying the IMF’s ECP have not yet been made public. Expectedly, publication will occur when pending issues with the use of proprietary data are solved. The IMF also aims at updating and adapting ECP estimates more quickly as new elements become available and publish them regularly to keep the model up-to-date in the future; and
- the OECD is considering piecemeal improvements to the ECR methodology, possibly consisting of more in-depth and comprehensive coverage of all energy

[172] The network of the EU environmental accountants, which includes both Eurostat and national statistical institutes, has been involved in carbon pricing indicators and the possibility of incorporating them in the EU environmental accounts. Cf. the paper recently presented at the 26th meeting of the London Group on Environmental Accounting: Palm, V., Calculating greenhouse gas transfers: transfers that reduce the cost of emitting GHG, Statistics Sweden, 2020.

price components that can be translated into carbon prices. The extension of OECD ECR data to other EU countries would pose no methodological problem, provided that contacts and resources can be obtained. Finally, if so requested by stakeholders, the OECD could complement its ECR with estimates of how strongly carbon rates reduce emissions, based on carbon price elasticities.

As for timing, the time-to-release of ECR estimates is mainly constrained by the availability of the UNFCCC emission data. As a result, 2018 estimates should be published in early 2021. A dedicated dataset focusing on EU Member States could be published some months earlier, given that data on emissions and EUA prices are usually also available earlier. In any case, any significant acceleration of the process should require using estimates of carbon emissions, based on past levels and economic trends.

7.4.3. Feasibility constraints

The above-mentioned indicators, including their possible improvements, do not appear particularly bound by resource issues, with the possible exception of accounting for free allowances within ETS average prices. Other than that, the ECR, building on the ETR, does not pose particular resource issues, while the IMF ECP, being model-based, allows piecemeal improvements at limited effort as better data become available, once the model is built.

7.4.4. Rationale for further commission action

Stakeholders' requests. A gap exists in EU climate change policies. The EU is at the forefront of the fight against climate change, with the most ambitious carbon emission reduction objectives among developed economies. Furthermore, it was among the first jurisdictions to introduce the ETS, carbon taxes play a significant and growing role in several Member States, and energy taxes are regulated by the EU framework. Still, the EU has not yet developed a carbon pricing indicator that could monitor policies in this field, both to track progress over time and compare Member State approaches.

Unsurprisingly, then, a widespread consensus exists among survey respondents on their ***willingness to invest resources in the field of carbon pricing to improve the availability of information,*** and to clarify and improve the existing methodologies. At the same time, a clear indication emerges on the preference for ***avoiding unnecessary duplications and using existing indicators*** rather than creating new ones. To further reinforce the point, some workshop participants explicitly requested that any further Commission work to refine and fine-tune the methodology for incorporating taxation effects into carbon pricing should be carried out in collaboration with both the OECD and the IMF, as comparability with non-EU players remains essential. An EU-specific indicator would be of little use in driving policymaking in this area, which requires coordination, and thus comparison, at global level. One Member States not currently covered by the OECD, conversely, would like Eurostat to get involved and ensure full coverage. In this respect, ***opening discussions with the OECD on the possibility of adapting the ECR to EU needs and cover all EU Member States*** could be advisable. This could include a revision of the update that could be made more in line with long-term EU policy objectives, including by considering different weights for the policy tools comprised therein (and in particular energy vs. carbon taxes).

Therefore, even though no policy interest exists in developing an EU-only indicator, the Commission could get a closer involvement into current developments, contributing to data collection and the definition of the methodology, and ensuring that resources are available to cover all EU Member States. Importantly, most of the data on the ETS, and carbon and energy taxes are already available to the EU institutions and Member States (or could be made so with limited effort, e.g. by improving the breakdown and availability of data on carbon taxes and their overlap with the ETS).

European Semester*.* Including a carbon pricing indicator within the framework of the European Semester process would make sense primarily to monitor progress towards common EU pledges and policy objectives, as enshrined in the Green Deal and the previous EU strategies, and as enabled into Member State-specific objectives. To this end, the EU could benefit from designing a model-based indicator, similar to the one developed by the IMF, to calculate the degree of attainment of the ***optimal carbon price*** that each Member State should introduce to meet its target, considering its starting point, economic structure and carbon policies.

Such a tool would still leave Member States free to decide the mix of policy tools to pursue carbon reduction objectives, providing at the same time a common framework to assess progress that can in turn be used as a basis for policy recommendations. A key challenge there would be to make sure that data are available soon enough for the European Semester. While determining energy and carbon tax rates, and the ETS in time should not pose significant problems, a degree of approximation would most probably be needed in "slower" data fields, such as emissions and energy consumption, based on past levels and economic trends.

Long-Term issues. Within the framework of the joint participative approach outlined, two further issues related to the ECR methodology can be discussed, namely:

- the way ETS prices are calculated, including an explicit treatment of free allocations; and
- the impact of the overlap between national carbon taxes and the supra-national ETS, and whether they should not be summed, but netted off in certain circumstances, which presupposes the availability of more detailed information on areas of overlap.

7.5. Indicators of coherence, subsidies, corrective tax rates

7.5.1. Information gaps

Desk Research. ***Few energy taxation indicators are relevant for assessing the coherence of energy taxation with other energy policies and no indicator of coherence as such exists*** linking energy taxation to energy security and availability or air pollution. Existing indicators on energy affordability discount the lack of breakdown of taxation aspects. The OECD has been working on correlation indicators with energy intensity, but the sectoral dimension has remained unexplored, as well as Purchasing Power Parity (PPP) considerations underlying differences in energy intensity. The IMF corrective tax rates can be used to analyse air pollution-related aspects, but are extensively model-based, subject to assumptions and only available for some fossil fuels.

Stakeholders' feedback. Survey results show limited support for building indicators of policy coherence***.*** A more widespread consensus exists on improving the classification of subsidies by policy objective, as a result of the interest in increasing knowledge about energy subsidies. After carbon pricing, ***a better estimation of energy subsidies represents the second policy area for which a need to improve EU data availability is acknowledged.*** Some Member States claimed to use the OECD inventory of fossil fuels subsidies.

Nonetheless, interest in developing coherence indicators is ***more apparent in specific policy areas,*** including first and foremost energy-related air pollution and, to a more limited extent, affordability subsidies. On the contrary, indicators on the coherence of energy taxation with energy security elicited the lowest level of interest.

Some stakeholders maintained that ex post ***indicators on the environmental impacts of energy taxation are underdeveloped*** and more should be done to know about the degree to which energy taxes have decreased consumption, emissions, or air pollution. In this context, they regret that the main data producers have focused only on the forward-looking dimension to the detriment of a backward-looking assessment of results achieved in the past. Similarly, some workshop participants reported interest in having ***more detailed comparative information on price elasticities*** to better frame tax policies towards high-impact areas.

Opinions differ in the expert community on the need to expand the use and scope of ***corrective tax rates*** (e.g. by adding data on other energy sources and biofuels). To some, corrective tax rates exacerbate political resistances to energy taxation, building a case for taxing a sector already generally considered as heavily taxed even more. On the contrary, to others, they ease political acceptance of taxation, showing that energy taxes mostly address local externalities bringing immediate benefits to citizens' everyday lives.

Furthermore, ***the use of corrective tax rates is not unanimously accepted***, either by experts or by policymakers. Some maintained that such an estimation is, to a large extent, an ex post rationalisation of revenues raised for completely different reasons. Therefore, for policy purposes, the way these resources are spent would be more relevant than the reason why they were raised. Others maintained that corrective tax rates are important as they shed light on the main economic justification for energy taxation, i.e. that there are negative externalities and associated costs. Therefore, these estimates should be used as an objective external benchmark for assessing energy taxation irrespective of policymakers' original intentions or motivations. In particular, it is highlighted that the corrective tax rate framework is the only one that can correctly account for the various externalities addressed by energy taxation (climate change, but also air pollution, traffic, accidents and congestion), and hence for some of the various aims pursued therewith.

7.5.2. Likely developments

Indicators of coherence of energy tax policies have hardly entered the agenda of the main indicator producing organisations. A notable exception is the OECD, intention to continue working on its ***correlation-based indicators*** between energy and carbon intensity, and effective tax and carbon rates, and possibly expand the analysis in PPP terms. The current set of IEA technical energy efficiency indicators may also be used to expand the analysis on the effects of taxation.

As for ***corrective tax rates,*** the IMF has not updated the data and parameters used for their calculation since 2015. An update of these estimates could be considered soon, together with discussions on whether corrective tax rates can also be calculated forward-looking, in line with the IMF's overall approach to carbon prices. Other refinements may include the introduction of country-specific climate change external costs (while rates are currently based on a standard global cost). Finally, the IMF is also considering the possibility of extending the analysis to emissions by biofuels, if sufficient data points at national level are available to extrapolate their external costs.

While work is ongoing among the main international organisations to agree on a common definition of energy subsidies, and of a methodology and benchmark to estimate them, ***this definition is unlikely to be adopted any time soon***. For the time being, benchmarks to estimate tax expenditures will continue to be identified by national tax systems, based on their specific methodologies, which makes estimates hardy comparable.

7.5.3. Feasibility constraints

Eurostat noted that an ***indicator on the coherence between energy taxation and energy security,*** such as ITRs on imported and domestic energy sources, could be designed, but would require a complex reconciliation between import data and energy balances. Consequently, feasibility is not to be taken for granted. Much in the same vein, all work on air pollutants is hindered by the fact that these taxes are not separately identified among environmental taxes[173].

The further development of ***corrective tax rates*** would further benefit from a global database on air pollution levels, related damage and epidemiological studies. The availability of this kind of information at a sufficiently granular level is one of the most important enabling factors for such estimates.

Any Eurostat indicator on ***energy subsidies*** would require a new data collection process – although existing repositories and ad-hoc studies could provide a starting point. Recently, a pilot data collection was launched on Potentially Environmentally Damaging Subsidies, on a voluntary basis, building in turn upon the previous attempt at collecting voluntary information from Member States on environmentally-friendly subsidies.[174] In any case, there is no such a thing as an EU energy subsidy repository and significant resources should be invested in this respect. On the contrary, within the OECD, ***correlation-based indicators*** can be further developed based upon existing databases at a relatively low cost.

7.5.4. Rationale for further commission action

Stakeholders' requests. While demand for any indicator in the area of coherence is limited, stakeholder's views and evidence from the desk research point to two possible areas of further investment:

- **Energy subsidies.** The EU should step up the availability of information on energy subsidies. Demand is clear within the Commission (as demonstrated by the numerous ad-hoc studies), by Member States and in international political fora. Therefore, a discussion should be tabled with Eurostat and the national statistical institutes on whether and how to redress this information gap, building upon the existing pilot data collection of potentially environmentally damaging subsidies. However, to avoid bogging the discussion down in a definition of when a subsidy is potentially damaging, the exercise could be usefully narrowed down to the identification and quantification of subsidies on fossil fuels, or, more on energy in general. As the latter would also include RES, synergies exist with the improvement of information on RES charges, demanded for other purposes when discussing revenue indicators and ITRs.

- **Corrective tax rates**. Given the very limited knowledge and use of this instrument and the discussions about its methodology and policy use, calling for estimating EU corrective tax rates may be premature. However, such an indicator provides a comprehensive framework to monitor energy policies from the point of view of various objectives, going beyond carbon pricing only, something which would suit the multi-purpose nature of EU and national energy policies. Therefore, the EU could actively participate in the review process which could be launched by the IMF soon to become more accustomed to the methodology and data needs. In parallel, a participative discussion could be launched with Member States to spread knowledge about this tool and its possible use, and overcome resistance to the use of model-based indicators. This could include the retrieval of studies on elasticities that may have been carried out at national level and the availability of

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[173] The OECD has proposed their separate identification, based on an internal classification exercise, with no additional request to Member States to provide separate tax bases.
[174] Eurostat, Working group Monetary environmental statistics and accounts, Meeting of 16 May 2019: Progress report on Environmental subsidies data reporting; Collection of data on (potentially) environmentally harmful subsidies.

other epidemiological and emission-related information required by this indicator. Further improvements could also be made in the way VAT is accounted for.

European Semester*.* On the one side, the availability of information on energy and fossil fuel subsidies in the EU should be improved, most likely by Member States carrying out an additional data collection under the supervision of Eurostat. On the other, subsidy indicators should not be used within the European Semester perspective for policy review purposes, because the impossibility of defining a benchmark for tax expenditures makes them poorly responsive to policy changes. As a result, an increase in top statutory rates would be highlighted as a bad environmental policy, while this may not necessarily be the case. Hence, it is recommended not to include subsidy indicators within the European Semester exercise.

Similar to the approach described above for the identification of the national optimal carbon price, corrective tax rates could be used to determine the degree of internalisation of energy-related externality costs per each Member State, given the estimates of local and global externalities borne by its citizens. is the estimation of corrective tax rates has already been attempted by DG MOVE in the field of transport, and would be very much in line with the principle of subsidiarity and the current governance of the Energy Union, often setting numerical targets for Member States and leaving them free to pursue them via a locally-determined mix of policies. However, any such consideration is seemingly too early and estimates not robust enough for a Semester forum, and this could only follow from an agreement on the desirability of developing this indicator as a work in progress.

Long-term issues. In addition to any consideration on the possibility, in the medium-term, of calculating EU corrective tax rates for each Member State as a policy benchmark, two areas for further reflection in the long-term are worth mentioning:

- depending on the extent to which a clear need or interest emerge, the possibility of building indicators (including correlation-based) to assess the coherence between energy taxation and other policies should be considered. While air pollution considerations would be included in the corrective tax rates, energy affordability and security would not. On energy affordability, the Commission should consider the extent to which the impact of energy taxes on affordability should be singled out within existing indicators; this would allow identifying the specific role played by taxes (or subsidies) in decreasing (increasing) energy affordability. On energy security, pilot studies could be launched on the feasibility of and interest in a separate ITR on domestic and imported energy sources; and
- the information base on the impacts of energy taxation would be improved if ETR and ECR data were put into better perspective by means of correlation with energy intensity or carbon intensity. Indicators expressed in PPP terms would make more apparent the legacy aspects of energy intensity on the taxation system of Member States in Eastern and Northern Europe.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions

Energy taxation indicators are not scarce, but information gaps persist in various areas of energy taxation policy**.** The field of energy taxation indicators has been developing fast over the last decades, driven by the increasing policy relevance of taxation as an environmental policy tool. To give the flavour of the size of the phenomenon, the present exercise has reviewed 30 different energy taxation indicators. The increase in demand has been driven by the information needs created by the introduction of innovative policy tools as a consequence of energy policy reforms and of the fight against climate change. Data needed to keep track of these developments, however, have not kept pace with the notable increase in the number of these indicators over time, so that the amount of areas with an insufficient or uncertain information base have been growing and this has been compounded by previous shortcomings.

Methodological disagreements and uncertainties have hindered the development of this kind of indicators**.** Having to bridge both traditional tax-related information (such as revenue generation) and the use of taxes for environmental objectives (such as 'providing the right price signal'), the indicators often had to pave the way for innovative solutions in data recording and processing which resulted in some methodological disagreements and uncertainties on how to best build them. Conflicts have appeared between conventional tax indicators, national accounting principles, underlying economic rationales and real policy interests and these have not yet been fully settled. The UN had to mediate between different energy taxation practices worldwide, not only as to the functioning of the ETS, but also on how VAT interacts with energy taxes, encouraging statistical compromises which may have come at the cost of accuracy and comparability.

Disagreements were not theoretical but arose because the policy tools that had to be tracked were new and sometimes unprecedented in the field of taxation, thus challenging old certainties. These tools included for instance RES charges and the ETS:

- quasi-fiscal tools are not that new, having multiplied following the privatisation and liberalisation waves in previously monopolistic services. However, over the last two decades, they have acquired increased importance, in quantitative terms, with the boom of RES support. While twenty years ago agreeing on whether such charges should be considered taxes or something else would have caused limited changes in the amount of environmental or energy taxes collected in a country, such a decision now can 'move' tens of billions of euros in or out of tax revenues;

- similarly, tax and national accounting experts had not been confronted with significant questions on how to treat the sale of ETS allowances. However, the topic is becoming more and more salient. In its first phases, limited revenues were obtained from the ETS, as most allowances were freely allocated. Now, the situation has changed and the current accounting rules are inconsistent with the tax burden borne by economic operators.

Other methodological challenges concern how to treat the overlap between the ETS and carbon taxes which – though likely limited at the moment – may lead to cancelling, and not summing, the two in certain circumstances, or how to calculate the aggregate energy tax burden when tax bases are expressed in different units of measurement or concern different products, with their own calorific and carbon content. Also, capturing another innovative environmental taxation tool, feebates, i.e. taxes paid with the only purpose of sending a price signal which are then reimbursed, is not easy, being a mechanism which is counterintuitive from the traditional perspective of taxation indicators. Finally, in addition to all this, no agreement exists on which taxation benchmark, if any, energy subsidies should be eventually measured against.

***Policy information needs have also changed over time*.** As energy taxation has increasingly been called to pursue different objectives, indicators had to be adapted accordingly and existing ones had to be given new meanings as proxies of concepts that could not be measured otherwise. The first 'traditional' energy tax indicators had been conceived to pursue very simple descriptive purposes and measure the degree to which taxation was environmentally-motivated, so as to assess to what extent fiscal policies pursued 'green' objectives. As discussed above, this was challenged by the growth of quasi-fiscal and non-fiscal environmental revenue-generating measures, which have strained the definition of 'energy tax' on which those indicators were based, reducing their capacity to produce accurate estimates and thus meaningful comparisons. In parallel, the policy agenda has increasingly shifted towards climate change objectives. Carbon pricing and fossil fuel subsidies have become the focus of most policy attention and indicators have been built accordingly to try to translate tax rates into carbon prices and highlight different fiscal treatments as subsidies. With the growing environmental role of energy taxation, a parallel demand for data to respond to competitiveness concerns by assessing the energy tax burden at sectoral level has arisen, particularly for energy-intensive industries. This was paralleled by increasing energy affordability concerns for households, especially when and where energy prices were liberalised.

Energy taxation indicators have changed in response to these changing policy priorities. Traditional revenue-based indicators have increasingly been replaced by others based on effective tax rates, capable of assessing (in)consistencies in the tax burden borne by different energy sources and of comparing average tax levels across countries. The attempt at estimating the tax burden at sectoral level has prompted the creation of quasi-indicators from *ad hoc* studies and the creation of dedicated datasets. The traditional retrospective approach based on actual data – the observational approach – has given way to forward-looking methodologies, explicitly built on models. In addition, indicators have increasingly been requested to measure the contribution of energy taxation to specific policy objectives other than revenue generation, which has further emphasised the problem of defining the benchmark against which the attainment of these objectives was to be measured. Importantly, setting benchmarks for energy policy objectives is a political process, which requires the involvement of policymakers, and, arguably, cannot be left to statistical or technical experts alone, since only in very few cases there is an objective ground for setting such reference values.

These changes have increased the indicator complexity, translating into lower data robustness and increased sensitivity to assumptions, related difficulties in communication and problems with timeliness in data publication, that, in turn, have become the limiting factors in their policy use. Trade-offs between the different possible quality features of indicators have increasingly become apparent should the aim be having more timely indicators based on more estimates or slower observational-data-based tools? Should we choose a single tax benchmark – one-size-fits-all approach – that can be easily communicated, or should we calculate the optimal tax rate per country or product, relying on complex models?

As a consequence, no 'silver bullet' and no energy indicator that can meet all existing policy needs seems to exist. At the same time, a number of improvements and ways forward could be considered to bring existing indicators, such as effective tax rates, 'up-to-date' and in line with the current policy debate. Though any improvement should carefully consider both the drawbacks of leaving the existing certainties and the feasibility constraints.

***Improvements in energy indicators depend, firstly, on improvements in the underlying existing datasets*.** Energy taxation indicators can only be as good as the underlying datasets. The main improvements that are suggested for consideration are summarised as follows:

- The ***Eurostat's NTL-based Energy Taxation Dataset*** reports only aggregate data as Member States are not bound to provide detail per energy product or category of taxpayers. Secondly, there are major problems with data comparability, as national RES revenue data recording practices do vary. Finally, full compliance with national accounting principles also has the potential drawback of distorting ETS revenue data;

- ***Eurostat's Energy Taxes by Industrial Sector*** is unique, but it is not compatible with energy consumption balances, which hinders the production of a sectoral implicit tax rate;

- The ***OECD's Energy Tax Revenue Statistics,*** until recently, did not report revenues from ETS and its values were slightly at variance from those recording other energy taxation datasets because of different classification criteria;

- ***DG ENER's Oil Price Bulletin*** only reports representative products and so it is not always possible to fully appreciate rebates or exemptions linked to given product environmental features (e.g. blending with biofuels);

- ***DG TAXUD's Excise Duty Tables*** report some breakdown of revenue data from most Member States, but not all, and data classification is not necessarily harmonised; reductions and rebates cannot be properly tracked;

- ***OECD's Taxing Energy Use Database*** report rates for fuel taxes, carbon taxes and electricity taxes, without encompassing RES charges and ETS on energy production; feebates, direct subsidies and those granted via other tax bases are not tracked, as much as VAT on energy products;

- In the ***OECD's Inventory of fossil fuel*** **subsidies** tax expenditures are quantified by relying on 'nationally-established benchmarks', for lack of a common benchmark. This makes cross-country comparison much less meaningful;

- The ***IMF's estimates of corrective tax rates and fuel subsidies*** depend on the scope and completeness of datasets used to estimate the cost of externalities and on certain model parameters, such as the value of saved lives.

As a consequence, ***any existing indicator measuring the amount of energy tax revenues suffer from those limitations***, so that their accuracy and policy relevance is limited. In particular, there is no indicator which can remove all subsidies and feebates and properly account for quasi-fiscal and non-fiscal charges. This also means that no ***perfect implicit or effective tax rate indicator can exist at the moment*****.** When calculated from revenue data, the same limitations become apparent, which hinder their policy use and result in possibly misleading ranking. Conversely, the "marginal" rationale behind the ETR seems a better fit to capture the specific dimension of taxation as a tool to increase energy prices and thus reduce energy demand, but is structurally unable to cover the impact of ETS, non-deductible VAT, and production taxes on energy prices. A word of caution is required on the use of the ITR and ETR as tools to highlight inconsistencies in the fiscal treatment of fuels, sectors or activities, thus identifying subsidised ones. There is no consensus on whether all energy products or uses should bear the same (or a similar) tax rate, and whether such an equivalence should be based on the calorific or carbon content. Finally, the growing interest in revenue recycling and earmarking practices**,** as complementary practices to energy taxation, has not materialised yet in any indicator published on a regular basis, but just *ad hoc* studies.

Methodological challenges become more serious for carbon pricing indicators, Different indicators have been developed to measure a carbon price as resulting from the sum of energy and carbon taxation and the ETS. They differ in their purpose, and thus in the underlying methodologies and assumptions. If the policy objective is to measure the relative effects of various carbon policies to achieve nationally-determined targets, the IMF's ECP appears possibly the best tool***.*** However, the ECP is model-based and this creates concerns on its robustness to assumptions (that could be cleared once data are fully released), its communicability and overall acceptance for policymaking. The OECD's ECR lie on much safer methodological ground as regards robustness and reliability for policymaking uses. However, the resulting carbon rate is an average which can 'hide' various emission pricing strategies and climate change policies with different effects in terms of emission reduction. As a consequence, its use for benchmarking remains fraught with some potential ambiguity. To this purpose, the Carbon Pricing Gap (or, alternatively, the share of emissions priced above a certain threshold) may represent a partial remedy and be a more suitable instrument for policy monitoring, especially when considering that, within the EU context, a single carbon price benchmark could in principle be agreed by the Member States.

Indicators on coherence of energy taxation with other energy policies are severely underdeveloped. This is because of the lack of a comprehensive framework for assessing the impact of taxation on other energy policy objectives (energy efficiency, energy security, energy affordability and air pollution), and also reflects a limited demand from stakeholders. In theory, a coherence framework could be built by classifying energy taxes and subsidies by the objective pursued. However, there is no agreement on how those taxes and subsidies could be allocated across various objectives, e.g. when a subsidy 'claims' a specific objective, but then also serves other ones. Corrective tax rates try to consider various aims in a single coherent framework, but cannot cover the energy security dimension as this is not considered an externality. Furthermore, they can only capture energy affordability aspects with some limitations.

8.2. Recommendations

In this section, a number of recommendations are formulated to improve the existing indicators and address the existing information gaps. These are grouped into ***general recommendations*** on energy tax indicators, and ***specific recommendations*** with respect to their use for the European Semester. For each group of recommendations, ***high-priority*** ones are identified, compared to improvements which could be considered in the longer term or that address issues with a lower relevance.

8.2.1 General recommendations

On the revision of the existing energy tax indicators and the definition of additional ones, the following high-priority recommendations are proposed:

1. Revise the existing energy tax revenue classification and recording methodology;
2. Support the extension of the OECD's TEU database to all EU Member States and RES charges;
3. Support the extension of the OECD's carbon pricing indicators to all EU Member States; and
4. Create an EU repository of energy subsidies managed by Eurostat.

First and foremost, ***the existing energy tax revenue classification and recoding methodology should be revised*** to account for the growth of quasi-fiscal and non-fiscal tools. In particular, charges, and especially RES charges, should be accounted among energy tax revenues, and ETS proceeds should be recorded in a way that more closely matches the costs borne by economic operators. Also, the classification of non-deductible VAT among energy taxes should be discussed and clarified. If it is not possible to reconcile the national accounts methodology and produce a correct representation of the energy tax burden, then it will be necessary to provide different versions of the datasets and indicators, one that can be used for national accounting purpose, and one that could be used to track energy taxes and policies. ***These reforms should lead to the calculation of a refined EU Implicit (or Effective) Tax Rate*** overcoming the data limitations described throughout the Report.

Given that such a revision of tax revenue classification is likely to be time-consuming, in the meantime ***the Commission could encourage and support the extension of the OECD's TEU database to RES charges and to all EU Member States***, and increase the coverage of the ETR estimates. This would also be instrumental to the extensions of the OECD's carbon pricing tools.

In the area of carbon pricing, there seems to be a demand not to develop the EU's own indicator, but rather ensure that a global indicator is in use. On the one side, climate change is a global problem, calling for a uniform measurement of carbon pricing; on the other, a global indicator would allow identifying the carbon costs in the various economies, an information which can be used to assess (and possibly compensate) the effects of carbon pricing on a country's competitiveness. This would call for ***the Commission to support the extension of the OECD's ECR to all EU Member States***, which would pose very limited additional burden should the TEU database also be extended, and consider its adaptation to the EU policy context. Even with their limitations, the ECR could be used to monitor carbon price trends within each Member State and the Carbon Pricing Gap could be used to peer-review carbon policies across countries.

Finally, ***the EU should increase the availability of information on energy subsidies***. To this purpose, a discussion should be tabled between Eurostat and the national statistical institutes on whether and how to redress this information gap, benefitting from the existing pilot data collection of potentially environmentally damaging subsidies. The exercise could be usefully narrowed down to the identification and quantification of subsidies on fossil fuels, or, more generally, on energy. As the latter would also include RES, there would be a synergy with the improvement of the information base on RES charges.

Other recommendations. In the longer term, the EU could explore the calculation of ***corrective tax rates,*** as this is the framework that best accounts for the various aims pursued and externalities addressed by the energy tax policy. The EU could actively participate in the review process which could soon be launched by the IMF, in order to become more accustomed to the methodology and data needs. In parallel, a participative discussion could be launched with the Member States, to spread knowledge about this tool and its possible use, retrieve studies that may have been carried out at national level, and test the availability of information required by this indicator. This would also allow the Commission and the Member States to consider any tailoring which is deemed necessary to the EU circumstances, including e.g. the treatment of the VAT surtax.

Other complementary recommendations to be considered:

- Strengthening EDT data collection in a more standardised and harmonised format;
- Exploring the feasibility and test the demand for ITR at the NACE 64 level based on the existing datasets;
- Within the framework of a more general strengthening of information on energy subsidies, collecting exhaustive data on feebates and subsidies not covered by existing repositories;
- Launching regular studies on earmarking of energy taxation revenues with a view to coming one day to a possible regular indicator.

8.2.2 Specific recommendations

As for the inclusion of energy tax indicators within the ***European Semester***, the analysis is made more complex by three factors: (i) indicators should not only be accurate in tracking energy taxation, but also correctly responding to policy changes; (ii) indicators should be available after a short time delay; and (iii) indicators should be relatively simple to understand and interpret for policy purpose. With this framework in mind, three high-priority recommendations related to the use of energy tax indicators within the semester are proposed:

1) Include energy tax revenues among the items monitored and improve the available breakdown;
2) Incorporate the OECD's ETR within the Semester exercise by addressing the existing problem of data timeliness;
3) Refrain from using existing Implicit Tax Rates and subsidy indicators.

In terms of descriptive indicators, the European Semester currently includes the environmental taxes as a share of total taxation revenues as the only monitoring tool. This could be usefully complemented by a ***further breakdown of energy taxes on a number of policy-relevant indicators***, such as:

- taxes on fossil fuels other than carbon taxes;
- carbon taxes;
- electricity taxes net of RES charges;
- other energy taxes net of ETS.

These data, possibly also drawn from enhanced ETD sources at least on a temporary basis, should be complemented by (i) data on RES support, including whether it is financed via charges or other tools; and (ii) estimates of proceeding from ETS auctions and any earmarking thereof.

To measure the 'average' tax burden on energy products, the quickest solution is to ***incorporate the OECD's ETR within the European Semester***, provided that its coverage can be extended to all EU Member States and that its timeliness can be improved by relying on estimates of energy consumption based on data from the previous year and extrapolated based on the economic trend. The main advantage of the ETR – especially once improved with data on RES charges, is that, being bottom-up, it is designed to ensure cross-country comparability in analytical terms and, since it focuses on rates, it is less ambiguous in singling out the effects of successful environmental policies than ITR is (e.g. Sweden's recent energy taxation interventions to reduce carbon emissions have tendentially resulted in a lower ITR ranking). Linked to this, enhanced consideration should be given to non-deductible VAT paid on energy consumption and energy taxes, to both appreciate the magnitude of impacts and improve data comparability. In the medium-term, this could be replaced by a EU version of a revised Implicit (or Effective) Tax Rate, whose design should incorporate the need for data to be readily available by the following year.

Furthermore, it is worth mentioning two indicators which appear effective and quite simple to monitor, but that sometimes produce misleading policy responses, and thus are not recommended for policy monitoring. In particular, it is advisable not to include:

- the implicit tax rate, as it is calculated today, given its limitations;
- existing subsidy indicators, given the issues in determining the benchmark and their reaction to increases in the top statutory rates; to monitor this aspect, it remains advisable to increase the information base by creating an EU repository, as well as considering the calculation of corrective tax rates.

Other recommendations. In the ‘typical’ EU energy and climate policy architecture, which objectives are set at EU level, while Member States then tailor their approach to their economic structure and policy preferences. Therefore, in the long-term, ***the IMF’s methodology to calculate the optimal carbon price for each country could be well suited as a tool to monitor national carbon pricing strategies***, and thus as a tool to monitor the progress towards the European Green Deal pledges and objectives. This tool would allow Member States to remain free to decide their mix of policy tools to pursue carbon reduction objectives, while at the same providing a common framework to assess its progress, that can in turn be used as a basis for policy recommendations. A key challenge would be to make sure that data are available soon enough for the European semester. While the EU should have no significant problem in determining energy and carbon tax rates and ETS in time, this would most likely require a degree of approximation in “slower” data fields, such as emissions and energy consumption, based on past levels and economic trends.

EUROPEAN COMMISSION

Study on Energy Taxation Indicators

Final Report

Volume 2 Annexes

Directorate-General for Taxation and Customs Union

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ANNEX A – APPRAISAL OF ENERGY TAXATION INDICATORS

A.1. INTRODUCTION

In this Annex, the appraisal of the energy taxation indicators reviewed by this Study is provided. First, the general appraisal framework used to assess the indicators is introduced in Section 1. Then, Section 2 provides the list of indicators considered, which is then followed by the factsheets – one per each indicator – in which the assessment is summarised.

For the purpose of this review, an indicator is defined as broadly as possible, to encompass indicators *stricto sensu*, quasi-indicators, reports, publications and databases which provide information on the various relevant areas.

The focus on the analysis is on the dimensions of the indicators directly relevant to the Assignment, i.e. energy taxes and quasi-fiscal measures, energy products and the externalities associated to their consumption, and carbon pricing. When the indicator covers also other aspects (e.g. transport externalities) or includes other statistical indicators (e.g. GDP), these are only briefly discussed, to the extent to which this is necessary to assess the overall indicator.

In most cases, when similar indicators are provided by different sources (e.g. carbon price, share of energy taxes over GDP), they are discussed separately, to highlight existing differences in results and methodology. Only in the case of implicit tax rates, TAXUD and EUROSTAT indicators are considered jointly, introducing a different assessment within the same factsheet where relevant.

A.2. GENERAL APPRAISAL FRAMEWORK

Existing energy taxation indicators have been evaluated against a general appraisal framework. This was outlined in the project proposal and then refined based on the comments received by the Inter-Service Group and the reviewers, and discussed with the Member States during the workshops.

The general appraisal framework is based on both policy and analytical criteria. For the former, the criteria to judge /compare indicators have been selected in line with the ***policy priorities*** and ***policymakers' information needs****.* This allows to verify the potential or actual use of existing indicators in policymaking, and to identify information gaps, to be possibly filled in by additional instruments. The analytical criteria concern the ***soundness*** of the indicator and its usefulness in timely ***measuring*** a phenomenon providing complete and comparable information.

The proposed assessment framework has been built upon a model originally proposed by the OECD[1], according to which indicators should be evaluated against three basic quality criteria, and considering Eurostat work on the subject[2]. These criteria are:

1. ***policy relevance***: indicators need to address issues that are (actually or potentially) relevant to policymaking;

[1] OECD, *Towards Green Growth: Monitoring Progress*, Organisation for Economic Co-operation and Development, Paris, 2011.

[2] See among others Eurostat, *Towards a harmonised methodology for statistical indicators Part 1: Indicator typologies and terminologies*, 2014.

2. ***analytical soundness***: indicators should be based on the best available statistical data and methodologies and should be robust to assumptions for them to be reliable and widely accepted;

3. ***measurability***: indicators need to reflect reality on a timely and accurate basis and be measurable at a reasonable cost. For use at the EU level, comparability and harmonisation aspects are also key as the definitions used and the data provided need to allow meaningful cross-country comparison.

The assessment criteria used for this report have been expanded to consider multiple judgment criteria, and several possible ways of measuring and ranking them based on a set of critical questions, as shown in the Table 1 below.

Table 1: General Appraisal Framework for Energy Taxation Indicators

Key Indicator Features	Judgment Criteria	Ways of Measurement	Overall Assessment
Policy relevance	What are the goals of the indicator? What does it aim to highlight?	Policy Relevance Non-Ambiguity	▪ Does the indicator relate to important policy debates? Is there consensus among policymakers / stakeholders on the issues worth monitoring? ▪ Are the concepts used clearly defined? Or are there areas of ambiguity in definitions?
	Is the indicator helpful to highlight a clear need for intervention or to monitor existing policies?	Responsiveness Comprehensiveness	▪ Does the indicator correctly reflect change in underlying policies? ▪ Is it possible to change the indicator (only) by means of policy action? ▪ Are there benchmarks / reference points available to define the adequacy of underlying policy? ▪ Is the indicator unambiguous in its interpretation about the existence / magnitude of policy needs / outcomes of existing policies? ▪ Does the indicator need to be integrated/complemented by other indicators to cover other concurrent aspects?
Analytical soundness	Is the indicator technically robust and based on reliable data?	Analytical Soundness Robustness in assumptions Robustness over time	▪ Does the indicator directly measure the problem? ▪ To what extent is the indicator sensitive to changes in underlying assumptions? ▪ Is the indicator consistent over time, and what is the resulting uncertainty? ▪ Is the indicator consistent with other similar indicators referred to the same period?
	Does the indicator have a transparent methodology? Has the indicator been proposed by a reliable source?	Transparency Communicability Credibility Independence	▪ Has the methodology been published? ▪ Is the indicator fully replicable by third parties based on available public data or does it depend on hidden/proprietary variables? ▪ Can a layman understand how the indicator has been built? ▪ Does the indicator come from a credible source? ▪ Are the indicator inputs validated by an independent statistical entity or provided by Government sources?

Measurability	What is the geographical coverage?	Geographical Coverage	▪ Are all EU Member States covered?
		Intra EU Comparability	▪ Is coverage homogenous between Countries or are there differences in indicator composition / data availability?
		Extra EU Comparability	▪ Are comparisons available / possible with third countries?
	What is the timing and frequency of the indicator?	Frequency	▪ What is the time period of the indicator?
		Timeliness	▪ How quickly can policy results be expected to materialise
		Regularity	▪ Has the indicator been released just once on a pilot basis, or is it published / updated at regular intervals?
		Sustainability	▪ Can it be reasonably deemed that the indicator is sustainable and will be also available in the future?
	What is the scope of the indicator?	Completeness	▪ Is it feasible to include in the indicator all the items that are deemed necessary?
		Level of detail	▪ If not, what is the degree of coverage of the requested items? Is the indicator available at the requested level of disaggregation?
		Range of available versions	▪ Is the indicator available upon request in multiple versions (e.g. both with and without certain optional or controversial items?

A.3. LIST OF ENERGY INDICATORS BY CATEGORY

- **Energy Taxation Revenues**
  1. Revenue from Energy Taxation as a % of GDP (Eurostat)
  2. Revenue from Energy Taxation as a % of GDP (OECD)
  3. Revenue from Energy Taxation as a Share of Total Revenues (Eurostat)
  4. Energy Taxes by Paying Entities and Industrial Sector (Eurostat)
  5. Transport Fuel Taxation as a % of GDP (DG TAXUD)
  6. Transport Fuel Taxation as a Share of Total Revenues (DG TAXUD)

- **Implicit/Effective Tax Rates**
  7. Implicit Tax Rates (DG TAXUD, Eurostat)
  8. Effective Tax Rate: Taxing Energy Use (OECD)
  9. Combustion Surcharge (OECD)
  10. Diesel Differential (OECD)
  11. Share of Taxes on Gasoline and Diesel Fuel Prices. Oil Weekly Bulletin (DG ENER)
  12. RES - Effective Tax Rates (CEER)
  13. Natural Gas and Electricity Prices (Eurostat)
  14. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries (DG GROW)
  15. Energy Prices, Costs, and Subsidies (DG ENER)
  16. Energy Prices and Taxes for OECD Countries (IEA)

- **Carbon pricing**
  17. Effective Carbon Price (IMF)
  18. Effective Carbon Rate (OECD)
  19. Share of Emissions Priced at a Given Level (OECD)
  20. Carbon Pricing Gap (OECD)
  21. State and Trends of Carbon Pricing (World Bank)

- **Corrective Tax Rates**
  22. Corrective Tax Rates on Fuels (IMF)
  23. Corrective Tax Rates on Emissions (IMF)
  24. Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities (DG MOVE)

- **Correlation and Model-based Indicators**
  25. Correlation Between Energy Tax Rate / Carbon Price and Energy / Carbon Intensity of GDP (OECD)

- **Assessment of Energy Subsidies**
  26. Energy Taxation and Subsidies in Europe (International Association of Oil and Gas Producers)
  27. Europe's Fossil Fuel Subsidies (ODI)
  28. Support and Tax Expenditures for Fossil Fuels (DG ENV)
  29. Inventory of Fossil Fuel Subsidies (OECD)
  30. Total Amount of Fossil Fuel Subsidies (IMF)

- **Energy consumption**
  31. Physical Energy Flow Accounts (Eurostat)
  32. Purchases of Energy Products (Eurostat).

Factsheet 1 – REVENUE FROM ENERGY TAXATION AS A % OF GDP

Category: Energy Taxation Revenues

Source: Eurostat, Database[3]

Energy tax revenue indicators are calculated based on NTL data and compared with GDP nominal values in the reference year. The indicator is published by DG TAXUD in their annual Taxation Trends Report and also available online on Eurostat databases. Data on energy taxes come from the National Accounts collected and validated within the framework of the European Statistical System and therefore are immediately comparable with GDP data.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator conceptually expresses the "weight" or the "importance" of energy taxation in an economic system independently from the general taxation policy. It was intended to measure the "greening of a tax system" and as such it is still extensively used for political purposes. The category of energy taxation is broader than what specifically required to respond to climate change information needs and therefore no longer entirely suitable in relevance terms.
	Non-Ambiguity:	▪ The indicator in primarily ambiguous in that if environmental taxation is successful in reaching its aims it decreases rather than increases. Minor elements of ambiguity are provided by the way ETS revenues are recorded because figures at times reflect revenue for Government and at times costs for companies when allowances are surrendered[4]. Moreover, some elements of energy taxation revenues are not related to energy. This is particularly so for the ETS
	Responsiveness:	▪ The indicator is poorly responsive and may vary for reasons totally unrelated to the greening of the tax systems or policy action. It heavily depends in absolute terms on the energy intensity of the underlying economy which hinders benchmarking or recourse to reference values. As a result, comparison by ranking has limited significance.
	Comprehensiveness:	▪ Needs to be complemented with data on the energy intensity of the economy.
Analytical soundness	Analytical Soundness:	▪ The indicator is fairly straightforward if the problem is to assess the extent to which energy is taxed within an economy. It lacks any analytical detail as to taxation composition.
	Robustness in assumptions:	▪ So far, the indicator robustness has crucially depended on whether RES costs are paid through the general budget or through off-budget mechanisms. ETS accounting methods seem bound to affect future robustness of results, as revenues from ETS increase.
	Robustness over time:	▪ As RES have moved in and out of the budget in certain Member States over time, the indicator

[3] European Commission DG TAXUD, Taxation Trends Report 2019 Edition. Data for the EU Member States, Iceland and Norway, Publications Office of the European Union, Luxembourg, 2019; Eurostat, Environmental tax revenues: https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax_esms.htm.
[4] See Vol. 1, section 4.3.

		might have been affected accordingly. In the past there were differences with a similar OECD indicator, but these are expected to lower.
	Transparency:	▪ The methodology on which the indicator is based is fully transparent and has been published as Eurostat metadata and underlying energy taxation guidelines. Data can be reconstructed in detail and the process can be replicated.
	Communicability:	▪ Very easy and immediate to communicate in both conceptual and political terms.
	Credibility:	▪ Indicator is based on the Environmental Taxation Dataset within the NTL whose contents may patently be at a variance with officially recommended classification criteria.
	Independence:	▪ Data are transmitted as classified by Government sources, the validation process does not enter into the classification of a tax as an energy tax, because vertical compliance with national accounting principles prevails.
Measurability	Geographical Coverage:	▪ All 27 Member States are covered with series dating back from 1995.
	Intra EU Comparability:	▪ Despite common methodology, inter EU comparability suffers from different Member States understanding of classification criteria of RES charges and other quasi-fiscal measures. Comparability also suffers from the different weight of energy production and consumption taxes, as these cannot be separately identified.
	Extra EU Comparability:	▪ Based on a common UN methodology can be compared worldwide. Dataset available from OECD also for many non-OECD countries not entirely comparable until recently because of different classification criteria
	Frequency:	▪ Data are published on an annual basis.
	Timeliness:	▪ The indicator appears on a t+2 years basis usually after 21 months. Related tax revenues are first reported at t+11 months
	Regularity:	▪ Current data series start from 1995 and the questionnaire for environmental taxes by economic activities is sent out every year
	Sustainability:	▪ The availability of the data necessary for producing the indicator is enshrined in a Regulation.
	Completeness:	▪ Feasibility constraints have hindered inclusion of VAT on energy taxes originally envisaged in the Un methodology.
	Level of detail:	▪ The indicator is currently available for energy taxation as a whole; breakdown by type of energy tax (energy, carbon, ETS) is not available.
	Range of available versions	▪ None

Strengths	**Weaknesses**
▪ Fairly straightforward in measuring the extent to which energy is actually taxed within an economy. ▪ Very easy to use and communicate. ▪ Regular and sustainable ▪ Harmonised at the UN level	▪ The way RES charges are dealt with can distort the comparability of the indicator. ▪ Environmental policy significance tends to be ambiguous in certain circumstances. ▪ Ranking can be distorted also by the underlying energy intensity of an economy and trends by exogenous energy supply market factors.

Factsheet 2 – REVENUE FROM ENERGY TAXATION AS A % of GDP

Category: Energy Taxation Revenues

Source: OECD, Database[5]

This energy tax revenue indicator is calculated by the OECD starting from their Revenue Statistics database. This is further validated by OECD environmental expert correspondents. Differently from Eurostat, OECD appears more rigorous with compliance with the proportionality principle. Until recently ETS revenues were not included.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Still relevant although increasingly less so as focus has switched from energy taxation to climate change taxation (see the OECD newly introduced horizontal classification of certain energy, transport and resource taxes as climate change taxes).
	Non-Ambiguity:	▪ Compared with the parallel Eurostat one, the OECD version was less ambiguous by exclusion of the ETS. These are now being included, reportedly at their auction values
	Responsiveness:	▪ Same considerations as for the Eurostat version in factsheet #1 applies.
	Comprehensiveness:	▪ It would profit from parallel information on a Country's overall energy efficiency.
Analytical soundness	Analytical Soundness:	▪ Fairly straightforward in measuring the extent to which energy is taxed within an economy. OECD is working on a more detailed analytical classification
	Robustness in assumptions:	▪ Strictly consistent with OECD Revenue Statistics and proportionality principles.
	Robustness over time:	▪ Generally robust over time if assessed by means of the criteria above.
	Transparency:	▪ The methodology on which the indicators are based is described and published
	Communicability:	▪ Reasonably easy to understand also to a layman.
	Credibility:	▪ Data on energy taxation are collected by OECD based on their sources and further validated through the environmental committee
	Independence:	▪ Data can be at a variance with what reported from national statistical offices to Eurostat based on their own national accounts, which increases their perceived independence.
Measurability	Geographical Coverage:	▪ All Member States are covered with series dating back from 1994.
	Intra EU Comparability:	▪ The comparability across EU countries is good but within the limitations above. Problems with uneven reporting of RES charges bundled to other taxes are not entirely solved.
	Extra EU Comparability:	▪ Indicators cover OECD members, accession countries and selected non-OECD countries, thus comparison with non-EU Member States is often possible. Lack of non-deductible VAT surcharges is a possible bias to international comparability in this respect.

[5] OECD, Environmental tax (indicator), 2020, doi:10.1787/5a287eac-en.

	Frequency:	▪ Data are published on an annual basis.
	Timeliness:	▪ Provisional figures for most countries become available with a lag of about 6 months; finalised data become available with a lag of around one and a half years.
	Regularity:	▪ Data are regularly published on an annual basis on the OECD database.
	Sustainability:	▪ Publication is bound to continue.
	Completeness:	▪ The indicators are fully completed in terms of fiscal revenues (taxes from fossil fuels and electricity; CO2 related taxes). Non-deductible VAT on energy taxes not included
	Level of detail:	▪ The indicators are currently available for energy taxation only. Further data breakdown on progress.
	Range of available versions:	▪ Parallel transversal version related to climate change taxation not published yet.
Strengths		**Weaknesses**
▪ Data appear to be more consistently classified than under the parallel Eurostat version above.		▪ RES charges remain in part inconsistently reported. ▪ Compliance with proportionality principles may hinder policy significance from environmental perspective.

Factsheet 3 – REVENUE FROM ENERGY TAXATION AS A SHARE OF TOTAL REVENUES

Category: Energy Taxation Revenues

Source: Eurostat, Database[6]

Energy tax revenue indicators are calculated based on NTL data. The indicator is published by DG TAXUD in their annual Taxation Trends Report and also available online on Eurostat database.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator has increasingly entered the policy debate with the emphasis on carbon taxation and the related "double dividend" argument about the benefits of revenue recycling to address distributional issues and smooth the acceptance of carbon taxes[7].
	Non-Ambiguity:	▪ The indicator tends to produce ambiguous or even paradoxical results when off-tax subsidies are in place and it remains ambiguous on the difference between revenues and net revenues because of shortcomings in the underlying energy revenue dataset. ETS values do not always reflect actual government revenues
	Responsiveness:	▪ The indicator may be affected by radical changes in the underlying tax system and does not capture tax offsetting mechanisms.
	Comprehensiveness:	▪ Would benefit from complementary data on revenue recycling.
Analytical soundness	Analytical Soundness:	▪ The indicator does not directly measure the amount of net resources made available by energy taxation to the budget, but represents a close proxy.
	Robustness in assumptions:	▪ In the current version VAT on energy taxes is not included, this can distort values when concessional rates on energy products are enacted, because the indicator nominally increases, while revenues actually decrease.
	Robustness over time:	▪ Member States may have changed RES accounting patterns or introduced VAT concessional rates and this may distort the significance of some time series. ETS values can intrinsically distort the indicator over time, as revenues may or may not appear in full depending on EUA surrendering patterns.
	Transparency:	▪ The methodology on which the indicator is based is fully transparent and has been published as Eurostat metadata and underlying energy taxation guidelines. Data can be reconstructed in detail and the process can be replicated.
	Communicability:	▪ Very easy and immediate to communicate in both conceptual and political terms.
	Credibility:	▪ Indicator is based on the Environmental Taxation Dataset within the NTL whose content appear at

[6] Eurostat, Environmental tax revenues: https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax__esms.htm. Also discussed in European Commission DG TAXUD, Taxation Trends Report 2019 Edition. Data for the EU Member States, Iceland and Norway, Publications Office of the European Union, Luxembourg, 2019;

[7] For a more detailed explanation see Vol. 1, section 5.2.

		a variance with official recommended classification criteria.
	Independence:	▪ Data are transmitted by government sources, the validation process does not enter into the classification of a tax as an energy tax, as Member States are left considerable room for data classification.
Measurability	Geographical Coverage:	▪ All 27 Member States are covered with series dating back from 1995.
	Intra EU Comparability:	▪ Suffers same comparability problems as energy taxation on GDP (see factsheet 1).
	Extra EU Comparability:	▪ Based on a common UN methodology but cannot be compared with underlying OECD total taxation data, because of differences in the scope of taxes covered.
	Frequency:	▪ Data are published on an annual basis.
	Timeliness:	▪ The indicator appears on a t+2 years basis usually after 21 months. National versions are likely to appear sooner than that
	Regularity:	▪ Current data series start from 1995 and the questionnaire for environmental taxes by economic activities is sent out every year
	Sustainability:	▪ The availability of the data necessary for producing the indicator is enshrined in a Regulation.
	Completeness:	▪ Feasibility constraints have hindered inclusion of VAT on energy taxes.
	Level of detail:	▪ The indicator is currently available for energy taxation as a whole; breakdown by type of energy tax (energy, carbon, ETS) is not available.
	Range of available versions:	▪ None

Strengths	**Weaknesses**
▪ Very relevant in times of double dividend and revenue recycling debate. ▪ Very easy to use and communicate. ▪ Regular and sustainable ▪ Harmonised at the UN level	▪ Ambiguous to off-tax subsidies. ▪ Robustness is challenged by ETS, RES and VAT reporting practices. ▪ Can be misunderstood as an indicator of net revenues. ▪ Needs complementary information on revenue recycling and earmarking practices

Factsheet 4 – ENERGY TAXES BY PAYING ENTITIES AND INDUSTRIAL SECTOR

Category: Energy Taxation Revenues

Source: Eurostat, Database[8]

The database includes data on energy taxes paid at sectoral level (NACE-2 disaggregation), in EU Member States and other European countries, together with data on environmental taxes, thus also including pollution, transport, and resource taxes. Data are provided in million EUR or national currency.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The database is the only source of information to estimate the amount of energy paid by seven categories of paying entities and by each NACE sector at 2-digit level.
	Non-Ambiguity:	▪ Non-Ambiguity is as good as underlying sources. Energy taxes are defined based on national definitions. .
	Responsiveness:	▪ Increases in taxes and/or reduction of subsidies ceteris paribus (i.e. with constant consumption), results in an increase of the tax burden. However, since both taxes and consumption can vary at the same time, and the latter is also influenced by exogenous factors, the indicator is not always directly responsive to policy and a decomposition factor analysis is needed.
	Comprehensiveness:	▪ Would require comparable energy consumption data at the NACE level for a proper assessment.
Analytical soundness	Analytical Soundness:	▪ The data series comply with the designed purpose. No data breakdown is specifically available for most energy-intensive industries.
	Robustness in assumptions:	▪ Data can be distorted by different assumptions on how taxes paid by non-residents are accounted for when a separate category is not reported
	Robustness over time:	▪ As indicated in metadata, dataset may suffer from vintage problems due to misalignment with NTLs, that must be re-aligned by Eurostat
	Transparency:	▪ Data reconciliation and NACE attribution are carried out at the Member State level based on unreported criteria.
	Communicability:	▪ Very easy to understand and communicate also to a non-specialist public, but very poorly known
	Credibility:	▪ Official Eurostat data
	Independence:	▪ Data are transmitted by national authorises. To ensure quality of the data Eurostat implements methodological guidelines to assist countries and uses validation tools to inform on apparent inconsistency, non-conformity, etc.
Measurability	Geographical Coverage:	▪ All 27 Member States are covered as well as the EU at aggregated level (from 2008-2017).
	Intra EU Comparability:	▪ The comparability across EU countries is good due harmonised by statistical framework provided. However, the primary data sources used for compilation of data by countries may differ in terms of quality and due to different definition of national taxes.

[8] Energy taxes by paying sector (t2020_rt300).

	Extra EU Comparability:	▪ Comparison of prices with other jurisdictions is limited to few extra EU countries.
	Frequency:	▪ Data are published on an annual basis.
	Timeliness:	▪ Dara are published on t+2 year
	Regularity:	▪ Current data series start from 1995 and the questionnaire for environmental taxes by economic activities is sent out every year.
	Sustainability:	▪ Data transmission became obligatory in September 2013.
	Completeness:	▪ There remain a few unallocated amounts of no practical significance
	Level of detail:	▪ Level of details for both indicators is high; one is for seven paying sectors; and the other in absolute terms for all NACE activities at 2-digit level. But, level of details related to energy products is still missing.
	Range of available versions:	▪ No indicator published
Strengths		**Weaknesses**
▪ Most comprehensive source to measure impacts of energy taxes across types of taxpayers / industries.		▪ Available data do not allow to disentangle the impact of specific forms of taxation

Factsheet 5 – TRANSPORT FUEL TAXATION AS A % OF GDP

Category: Energy Taxation Revenues

Source: DG TAXUD, Report[9]

The indicator aims at measuring the share of transport fuel tax revenues on GDP. It is calculated by DG TAXUD from data extrapolated from the Excise Duty Tables data and other unpublished sources. Depending on data availability, methods of estimation for transport fuel revenues might differ by country. The indicator is published in the DG TAXUD Taxation Trends Report.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Aims at emphasising the tax burden falling on fuel transport energy products, which represent the largest portion of energy tax revenues in the EU. The issue is still certainly relevant, but no longer as before, and the issue is what share of these taxes contributes to carbon reduction. Long term importance of the indicator bound to decrease, as long as fuel transport taxes might be replaced by other transport taxes.
	Non-Ambiguity:	▪ Definitions of transport fuel are clear and do not lead to any particular ambiguity.
	Responsiveness:	▪ Possibly the least affected by exogenous factors among energy taxation revenue-based indicators, as demand for transport and GDP tend to correlate. Little distortion from the energy intensity of the underlying economy
	Comprehensiveness:	▪ Parallel data on subsidies granted to biofuels would allow an assessment of the degree of progression in the erosion of the tax bases.
Analytical soundness	Analytical Soundness:	▪ The indicator appears fairly straightforward in measuring the importance of fuel transport taxation on the economy. Analytical soundness would benefit from breakdown of taxes on private, public and freight transportation
	Robustness in assumptions:	▪ Since extrapolation assumptions are based on energy balance consumption data and uncertainty on the underlying assumptions can vary only real revenue data from tax administrations can improve accuracy. These are currently provided by most but not all MS
	Robustness over time:	▪ Vintage data have not been recalculated for all Member States when estimation methods have changed at the Member State level.
	Transparency:	▪ The methodology for estimation has been extensively described and is published by the Commission in the Taxation Trend in Europe report, by making comparisons with ETD data it is possible to reconstruct how the indicator is calculated by country.
	Communicability:	▪ The indicator per se is very easy to communicate. Methodology and the underlying level of approximation, conversely, may not be easy to grasp by an ordinary layman.
	Credibility:	▪ Data are collected by DG TAXUD, by combining specific disaggregated data provided for the

[9] European Commission DG TAXUD, Taxation Trends Report 2019 Edition. Data for the EU Member States, Iceland and Norway, Publications Office of the European Union, Luxembourg, 2019.

		Taxation Trends Report with those submitted to the EDT by Member States. The Commission warns that it does not guarantee for their reliability and compliance with SEEA principles.
	Independence:	▪ Data are transmitted by relevant Government sources without any further validation and statistical supervision.
Measurability	Geographical Coverage:	▪ Data available for all EU 27 Member States
	Intra EU Comparability:	▪ Available data reflect an uneven degree of recourse to extrapolation techniques and miscellaneous sources for different Member States. The data provided by the Member State could differ in the underlying methodology and definition. This has hindered so far their publication as absolute values. Some distortions also possible as off-tax subsidies on freight transport are not captured.
	Extra EU Comparability:	▪ The indicator is directly comparable with only two non-EU countries.
	Frequency:	▪ The indicators are published on an annual basis. Current data series start from 2006.
	Timeliness:	▪ As for primary data, it is available with a two-year delay.
	Regularity:	▪ The indicators have been regularly released without interruption.
	Sustainability:	▪ Transmission of primary data by Member State has smoothly taken place for a long time.
	Completeness:	▪ Only marginal transport fuels on the EU market are not included (e.g. methane).
	Level of detail:	▪ The indicator is available for transport fuel taxes as a whole. A detailed breakdown of revenues by type of tax or mode of transport is not available because of constraints in energy balance sources.
	Range of available versions:	▪ None

Strengths	**Weaknesses**
▪ Fairly straightforward and not distorted by exogeneous sources of bias. ▪ Robust in given conditions of data availability ▪ Reliable and sustainable over time, long series available	▪ Possibly slightly outdated as a policy issue, unless data breakdown is provided on the carbon tax component. ▪ Recourse to extrapolations as a proxy for missing data inevitably reduces comparability. ▪ Would profit from breakdown between passenger, freight and public transportation and/or by mode of transport indicators and from data on parallel off-tax subsidies

Factsheet 6 – TRANSPORT FUEL TAXATION AS A SHARE OF TOTAL TAX REVENUES

Category: Energy Taxation Revenues

Source: DG TAXUD, Commission Reports[10]

The indicator aims at measuring the level transport fuel tax taxation revenue as a share of total fiscal receipts. It is calculated by DG TAXUD based on the Excise Duty Tables data and other unpublished sources. Depending on data availability, methods of estimation for transport fuel revenues might differ by country. The indicator is published in the DG TAXUD annual Taxation Trends report.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The topic is still certainly relevant, although possibly slightly less so than in the past as the focus of the policy debate has switched from road transport fuels as a source of revenue to its contribution to carbon taxation.
	Non-Ambiguity:	▪ Definitions of transport fuel are clear and do not lead to any particular ambiguity. Data can be overestimated in certain Member States as off-tax subsidies on freight transport are not captured. Cannot capture fuel tourism.
	Responsiveness:	▪ Fully responsive to policy action as transport fuel taxation is actively pursued in a number of Member State as a tool to modulate total taxation revenues.
	Comprehensiveness:	▪ Parallel data on off-tax subsidies granted to freight transportation would complement well the indicator.
Analytical soundness	Analytical Soundness:	▪ The indicator appears fairly straightforward in measuring the importance of fuel transport taxation on total taxation. It would benefit from more analytical data on private, public and freight transportation.
	Robustness in assumptions:	▪ Data in certain Member States likely to substantially change if revenues from fuel tourism were accounted separately.
	Robustness over time:	▪ Vintage data have not been recalculated for all Member States when estimation methods have changed at the Member State level.
	Transparency:	▪ The methodology for estimation has been extensively described and is published by the Commission in the Taxation Trend in Europe report, by making comparisons with ETD data it is possible to reconstruct how the indicator is calculated by country.
	Communicability:	▪ The indicator per se is very easy to communicate. Methodology and the underlying level of approximation may not be easy to grasp by an ordinary layman.
	Credibility:	▪ Data are collected by DG TAXUD, by using disaggregated tax data submitted to the EDT by Member State. The Commission warns that it

[10] European Commission DG TAXUD, Taxation Trends Report 2019 Edition. Data for the EU Member States, Iceland and Norway, Publications Office of the European Union, Luxembourg, 2019.

		does not guarantee for their reliability and compliance with SEEA principles.
	Independence:	▪ Data are transmitted by relevant Government sources without any further validation and statistical supervision.
Measurability	Geographical Coverage:	▪ Data available for all EU 27 Member States
	Intra EU Comparability:	▪ Available data reflect an uneven degree of recourse to extrapolation techniques and miscellaneous sources for different Member States. This has hindered their publication as absolute values so far. Some distortions also possible as off-tax subsidies on freight transport are not captured.
	Extra EU Comparability:	▪ The indicator is directly comparable with only two non-EU countries.
	Frequency:	▪ The indicators are published on an annual basis. Current data series start from 2008.
	Timeliness:	▪ As for primary data, it is available with a two-year delay.
	Regularity:	▪ The indicators have been regularly released without interruption.
	Sustainability:	▪ Transmission of primary data by Member State has smoothly taken place for a long time.
	Completeness:	▪ Only marginal transport fuels on the EU market are not included (e.g. methane).
	Level of detail:	▪ The indicator is available for transport fuel taxes as a whole. A detailed breakdown of revenues by type of tax or type of fuel is not published either because of missing data or because existing disaggregated data estimation method might largely vary by country.
	Range of available versions:	▪ None.

Strengths	**Weaknesses**
▪ Fairly straightforward and not distorted by exogeneous sources of bias. ▪ Robust in given conditions of data availability ▪ Reliable and sustainable over time, long series available	▪ Possibly slightly outdated as a policy issue, unless data breakdown is provided on the carbon tax component. ▪ Recourse to extrapolationsas a proxy for missing data inevitably reduces comparability. ▪ Would profit from breakdown between passenger, freight and public transportation and/or by mode of transport indicators and from data on parallel off-tax subsidies

Factsheet 7 – IMPLICIT TAX RATES

Category: Implicit / Effective Tax Rates

Source: EUROSTAT, Database;[11] TAXUD, Report.[12]

This factsheet describes the three economy-wide implicit tax rates indicators published by the European Commission. The indicator is defined as the ratio between total energy tax revenues and final energy consumption calculated for a calendar year; it is measured in EUR per TOE. DG TAXUD publishes the implicit tax rate in nominal and real terms (deflated with both the final demand and the GDP implicit deflator). Eurostat publishes the implicit tax rate in real terms (deflated with the GDP implicit deflator).

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator allows to quantify in aggregate terms the role of fiscal policy in shaping demand for energy.
	Non-Ambiguity:	▪ The nominal version of the indicator clearly provides the economy-wide level of energy tax burden. However, cross-country comparisons may be hindered by differences in the accounting treatment of quasi-fiscal charges (e.g. RES). Can actually differ from OECD ETR data because of the weight of RES
	Responsiveness:	▪ The indicator depends on energy intensity of an economy, the energy mix and industrial structure. The indicator does not have a clear reference benchmark and the ranking across countries is not particularly significant and can actually be misleading.
	Comprehensiveness:	▪ Would require complementary information on the energy intensity of an economy.
Analytical soundness	Analytical Soundness:	▪ The indicator is a very simple tool to measure the role of fiscal policy in shaping demand for energy. In the current format it is not possible to have any further analytical breakdown
	Robustness in assumptions:	▪ The real-term versions of the indicators were deflated via two different deflators; now aligned. Both the implicit rates and their time trends are ambiguous with respect to the deflator used, and there is no strong methodological indication on which deflator is the most appropriate. The indicator is not robust to the use of two different deflators over time
	Robustness over time:	▪ Backwards calculations are made in case of any changes in the data.
	Transparency:	▪ The methodology on which the indicator is based is fully transparent and has been published by Eurostat. Calculations can be easily replicated.
	Communicability:	▪ The way the indicator is built is reasonably easy to understand, although the distinction between the two deflators may not be easy to grasp for the layman.

[11] Eurostat, Implicit tax rate on energy (ten00120): https://ec.europa.eu/eurostat/cache/metadata/en/ten00120_esmsip2.htm.

[12] DG TAXUD, Taxation Trends Report 2019 Edition, European Commission Directorate-General for Taxation and Customs Union, Publications Office of the European Union, Luxembourg, 2019.

	Credibility:	▪ The indicator is published by reliable sources (DG TAXUD and Eurostat) and has been quoted in the literature.
	Independence:	▪ Data are processed as they are provided and classified by relevant Government sources in the NTL.
Measurability	Geographical Coverage:	▪ Data are available for the all Member States with series dating back from 1995.
	Intra EU Comparability:	▪ The procedure to identify energy taxes is the same for all the countries. However, internal EU comparability can mainly depend on differences in how RES are financed by the different Member States and other divergences in the underlying datasets.
	Extra EU Comparability:	▪ The indicator is calculated only for a few non-EU Member States (Iceland, Norway, Serbia and Turkey). External comparability is hindered by lack of comparable sources.
	Frequency:	▪ Data are released on a yearly frequency.
	Timeliness:	▪ Policy action can be captured on a t+2 years basis.
	Regularity:	▪ The indicator regularly published on an annual basis.
	Sustainability:	▪ The indicator is de facto enshrined in an EU Regulation.
	Completeness:	▪ Differently from the OECD ETR, the indicator covers all components of energy taxation including indirect production taxes and ETS revenues.
	Level of detail:	▪ Similar indicators on breakdown of implicit tax rates by sector or other typology of use are currently missing because there is no further correspondence in how data on taxation and energy consumption are classified to allow for a ratio to be built.
	Range of available versions:	▪ Multiple versions with different deflators are also available.
Strengths		**Weaknesses**
▪ Reasonably easy to understand, can be used to assess the total fiscal incentive provided to pursue energy efficiency ▪ Fairly straightforward and complete in what it aims to measure		▪ Suffers from inconsistencies on how energy taxes are classified in the NTL ▪ NTL classification hinders any further data breakdown below the whole economy ▪ Can be distorted by different energy mix and industrial structures

Factsheet 8 – EFFECTIVE TAX RATE (TAXING ENERGY USE)

Category: Implicit / Effective Tax Rates

Source: OECD, Database[13]

Effective tax rates on energy use translate statutory energy excises and carbon taxes into rates per GJ net of subsidies. These figures are calculated based on nominal rates and extrapolated by comparison with the underlying IEA energy consumption sources to ensure internal consistency of data; the OECD removes the carbon tax from industries where this is not compatible with the ETS at the national level.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Conceptual indicator to highlight tax burden consistency issues in the policy debate. The idea has been massively taken up by NGOs active in energy policy and climate change. Being based on a set of tax rates rather than overall actual revenues, the OECD ETR cannot capture total tax burden problems.
	Non-Ambiguity:	▪ All criteria used are clearly defined but does not consider ETS and RES, which underestimates ETR on electricity. Presupposes inertia in underlying demand and poorly suitable to follow energy shocks.
	Responsiveness:	▪ Directly responsive in the numerator, less so in the denominator. The indicator appears to have been conceived not to assess progress in redressing action ex post but to highlight consistency issues ex ante. Cannot structurally capture trends in ETS and other indirect production taxes. Average values differ from Commission ITR because taxes considered are different. Benchmarking is self-explaining and refers to the Country's own average values or to the average in a group of Countries.
	Comprehensiveness:	▪ ETR is generally exhaustive, and comprehensive.
Analytical soundness	Analytical Soundness:	▪ Analytical breakdown available on a number of sectors up to 2% of total energy consumption. Focuses on Government intervention on consumption taxes. Cannot capture other policy problems (e.g. evasion)
	Robustness in assumptions:	▪ Based on rates on given date cannot capture changes thereafter. The main robustness challenge is definitory and concerns lack of RES data that represent after all an indirect tax on carbon.
	Robustness over time:	▪ The approach has been refined over time but draws on one fundamental idea: the statutory tax rates at a given date are translated into rates per unit of energy or €/GJ. Vintage years were recalculated in

[13] OECD, Taxing Energy Use 2019: Using Taxes for Climate Action, OECD Publishing, Paris, 2019. OECD, Taxing Energy Use 2018: Companion to the Taxing Energy Use Database, OECD Publishing, Paris, 2018; OECD, Taxing Energy Use 2015: OECD and Selected Partner Economies, OECD Publishing, Paris, 2015; OECD, Taxing Energy Use 2013: A Graphical Analysis, OECD Publishing, Paris, 2013.

		2018 based on the new assumptions and categorisation.
	Transparency:	▪ The methodology is fully described and indicators are published in the OECD publications.
	Communicability:	▪ Reported in a graphic format and easy to understand also for the non-specialist reader.
	Credibility:	▪ The indicator comes from the OECD, which is reputable and the indicator is widely used and recognised among energy professionals.
	Independence:	▪ Indicators are based on public databases and fully replicable. Degree of independence from Government influence appears clearly from the transparent peer review.
Measurability	Geographical Coverage:	▪ Data are provided for 44 OECD countries and selected partner economies, including 23 EU Member States. Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 non-EU Member States (other OECD members and G-20 countries). Lack of consideration for non-deductible VAT surcharge may bias comparability at the more granular level
	Frequency:	▪ Data are published on a three years basis.
	Timeliness:	▪ OECD effective tax rates are based on fairly updated tax rate information, but then make comparison with IEA energy consumption data published with reference to two-three years before.
	Regularity:	▪ There are four editions (2013, 2015, 2018 and 2019) and availability of data seems to be fairly predictable.
	Sustainability:	▪ At the moment publication and updates have not been suspended. No guarantee they will continue either.
	Completeness:	▪ The ETR does not net off rebates and other off tax subsidies. Does not include charges, non-deductible VAT.
	Level of detail:	▪ The ETR is calculated at country level and for various sectors (some taxes are also set a subnational level). It is disaggregated by five main fuel groups and across six sectors.
	Range of available versions:	▪ None

Strengths	**Weaknesses**
▪ Highlights broad disparities in the structure of the energy tax system. ▪ Very easy to communicate	▪ Not particularly timely, incorporates quite delayed consumption data ▪ Does not allow to appreciate impact of certain energy taxation components

Factsheet 9 – COMBUSTION SURCHARGE

Category: Implicit / Effective Tax Rates

Source: OECD, Report (Taxing Energy Use)[14]

The indicator measures the extent to which countries tax combustibles (mainly fossil fuels) more than non-combustibles (e.g. wind and solar, hydro), by measuring the difference between their respective effective tax rates.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Provides an assessment of one of the possible incentives for switching from carbon-emitting to carbon-free forms of energy: the tax differential between the two forms. Negatively correlated with an economy's carbon intensity.
	Non-Ambiguity:	▪ The indicator is significantly driven by the (i) high taxation of transport fuels – even though non-carbon alternatives are less than complete in this sector; and (ii) electricity levy, with countries with little such a levy reporting high differentials even when the taxation of combustibles is lower.
	Responsiveness:	▪ Directly responsive to variations in the respective tax rates
	Comprehensiveness:	▪ Includes all types of fuels
Analytical soundness	Analytical Soundness:	▪ Lacks of RES coverage skews the indicator. Results from the differences of the ETR (factsheet #8 above), as calculated for combustible and non-combustible sources in each jurisdiction. As such, it is based on nominal tax rates and cannot capture off-tax subsidies or tax evasion.
	Robustness in assumptions:	▪ Based on simplified assumptions and shortcuts to calculate tax rates applied to the various fuels and uses. The main robustness challenge is definitory and concerns the non-inclusion of RES charges, which would impinge significantly upon non-combustible.
	Robustness over time:	▪ First appeared in the 2019 edition of TEU
	Transparency:	▪ All data made available in a modifiable format. Limited description of the methodology used.
	Communicability:	▪ Reported in a graphic format and easy to understand.
	Credibility:	▪ The indicator comes from the OECD, which is a reputable source.
	Independence:	▪ Indicators are based on public databases and fully replicable. Degree of independence from Government influence appears clearly from the transparent peer review.
Measurability	Geographical Coverage:	▪ Data are provided for 44 OECD countries and selected partner economies, including 23 EU Member States. Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.

[14] OECD, Taxing Energy Use 2019: Using Taxes for Climate Action, OECD Publishing, Paris, 2019.

	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 non-EU Member States (other OECD members and G-20 countries).
	Frequency:	▪ First publication
	Timeliness:	▪ OECD effective tax rates are based on updated tax rate information and IEA energy consumption data published with reference to two-three years before.
	Regularity:	▪ Expected to be replicated in next editions.
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ As the ETR, the indicator does not include some reimbursements administered as direct subsidies or via non-energy tax basis; RES charges, ETS.
	Level of detail:	▪ The indicator is calculated at country level; no differentiation per sector.
	Range of available versions:	▪ None
Strengths		**Weaknesses**
▪ Provides a measure of a tax differential which is an incentive to switch to non-carbon energy sources.		▪ Mostly depends on transport fuel rate and electricity levy. Lack of RES coverage 'skews' the indicator in favour of non-combustible. ▪ Being an application of the ETR rather than a 'new' indicator, methodological description is limited

Factsheet 10 – DIESEL DIFFERENTIAL

Category: Implicit / Effective Tax Rates

Source: OECD, Report (Taxing Energy Use)[15]

The indicator measures the difference between the effective tax rate of gasoline and diesel for transport use, for each country covered by the Taxing Energy Use report, as well as the time-trend of this indicator. In the last edition of TEU, it is measured as a EUR differential per litre.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The tax advantage (subsidy) of diesel vs. gasoline once controlling for energy and carbon content has been highly debated over the last years. Few tax reforms have been implemented to reduce this gap in EU Member States (e.g. Belgium, France, Slovenia). However, limited correlation between diesel differential and use, because of other factors (other regulatory, fiscal, and market drivers).
	Non-Ambiguity:	▪ Previous editions accounted for the different carbon and energy content (which resulted in higher tax differential) which presupposes an implicit equalisation that is far from agreed in the expert community; this is no longer accounted in the last edition.
	Responsiveness:	▪ As with subsidy indicators, increase in the rate of gasoline may worsen the indicator even though, as a whole, this results in an increase of the taxation of fossil fuels.
	Comprehensiveness:	▪ Coverage of energy taxes on road fuels is very comprehensive.
Analytical soundness	Analytical Soundness:	▪ Higher than overall ETR, since effective tax rates for transport fuels are easy to capture and calculate, present no issue with respect to e.g. RES charges and ETS. Off-tax subsidies remain out of the indicator. The indicator cannot take into account possible energy efficiency considerations (i.e. litre of fuels per km).
	Robustness in assumptions:	▪ Less assumptions or shortcuts needed compared to the overall ETR.
	Robustness over time:	▪ The indicator has been included since the 2012 version of the TEU. In 2012 and 2015, it was calculated as EUR/GJ; in 2018, as EUR/GJ and EUR/tCO2. In 2019, in EUR7/litre.
	Transparency:	▪ Data are made available in a modifiable format; the methodology can be reconstructed from the overall OECD ETR methodology.
	Communicability:	▪ Reported in a graphic format and easy to understand also for the non-specialist reader.

[15] OECD, Taxing Energy Use 2019: Using Taxes for Climate Action, OECD Publishing, Paris, 2019. OECD, Taxing Energy Use 2018: Companion to the Taxing Energy Use Database, OECD Publishing, Paris, 2018; OECD, Taxing Energy Use 2015: OECD and Selected Partner Economies, OECD Publishing, Paris, 2015; OECD, Taxing Energy Use 2013: A Graphical Analysis, OECD Publishing, Paris, 2013.

	Credibility:	▪ The indicator comes from the OECD, which is reputable source.
	Independence:	▪ Indicators are based on public databases and fully replicable. Degree of independence from Government influence appears clearly from the transparent peer review.
Measurability	Geographical Coverage:	▪ Data are provided for 44 OECD countries and selected partner economies, including 23 EU Member States. Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 non-EU Member States (other OECD members and G-20 countries).
	Frequency:	▪ Data were published on a three years basis; as of 2019, the publication became yearly.
	Timeliness:	▪ OECD effective tax rates are based on updated tax rate information and consumption data provided by IEA with reference to two-three years before.
	Regularity:	▪ There are four editions (2013, 2015, 2018 and 2019) and availability of data seems to be fairly predictable.
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ The ETR does not include some reimbursements administered as direct subsidies or via non-energy tax basis.
	Level of detail:	▪ The ETR is calculated at country level; no disaggregation between sectors.
	Range of available versions:	▪ None at the moment; in 2018, per GJ or per tCO_2.

Strengths	**Weaknesses**
▪ Easy-to-handle indicator to measure the differential treatment of gasoline and diesel in the various jurisdictions ▪ Robust and comprehensive methodology in place for a number of years	▪ It does not account for possible differences in energy efficiency between gasoline and fuel motors ▪ Limited correlation between tax differential and use of diesel in a jurisdiction

Factsheet 11 – SHARE OF TAXES ON GASOLINE AND DIESEL FUEL PRICES

Category: Implicit / Effective Tax Rates

Source: DG ENER (OIL WEEKLY BULLETIN), Report[16]

The database includes separate information on retail prices, with and without taxes, for the main transport fuels: gasoline, diesel, LPG, fuel oil. The main original objective of the dataset was to improve transparency of oil prices and strengthen the Internal Market. The Oil Price Bulletin dataset reports data in Euro/National currency per 1000L or per tonne; data are recorded by competent authorities for each Member State and transmitted weekly to the European Commission.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Provides info on the tax burden on transport fuels; addresses policy debate on whether energy taxation should smooth variability in underlying energy prices for energy efficiency and security purposes. Lack of consensus on whether the latter represents an externality.
	Non-Ambiguity:	▪ The way taxes on biofuels were accounted for could cause some ambiguity in understanding. This has been partly addressed by an indicator revision in 2011, but still hinders indicator usefulness for policymaking purposes.
	Responsiveness:	▪ Decisions to modify tax levels are immediately captured. It is not necessarily straightforward in signalling need for policy action to act as a countervailing measure for variability in low prices.
	Comprehensiveness:	▪ Needs to be complemented with data on price variations. Suffers from lack of complementary data on energy price inflation.
Analytical soundness	Analytical Soundness:	▪ The indicator was conceived for completely different purposes and was borrowed for energy taxation monitoring.
	Robustness in assumptions:	▪ The indicator is not particularly sensitive to how prices are defined and measured at the retail level, as these factors accounted in the past for variations in total price data level in the region of 2-3%.
	Robustness over time:	▪ There was a break in the series with the 2011 reform, but this is unlikely to have affected data substantially.
	Transparency:	▪ There is very comprehensive methodological information available inclusive of details on differences in how the underlying data are collected and processed in the different Member States to allow a full understanding of data comparability issues. As such the indicator is fully replicable starting from raw data.
	Communicability:	▪ Immediate to grasp and easy to describe Very easy to understand and communicate also to a non-specialist public.
	Credibility:	▪ The source is reputable and the indicator is widely used and recognised among energy professionals.
	Independence:	▪ Data are provided by energy companies and collected by government without any

[16] Information available on https://ec.europa.eu/energy/data-analysis/weekly-oil-bulletin_en.

		intermediate validation steps by either Statistical offices or Government authorities. This can give rise to concerns on biases and data significance when the sample is small.
Measurability	Geographical Coverage:	▪ All Member States are covered.
	Intra EU Comparability:	▪ There remain differences in how data are collected and weighted between Member States, but these differences are made public and fully transparent in metadata.
	Extra EU Comparability:	▪ A number of non-EU Countries calculate the same ratio, comparable data are published in the IEA OECD Oil Prices and Taxes datasets and are available at a cost.
	Frequency:	▪ Data are published on a weekly or fortnight basis.
	Timeliness:	▪ Policy action is immediately captured.
	Regularity:	▪ The underlying bulletin is regularly published on a weekly basis.
	Sustainability:	▪ The provision of the underlying data is enshrined in Commission Regulation.
	Completeness:	▪ Only mainstream fuels with an EU-wide trade dimension are covered. New products can be added upon Member States request when there is a significant EU market.
	Level of detail:	▪ Separate data are provided for VAT and other indirect taxes. No further breakdown available.
	Range of available versions:	▪ One version published little detail provided on market for biofuels when separate from other products.
Strengths		**Weaknesses**
▪ Extremely well known and easy to use: Can capture pass-through of taxes with reasonable approximation ▪ Very timely and reasonably responsive. Allows quick comparisons.		▪ Conceived for other purposes maintains some ambiguity for use for taxation policymaking purposes ▪ Level of data disaggregation unfit to capture purely national incentive policies and dynamics of different tax components.

Factsheet 12 – RES - EFFECTIVE TAX RATES

Category: Implicit / Effective Tax Rates

Source: CEER Status Review, Report[17]

CEER Status Review Reports collect comparable data on RES support in Europe by means of a survey to Member States relevant authorities. The indicator intends to measure the total RES support per unit of total electricity produced [€/MWh] and de facto is equivalent to an effective tax rate, if RES charges are understood as a burden on consumers.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator is one of the few pieces of information for monitoring RES charges across Europe, that are non-standardised and widely differ by country. RES policies can be considered within the framework of climate change policies and related effective tax rate can represent a benchmark for any implicit carbon price.
	Non-Ambiguity:	▪ It is not always clear what is being measured whether cash or accrual values and who bears related costs: the general budget or directly consumers.
	Responsiveness:	▪ It is one of the few indicators to monitor the cost of RES per unit of energy produced. As such it is not distorted by external factors. Ranking is significant.
	Comprehensiveness:	▪ It should be complemented with data on the sources of financing of RES costs and weight of RES on total electricity consumption.
Analytical soundness	Analytical Soundness:	▪ Fairly straightforward. It intends to measures the amount of incentives provided to renewables compared to their contribution to the electricity market.
	Robustness in assumptions:	▪ Indicator includes 'direct' incentives to RES, i.e. subsidies as well as 'indirect' cost such as. connection charges (e.g. BE) and usage/access network charges(e.g. IE); cost related to network congestion problems / compensation to RES operators (e.g. IT, DE); However, not all Member States report data and it is unclear whether data refer to the same issue: administration costs associated with RES support schemes are not comprised
	Robustness over time:	▪ There is little indication whether Member States change their data gathering methodology over time.
	Transparency:	▪ All data sources are published in the CEER Status Review publications. Data are collected through the questionnaire but methodology implemented by Member State to calculate incentives not provided. Lack of explanation on indicator's composition and methodology applied, makes it difficult to assess its reliability.

[17] CEER, Status Review of Renewable Support Schemes in Europe for 2016 and 2017, Council of European Energy Regulators asbl, Brussels, Ref: C18-SD-63-03, 14 December 2018. Previous reports (C10-SDE-19-04a, C12-SDE-33-03, C14-SDE-44-03 and C16-SDE-56-03).

	Communicability:	▪ Presumably easy to understand for an informed reader familiar with the RES concept.
	Credibility:	▪ The indicator comes from the Council of European Energy Regulators an official reputable institution, but relatively poorly known among the general public.
	Independence:	▪ Data are transmitted by national regulatory authorities for energy, through a questionnaire prepared by CEER. There is no explanation concerning validation of data and consistency over time.
Measurability	Geographical Coverage:	▪ Data are provided for 23 Member States out of 27. Among missing countries, there are BE, BG, SK and SI.
	Intra EU Comparability:	▪ Data are comparable among covered EU Member States. The indicator seems to be broadly compatible in terms of unit of measurement with Commission implicit tax rates.
	Extra EU Comparability:	▪ CEER information on RES are extended only to Norway and United Kingdom.
	Frequency:	▪ CEER reports as sources of data are published on a biennial basis with some more limited predictability.
	Timeliness:	▪ Time necessary to capture changes in support schemes adopted might require more than 2 years.
	Regularity:	▪ CEER Reports on RES support schemes are published with regularity.
	Sustainability:	▪ Presumably high, as the report has routinely been published for a long time.
	Completeness:	▪ Indicator covers all major renewable sources (solar energy, wind energy offshore and onshore etc.) and type of instruments (both quantity-based and price-based policy instruments) as well as indirect support.
	Level of detail:	▪ A suitable level of disaggregation is provided for each country, by scheme type and by technology but no breakdown of financing sources, even as a share of the total, is provided when Member States report both support from general taxation and recourse to dedicated levies (e.g. LU, DK).
	Range of available versions:	▪ None

Strengths	**Weaknesses**
▪ One of the few sources allowing a calculation of indicators based on RES costs with some reasonable degree of approximation.	▪ Lack of a fully described methodology largely affects the assessment of statistically-relevant issues and indicator reliability.

Factsheet 13 – NATURAL GAS AND ELECTRICITY PRICES

Category: Implicit / Effective Tax Rates

Source: Eurostat, Database[18]

The database includes data on electricity and natural gas prices and their components, including energy and supply, network costs, and taxes, fees, levies and charges. Taxes separately include VAT, RES charges, capacity taxes, environmental taxes, and nuclear taxes; there is no separate classification for excises. Data are provided for EU Member States and other European countries, and are expressed in currency unit/KWh or GJ; the currency unit can be expressed in EUR, PPS, or local currency. Data are provided separately for household and non-household consumers; each category is then subdivided in a number of consumption bands.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The dataset is the most important repository of electricity and natural gas price statistics in the EU and regularly used as an input to policymaking.
	Non-Ambiguity:	▪ Total prices, various components, and consumption band are precisely defined.
	Responsiveness:	▪ Data are provided over a number of policy-relevant and policy–actionable dimensions (e.g. with or without fiscal instruments; for type of consumers; detailing the incidence of various regulatory components), but total prices can be affected by exogenous factors (e.g. price of fossil fuels).
	Comprehensiveness:	▪ The databases are fully comprehensive.
Analytical soundness	Analytical Soundness:	▪ The data series explicitly measure prices and price components of electricity and natural gas.
	Robustness in assumptions:	▪ Apparent lack of consistency in how Member States classify energy taxes.
	Robustness over time:	▪ Due to a change in methodology from 2007 onwards, there is a break in series. From 2007 onwards data are consistent.
	Transparency:	▪ Not applicable to databases.
	Communicability:	▪ Easy to understand and communicate also to a non-specialist public.
	Credibility:	▪ Data are collected by Eurostat, by using a method that enables price comparisons between Member States.
	Independence:	▪ Data are transmitted to Eurostat by national authorises based on a questionnaire in the Excel file format. Eurostat assesses the quality of the transmitted data for consistency and completeness.
Measurability	Geographical Coverage:	▪ All EU Member States are covered although a few of them only in part; for certain components (e.g. taxes on non-household consumers).
	Intra EU Comparability:	▪ Comparability across Member States is full for price data; on components, including taxation, comparison is limited by the national statistical definition of specific taxes and fees or the lack of certain Member States for certain consumption bands.

[18] Energy statistics - natural gas and electricity prices (from 2007 onwards) (nrg_pc).

	Extra EU Comparability:	▪ Comparison of prices with other jurisdictions is limited to some 10 extra EU countries. Comparison of prices with other jurisdictions is possible relying on IEA data, though limited because of (i) the need to collect price information for similar consumption bands; (ii) significant differences in estimated prices.
	Frequency:	▪ Price data are biannual. Price component data are annual.
	Timeliness:	▪ Policy action is immediately captured.
	Regularity:	▪ Price data and price components data are regularly published on an annual basis.
	Sustainability:	▪ Sustainability of data provision is guaranteed by a binding act.
	Completeness:	▪ Prices data and price components data can be partially available for some countries due to limited market size, not applicability of specific bands, or confidentiality. Additionally, prices for household end-users are collected on a voluntary basis.
	Level of detail:	▪ Data are provided separate for household and non-household consumers; each category is then subdivided in a number of consumption bands. More detailed data could be provided with a breakdown by sector (i.e. NACE rev2).
	Range of available versions:	▪ Not applicable
Strengths		**Weaknesses**
▪ Extremely well known and easy to use. Data are provided over a number of policy-relevant (and policy–actionable) dimensions.		▪ Comparability of price components data is affected by how various Member States classify their own national component of the natural gas and electricity bills. This limits the usefulness of the database to investigate the incidence of regulatory and tax components on industrial energy prices.

Factsheet 14 – COMPOSITION AND DRIVERS OF ENERGY PRICES AND COSTS IN SELECTED ENERGY INTENSIVE INDUSTRIES[19]

Category: Implicit / Effective Tax Rates

Source: DG GROW, Report.

The report estimates, via a number of specific indicators, the prices of and costs of electricity and natural gas for a selection of energy intensive industries in the EU[20]. Prices reflect the charges included in the energy bills, while 'costs', that also include out-of-bill factors, such as subsidies or self-generation costs and revenues. Both prices and costs are differentiated by their components, including energy and supply, network costs, RES fees, and taxes.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Attempts to fill a number of data gaps in the area of energy costs and prices for the energy intensive industries, and their impacts on their competitiveness.
	Non-Ambiguity:	▪ Prices and costs of electricity and natural gas in the industries selected, as well as their energy intensity both in physical and financial terms are precisely defined.
	Responsiveness:	▪ Energy prices as such depend on both exogenous and policy endogenous factors. However, the identification of the regulatory components of the energy prices provide a guidance for policymakers on the outcomes of existing policies and the impacts of possible changes.
	Comprehensiveness:	▪ It should be stepped up by matching this approach with a sampling strategy and mandatory data collection carried out by statistical offices, so that the indicator could be statistically significant.
Analytical soundness	Analytical Soundness:	▪ It retrieves cost and price data directly from plants and adopts a narrow sectoral approach which can thus account for the variation in production processes and costs across sectors and sub-sectors.
	Robustness in assumptions:	▪ Being bottom-up, there are no significant assumptions incorporated into the methodology.
	Robustness over time:	▪ The methodology remained consistent, but the indicators are not fully replicable because of the variation in the sample of companies participating to the report.
	Transparency:	▪ The methodology is transparently and comprehensively described. The underlying data are not available, as costs and prices have been collected by companies and represent a commercially sensitive information.
	Communicability:	▪ Indicators are understandable to an informed reader.

[19] The title varies across the various editions.
[20] In the 2018 edition, the report covered (i) ceramics (bricks and roof tiles, wall and floor tiles); (ii) glass (tableware, packaging); (iii) aluminium (primary, secondary, downstream); (iv) steel; and (v) petrochemicals (nitrogen fertiliser, refineries). The coverage varies across the editions. Cf. CEPS and Ecofys (2018), Composition and Drivers of Energy Prices and Costs: Case Studies in Selected Energy Intensive Industries, Report for the European Commission, October 2018.

	Credibility:	▪ Data are collected by independent consultants through surveys based on digital questionnaires. Data are validated based on energy bills for a large share of the sample.
	Independence:	▪ Detailed data are provided by companies operating those plants, which implies that a randomised sampling could not be performed. Hence, participation to the Study by energy intensive companies is largely voluntary.
Measurability	Geographical Coverage:	▪ Available for the EU, and three EU regions (Central-eastern, North-Western, Southern). Data are also presented for selected Member States.
	Intra EU Comparability:	▪ Data are comparable across EU regions; interesting insights emerge from the comparison of national data, but with a limited comparability because of the differences in e.g. sampling, sector coverage, type of plant, energy consumption.
	Extra EU Comparability:	▪ As for external comparability, there is lack of international data for most sectors.
	Frequency:	▪ Data are published on a biannual basis, from 2014 onwards with some more limited predictability.
	Timeliness:	▪ Policy action is immediately captured (time lag of one year).
	Regularity:	▪ Reports released with a regular schedule so far.
	Sustainability:	▪ Sustainability depends on the Commission interests in replicating the report.
	Completeness:	▪ The indicators estimate prices and costs of electricity and natural gas focusing only on energy-intensive plants. Within these, indicators mostly include all the items necessary.
	Level of detail:	▪ Disaggregated data are provided at plant level to overcome the data gaps, but geographically data are not enough disaggregated to build country-level indicators.
	Range of available versions:	▪ A differentiation has been introduced between 'prices' as paid in the energy bills, and costs, that also include out-of-bill factors, such as subsidies or self-generation costs and revenues.

Strengths	**Weaknesses**
▪ Only wide-scale attempt at measuring energy costs and prices in energy-intensive industries starting from what industry actually pays, rather than available top-down statistics. ▪ It shows that the real driver of energy costs in these industries, including of the level of fees and taxes, is not the specific industry, but the band of consumption.	▪ It cannot be ascertained to what extent the estimates are representative of the whole sector. The same applies to national data, only some of which can be considered representative of the whole country situation, and are not fully comparable across countries.

Factsheet 15 – ENERGY PRICES, COSTS, AND SUBSIDIES[21]

Category: Implicit / Effective Tax Rates

Source: DG ENER, Report

The report's objective is to collect and analyse existing data on energy prices, costs, and subsidies in the EU and in comparison with other jurisdictions based on existing public and private databases (top-down approach) over a number of dimensions: (i) wholesale and retail prices of energy products; (ii) effects of energy costs on production costs and thus competitiveness of EU industries; and (iii) gas and electricity price and price regulation; (iv) energy subsidies. The analysis incudes the role of energy taxes in determining prices and costs, as well a detailed analysis of fiscal subsidies in the EU.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Helps to define the dimension of the policy issue at stake, that is the price and cost of energy in the EU.
	Non-Ambiguity:	▪ Most of indicators are fully defined, but energy subsides remains not properly robust to the definition of the benchmark, so that different methodologies result in vastly different estimates. Drivers of industry energy costs are not identifiable.
	Responsiveness:	▪ Some of the indicators are policy-actionable, i.e. correspond to outcomes of EU or national policies, such as subsidies and regulated prices, while other concern exogenous factors (e.g. energy prices).
	Comprehensiveness:	▪ Very comprehensive repository of existing and new data and information on energy prices, costs and subsidies in the EU and, to the extent possible, other G20 countries.
Analytical soundness	Analytical Soundness:	▪ Rigorous attempt to collect, collate, and analyse existing top-down information on energy prices, costs, and subsidies in Europe, including whenever possible a comparison with third countries.
	Robustness in assumptions:	▪ Depending on that of the underlying sources. Number of assumptions adopted are limited due to availability of public data (estimate of energy expenditures and consumption in various industries). Data gaps have been filled based on average values or existing national data.
	Robustness over time:	▪ The methodology remained consistent.
	Transparency:	▪ The methodology is fully described. Data gaps and limitations are very transparently underlined. Underlying data are either available on the public domain, or can be retrieved or purchased from commercial data providers. The list of national subsidies and their magnitude is not published.
	Communicability:	▪ Indicators are understandable to an informed reader.
	Credibility:	▪ Data are collected by independent consultants from highly credible public sources.

[21] Latest edition is Trinomics, Study on energy prices, costs and subsidies and their impact on industry and households, Final Report, for the DG ENER, European Commission, published in 2018; the title varies across the various editions.

		Information on subsidies and national regulation collected from public sources and local antennas.
	Independence:	▪ Data come from reviewed previous iterations, existing public databases (e.g. Eurostat, IEA, OECD, etc.) and private and commercial databases, working with the EC.
Measurability	Geographical Coverage:	▪ Data are provided for the EU and each Member State.
	Intra EU Comparability:	▪ Comparability across Member States depends on the underlying data source. Availability and comparability of data is relatively high for product prices, not so much for industrial price data.
	Extra EU Comparability:	▪ External comparability is ensured for other G20 countries, other than EU Member States for which data is available.
	Frequency:	▪ Reports are published on a biannual basis, from 2014 onwards with some limited predictability.
	Timeliness:	▪ Policy action is captured with a time lag of one to two years, depending on the indicator.
	Regularity:	▪ Report released regularly so far.
	Sustainability:	▪ Sustainability depends on the Commission interests in replicating the report.
	Completeness:	▪ Sectoral data present gaps: energy costs do not cover self-generated energy and feedstocks; energy price at sectoral level are rarely available; and sectoral energy consumption (3- or 4-digit NACE level) is available for few Member States. Subsidies coverage is extended, though sub-national interventions, investment of development banks, and the diesel-gasoline gap have not been covered. It covers any form of energy, including RES.
	Level of detail:	▪ Data define energy-intensive industries at a very granular level, and that is up to 3- or 4-digit NACE level. The amount of subsidies received by energy-intensive industries (at NACE-2 level) and taxes paid is available for 9 Member States and the UK.
	Range of available versions:	▪ Not applicable

Strengths	**Weaknesses**
▪ Comprehensive report collating the most relevant public sources on energy prices and costs in the EU, with a top-down approach. It successfully deepens analysis of energy subsidies, while it cannot to a full extent as for energy costs in energy intensive industries.	▪ Due to the data gaps, and the problems in using NACE-based company lists to define energy intensive industries, most of the changes in energy costs in those industries over the last years cannot be explained by identifiable reasons. ▪ The choice to rely on national benchmarks for energy subsides indicators strongly impacts on cross-country comparability of data.

Factsheet 16 – ENERGY PRICES AND TAXES FOR OECD COUNTRIES

Category: Implicit / Effective Tax Rates

Source: IEA, Database[22]

The database includes annual and quarterly energy price for end users (industry and consumers) as well as annual, quarterly and monthly crude oil spot prices, oil product spot prices, and import costs for 36 OECD countries and regional aggregates. The end user prices cover the main oil products, gas, coal and electricity.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The dataset is an important repository to monitor energy unit prices and taxes effectively paid by consumers over a period of time in a given country.
	Non-Ambiguity:	▪ Total energy prices and taxes and indices are precisely defined.
	Responsiveness:	▪ Policies to modify tax levels are immediately captured.
	Comprehensiveness:	▪ The databases are very comprehensive, including information on monthly reports on oil prices data, quarterly databases on prices and taxes, and annual global energy prices. No information on quasi- or non-fiscal measures (e.g. RES charges).
Analytical soundness	Analytical Soundness:	▪ The data series explicitly measure end-user prices and taxes in national and international energy markets. Tax classification is at a variance from energy taxation categories and includes classification for nominal purpose and earmarking of funds
	Robustness in assumptions:	▪ Categories are different from those in use in other tax repositories and refer to stated intentions and benchmarks.
	Robustness over time:	▪ Data collection on taxation has just started.
	Transparency:	▪ The methodology on which the included indices is based is fully transparent and has been published by IEA.
	Communicability:	▪ Easy to understand and communicate also to a non-specialist public.
	Credibility:	▪ Data are collected and compiled by the IEA Energy Data Centre (EDC) from relevant official agencies in each country, or from trusted secondary sources.
	Independence:	▪ Data are transmitted by national energy ministries, central banks, other ministries and national statistics agencies; secondary sources, which might include Eurostat, the Commission, and country-specific sources.
Measurability	Geographical Coverage:	▪ EU-OECD Member States are covered together with other OECD members (36 countries in total). Non-OECD EU countries (BG, CY, HR, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 14 non-EU Member States.

[22] IEA, Energy Prices and Taxes for OECD Countries, International Energy Agency Statistics. Most recent version 1st Quarter 2020.

	Frequency:	▪ Data are updated four times per year.
	Timeliness:	▪ Data are provided with one quarter or two-month delay.
	Regularity:	▪ Current data series start from 1978, data are collected each quarter and regularly published. Time series availability might vary with each data series. Data on taxes available since 2020
	Sustainability:	▪ Sustainability of data provision is guaranteed.
	Completeness:	▪ The database includes annual and quarterly end user industry and consumer prices as well as annual, quarterly and monthly crude oil spot prices, oil product spot prices and import costs by crude stream. The end user prices cover the main oil products, gas, coal and electricity.
	Level of detail:	▪ Data are provided by products, covering the main petroleum products, gas, coal and electricity; sector or type of use; end-use prices are disaggregated into ex-tax prices and total tax. The latter is further disaggregated into excise taxes and VAT.
	Range of available versions:	▪ Not applicable

Strengths	**Weaknesses**
▪ Comprehensive repository, collating the most relevant public sources on energy prices and taxes. ▪ Easy to use: can capture energy taxes with reasonable approximation.	▪ Limited to OECD countries, reducing the comparability in Europe and worldwide.

Factsheet 17 – EFFECTIVE CARBON PRICE

Category: Carbon Pricing

Source: International Monetary Fund, Report (database expected)[23]

The IMF's Effective Carbon Price' (ECP) aims at helping countries in evaluating their progress towards meeting their mitigation pledges undertaken in the framework of the Paris Agreement. The measurement of the ECP accounts for the effectiveness[24] of different policy instruments, and weighting them for their emission coverage.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Addresses a major policy debate on taxation of carbon from a holistic perspective, assessing how various countries are using or should use carbon prices to meet their Paris pledge agreements. ▪ Being model based, policymaking use may be more complex; additional complexity and differentiation may be required in a global context, but of limited relevance within the EU.
	Non-Ambiguity:	▪ All criteria used are clearly defined and the indicator allows determining the distance between the carbon price that a country should introduce to meet its pledges and its current carbon price.
	Responsiveness:	▪ By acting on carbon taxes or the ETS price, the indicator will be affected.
	Comprehensiveness:	▪ It is one of the two comprehensive carbon price indicators as it results from the combination of carbon taxation (including energy taxes with a non-carbon tax base and assuming that the full cost of energy taxes covers for the carbon emission externality), and ETS
Analytical soundness	Analytical Soundness:	▪ The indicator captures the purpose for which was conceived.
	Robustness in assumptions:	▪ The ECP and its impacts are calculated based on an economic model. The structure of the model and its assumptions– e.g. elasticities – are retrieved from the relevant literature, and transparently reported and discussed in the text.
	Robustness over time:	▪ Various publications, but unclear whether they use the same dataset
	Transparency:	▪ The data collected and the model used are transparently reported in the text, thus allowing replicability. The accompanying spreadsheet, where the various data would be made available in an editable format is not in the public domain yet.
	Communicability:	▪ While the overall message of the indicator is understandable to the layman, the way the indicator has been built can be understood by a specialist reader.

[23] IMF Working Paper WP/18/193, Mitigation Policies for the Paris Agreement: An Assessment for G20 Countries by Ian Parry, Victor Mylonas, and Nate Vernon; IMF Policy Paper, Fiscal Policies for Paris Climate Strategies— From Principle to Practice; International Monetary Fund, 2019, OCT Fiscal Monitor, How to Mitigate Climate Change.

[24] Effectiveness is defined as the amount of emission reduction achievement by an equivalent level of other policies whose carbon price can be implicitly or explicitly calculated.

	Credibility:	▪ The indicator comes from the IMF, which is a reputable source.
	Independence:	▪ Indicator is based on World Economic Outlook database and compiled by the IMF staff.
Measurability	Geographical Coverage:	▪ Data are provided for the 135 global jurisdictions, including all EU Member States except for Estonia.
	Intra EU Comparability:	▪ Data are comparable among covered countries. However, since the approach measures the distance between current policies and national commitments, countries with a higher climate ambition may appear to perform worse.
	Extra EU Comparability:	▪ Data are comparable and available for 109 non-EU countries.
	Frequency:	▪ The indicator does not have a real frequency and can use data referred to slightly different time periods.
	Timeliness:	▪ This issue is of more limited relevance for the IMF estimates, which are model-based forward-looking
	Regularity:	▪ Two publications over the last two years
	Sustainability:	▪ Too early to assess
	Completeness:	▪ The indicator is complete, as it captures the three main market-based instruments for carbon pricing
	Level of detail:	▪ ECP is less detailed in terms of fuel tax and permit data then the OECD ECR, but it weights the various policies by their effectiveness in reducing carbon emissions, depending on the share.
	Range of available versions:	▪ No alternative version available, but the spreadsheet, when published, will allow for tailoring calculations and the indicators

Strengths	**Weaknesses**
▪ The measurement of the ECP accounts for the effectiveness of different policy instruments, and weighing them for their emission coverage. ▪ It helps countries in evaluating their progress towards meeting the mitigation pledges undertaken in the framework of the Paris Agreement.	▪ The indicator requires to aggregate values across instruments, fuels or sectors, and it can thus be affected by methodological choices; this can be fully appreciated once the spreadsheet is made available.

Factsheet 18 – EFFECTIVE CARBON RATE

Category: Carbon Pricing

Source: OECD, Report[25]

The Effective Carbon Rate (ECR) is the total price that applies to CO_2 emissions from energy uses as a result of three market-based policy instruments: energy taxes, carbon taxes, and carbon emission permits; VAT is excluded. The ECR is expressed in EUR/tonCO_2. The indicator is calculated for OECD-members and across six sectors. It was last published in the 2015 edition of the Effective Carbon Rate report, but it is no longer disclosed as such in the latest edition.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Price of carbon is extensively relevant and the indicator answers to policy issues largely debated - how much is carbon taxed?
	Non-Ambiguity:	▪ All criteria used are clearly defined and allow to considering the most important forms of explicit and implicit carbon pricing in the economy: energy taxes, carbon taxes, and ETS. EUA are, however, accounted at their average auction prices regardless of free allowances.
	Responsiveness:	▪ The ECR results from three market-based policy instruments: energy taxes, carbon taxes, and carbon emission permits: policies affecting taxes or the ETS setting / price would be reflected in the indicator.
	Comprehensiveness:	▪ It is among the most comprehensive carbon price indicators as it includes all relevant market-based instruments. Though, the indicator is not adjusted for subsidies other than those reflected in energy tax policies.
Analytical soundness	Analytical Soundness:	▪ The ECR measures the average carbon rate on carbon imposed in a jurisdiction; being an average, it is affected by very high values (e.g. the typically very high taxation of transport fuels).
	Robustness in assumptions:	▪ Assumptions on how tax and permit burdens were allocated across the various industries are clearly described in the first edition; country notes allow verifying how national data have been processed in fine details.
	Robustness over time:	▪ The methodology remained consistent over the various editions.
	Transparency:	▪ The methodology is transparently described. however, the ECR is no longer published as of the last edition.
	Communicability:	▪ The ECR directly communicates the carbon pricing as resulting from the combined impacts of various fiscal and non-fiscal policies
	Credibility:	▪ The indicator comes from the OECD, which is reputable and the indicator is widely used and recognised among energy professionals.

[25] OECD (2016), Effective Carbon Rates: Pricing CO_2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, and OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris.

	Independence:	▪ The indicator is based on public databases and fully replicable. Primary data are collected by or from international independent organisations (e.g. OECD, IEA, etc.) and national governments. Data on the emission coverage of the emission trading systems is collected from government authorities.
Measurability	Geographical Coverage:	▪ Data are provided for only EU 21 Member States (i.e. OECD countries). Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Cross-country comparability is possible, but its interpretation is affected by differences in national carbon policies.
	Extra EU Comparability:	▪ Data are comparable and available for 19 extra EU Member States (other OECD members and G-20 countries). External comparability may be hindered by lack of non-deductible VAT.
	Frequency:	▪ The indicator is no longer published as such
	Timeliness:	▪ The indicator makes use of emission and tax data which can be as old as three years.
	Regularity:	▪ There are two editions of this publication (2016 and 2018) and data refer to respectively 2012 and 2015.
	Sustainability:	▪ At the moment publication and updates have not been suspended, but the ECR is no longer published as such
	Completeness:	▪ The indicator includes all major relevant items across six economic sectors, but rebates administered as direct subsidies or via non-energy tax basis are often missing from most of indicators.
	Level of detail:	▪ Separate data are provided by typology of products, across six economic sectors: road transport, off-road transport, agriculture and fisheries, residential and commercial energy use, industry, and electricity generation.
	Range of available	▪ The indicator is presented in two versions: one where biofuels are treated as carbon neutral and another where they are not.

Strengths	**Weaknesses**
▪ ECR allows to jointly consider any form of carbon pricing in the economy, avoiding skewed or partial analyses. It is in line with the international best practice.	▪ As it is published every three years and with a 3-years delay for some data, the time lag is currently too large. In addition, calculating implicit and explicit tax rates can be difficult, due to the problems in capturing the various direct and indirect subsidies. ▪ The use of the same weight for both explicit and implicit carbon tools is questioned, as carbon rates do not capture similar impact on carbon emission reductions

Factsheet 19 – SHARE OF EMISSIONS PRICED AT A GIVEN LEVEL

Category: Carbon Pricing

Source: OECD, Report[26]

The OECD calculates the share of carbon emissions priced above certain price level: EUR 0, 5, 30, and 60, the latter two values being the midpoint estimate to the carbon cost in 2020 and 2030 which would be consistent with the blueprint of the Paris Agreement. Data are provided for six economic sectors and for 42 OECD member and partner countries.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator measures the extent to which national policies price carbon at all (>0 EUR), with a non-negligible price (>5 EUR) or above literature-based carbon costs estimates. As such, it contributes answering a very relevant policy question: to what extent are fiscal and other policies (correctly) pricing carbon?
	Non-Ambiguity:	▪ All criteria used are clearly defined and allow to considering the most important forms of explicit and implicit carbon pricing in the economy: energy taxes, carbon taxes, and ETS. Also, there is no discussion on whether thresholds should be adjusted for PPS or for national commitments under the Paris agreement.
	Responsiveness:	▪ The calculation of the share results from three market-based policy instruments: energy taxes, carbon taxes, and carbon emission permits: policies affecting taxes or the ETS setting / price would be reflected in the indicator, only when the thresholds are crossed (i.e. a policy raising the price of carbon for certain emissions from 6 to 29 EUR/tonne CO_2 would not affect the indicator)
	Comprehensiveness:	▪ It is among the most comprehensive carbon price indicators as it includes all relevant market-based instruments. Though, the indicator is not adjusted for subsidies other than those reflected in energy tax policies.
Analytical soundness	Analytical Soundness:	▪ The indicator directly measures the extent to which countries impose a price on carbon above meaningful thresholds.
	Robustness in assumptions:	▪ Assumptions on how tax and permit burdens were allocated across the various industries are clearly described in the 2016 edition; country notes allow verifying how national data have been processed in fine details. ▪ The value of the indicator may be affected by exogenous non-climate factors (e.g., variations in the exchange rate against the EUR), which may distort its findings.
	Robustness over time:	▪ The methodology remained consistent over the various editions.
	Transparency:	▪ The methodology is transparently described.

[26] OECD (2016), Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, and OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris.

	Communicability:	▪ The indicator is easy to understand and communicate.
	Credibility:	▪ The indicator comes from the OECD, which is reputable and the indicator is widely used and recognised among energy professionals.
	Independence:	▪ The indicator is based on public databases and fully replicable. Primary data are collected by or from international independent organisations (e.g. OECD, IEA, etc.) and national governments. Data on the emission coverage of the emission trading systems is collected from government authorities.
Measurability	Geographical Coverage:	▪ Data are provided for only EU 21 Member States (i.e. OECD countries). Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 extra EU Member States (other OECD members and G-20 countries). External comparability may be hindered by lack of non-deductible VAT.
	Frequency:	▪ Data are published every three years.
	Timeliness:	▪ The indicator makes use of emission and tax data which can be as old as three years.
	Regularity:	▪ There are two editions of this publication (2016 and 2018) and data refer to respectively 2012 and 2015.
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ The indicator includes all major relevant items across six economic sectors, but rebates administered as direct subsidies or via non-energy tax basis are often missing from most of indicators.
	Level of detail:	▪ Separate data are provided by typology of products, across six economic sectors: road transport, off-road transport, agriculture and fisheries, residential and commercial energy use, industry, and electricity generation.
	Range of available versions:	▪ The indicator is presented in two versions: one where biofuels are treated as carbon neutral and another where they are not.

Strengths	**Weaknesses**
▪ This indicator allows to jointly consider any form of carbon pricing in the economy, avoiding skewed or partial analyses. It is in line with the international best practice. ▪ The indicator can be easily understood and communicated. The thresholds are selected to show whether carbon emissions are priced at all, non-marginally, or above levels considered necessary to achieve the objectives of the Paris Agreement. Therefore, the indicator can be used to assess various commitment levels.	▪ As is published every three years and with a 3-year delay for some data, the time lag is currently too large. In addition, calculating implicit and explicit tax rates can be difficult, due to the problems in capturing the various direct and indirect subsidies. ▪ Some of possibly large policy interventions on carbon price are not reflected in the indicator, unless the thresholds are crossed.

Factsheet 20 – CARBON PRICING GAP

Category: Carbon Pricing

Source: OECD, Report[27]

The Carbon Pricing Gap (CPG) is a summary measure of the difference between a country carbon pricing policy and two external benchmarks, EUR 30 and 60 per tonne of CO2; it measures the extent to which national policies price carbon below a certain benchmark, by summing up the difference between the current carbon rate per percentile and emissions, and the benchmark It is measured both at country and sectoral level.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The indicator measures the extent to which national policies price carbon below a certain benchmark, by summing up the difference between the current carbon rate per percentile and emissions, and the benchmark. Thereby, it answers a very relevant policy question: to what extent are fiscal and other policies correctly pricing carbon?
	Non-Ambiguity:	▪ All criteria used are clearly defined and allow to considering the most important forms of explicit and implicit carbon pricing in the economy: energy taxes, carbon taxes, and ETS.
	Responsiveness:	▪ Any policy affecting the level of energy / carbon tax or the ETS price / setting would be reflected in the CPG
	Comprehensiveness:	▪ It is among the most comprehensive carbon price indicators as it includes all relevant market-based instruments. Though, the indicator is not adjusted for subsidies other than those reflected in energy tax policies.
Analytical soundness	Analytical Soundness:	▪ The CPG relies on two external carbon price benchmarks (30 and 60 EUR/tonne of CO_2), corresponding to the estimates of carbon costs. The benchmark is based on literature estimates.
	Robustness in assumptions:	▪ Assumptions on how tax and permit burdens were allocated across the various industries are clearly described in the 2016 edition; country notes allow verifying how national data have been processed in fine details.
	Robustness over time:	▪ The methodology for CGP remained consistent over time, but detailed country estimates are published only in the last edition
	Transparency:	▪ The methodology is transparently described and the CGP is presented per each country and each sector.
	Communicability:	▪ The CPG is a technical indicator very responsive, but not immediately understandable to the layman
	Credibility:	▪ The indicator comes from the OECD, which is reputable and the indicator is widely used and recognised among energy professionals.

[27] OECD (2016), Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, and OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris.

	Independence:	▪ Indicators are based on public databases and fully replicable. Primary data are collected by or from international independent organisations (e.g. OECD, IEA, etc.) and national governments. Data on the emission coverage of the emission trading systems is collected from government authorities.
Measurability	Geographical Coverage:	▪ Data are provided for 21 EU Member States (i.e. OECD countries). Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable among covered countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 extra EU Member States (other OECD members and G-20 countries). External comparability may be hindered by lack of non-deductible VAT.
	Frequency:	▪ Data are published every three years.
	Timeliness:	▪ The indicator makes use of emission and tax data which can be as old as three years.
	Regularity:	▪ There are two editions of this publication (2016 and 2018) and data refer to respectively 2012 and 2015.
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ The indicators include all major items across six economic sectors, but rebates administered as direct subsidies or via non-energy tax basis are often missing from most of indicators.
	Level of detail:	▪ CPG is provided per each country, and across six economic sectors: road transport, off-road transport, agriculture and fisheries, residential and commercial energy use, industry, and electricity generation. The indicator is not reported for each sector within a country.
	Range of available versions:	▪ The indicator is presented in two versions: one where biofuels are treated as carbon neutral and another where they are not. ▪ The CGP is presented against a EUR 30 or 60 benchmarks.
Strengths		**Weaknesses**
▪ CGP is considered more policy relevant, since its directly answer the question: to what extent are fiscal and other policies correctly pricing carbon; and thus to monitor efforts towards fighting climate change.		▪ As it is published every three years and with a 3-years delay for some data, the time lag is currently too large. In addition, calculating implicit and explicit tax rates can be difficult, due to the problems in capturing the various direct and indirect subsidies. ▪ The indicator results from the integration of the difference between price level of emission percentiles and the benchmarks, and therefore cannot be easily understood by the layman.

Factsheet 21 – CARBON PRICING DASHBOARD

Category: Carbon Pricing

Source: World Bank, Database[28]

The database does not include carbon pricing indicator as such, but consists in a repository of explicit carbon pricing initiatives undertaken at global level which could be used to populate carbon pricing indicators. These include carbon taxes and emission trading systems, for which data on the tax rates and price levels are provided. The accompanying report also encompasses other explicit carbon pricing mechanisms, such as offset mechanisms, and results-based climate finance; it then considers, in a non-comprehensive way, company's internal carbon pricing policies, and implicit carbon pricing, such as energy or fuel taxation and the removal of fuel subsidies.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Represents an important source of up-to-date and internationally comparable data that need to be fed into any indicator, or policymaking process, concerned with carbon pricing; focusing on explicit carbon policies, its policy relevance for the definition and management of energy taxation policies is more limited than other sources; but.
	Non-Ambiguity:	▪ Data on carbon taxes and ETS are presented clearly for all global jurisdictions implementing those tools.
	Responsiveness:	▪ The dataset consists in a repository of explicit carbon pricing initiatives undertaken at global level. Past and schedule changes are immediately reflected in the repository.
	Comprehensiveness:	▪ The repository could be complemented by other forms of implicit carbon pricing, in particular, fuel and energy taxes.
Analytical soundness	Analytical Soundness:	▪ The inventory captures the purpose for which was conceived including nominal carbon tax rate and basis, and permit price value and emissions covered, and government revenues from public sources. Limited information on overlap between ETS and carbon taxes.
	Robustness in assumptions:	▪ Not applicable to database.
	Robustness over time:	▪ The accompanying analysis focused first on carbon markets, and then expanded more broadly to carbon pricing, including carbon taxes.
	Transparency:	▪ Not applicable to database.
	Communicability:	▪ The database is extensively described and easy to is understand.
	Credibility:	▪ Data are collected by the World Bank, which is a reputable source.
	Independence:	▪ The database is led by the World Bank, with the support of Navigant and with contributions from the International Carbon Action Partnership and experts in the climate and carbon finance community.
Measurability	Geographical Coverage:	▪ The database covers 46 national jurisdictions and 28 subnational jurisdictions, including all EU Member States.

[28] Available on https://carbonpricingdashboard.worldbank.org/.

	Intra EU Comparability:	▪ Carbon prices are expressed as €/tonneCO2 and data are comparable across countries. The whole EU is covered because of the ETS, as well as Member States having introduced a carbon tax.
	Extra EU Comparability:	▪ Data are comparable and available for other 19 non-EU countries
	Frequency:	▪ Data available from 1990 onwards on annual basis.
	Timeliness:	▪ Policy changes are immediately captured (0- to 1-year time lag).
	Regularity:	▪ State and Trends of Carbon Pricing is a report series annually published by the World Bank since 2004. Since 2017, the Carbon Pricing Dashboard is also available.
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ The repository includes carbon taxes and ETS. The accompanying report also discusses other explicit carbon pricing mechanisms (offset mechanisms, results-based climate finance) and implicit carbon pricing (e.g. energy or fuel taxation and the removal of fuel subsidies).
	Level of detail:	▪ Data are provided for 57 explicit carbon pricing initiatives, which have been implemented, or are scheduled for implementation, as of 2019: 28 trading systems, and 29 carbon taxes. Most relevant aspects of those measures (e.g. rates, coverage, revenues) are included in the database.
	Range of available versions:	▪ Not applicable to database.

Strengths	**Weaknesses**
▪ Its information is updated very quickly, with a 0 to 1-year time lag, and allows for a wide comparison of all national initiatives.	▪ Focusing only on carbon taxes and ETS, its policy relevance is more limited than other sources on carbon pricing.

Factsheet 22 – CORRECTIVE TAX RATES ON FUELS

Category: Corrective Tax Rates

Source: International Monetary Fund, Database[29]

The indicator provides country-specific corrective tax rate estimates by fuel, expressed ad US$ per GJ or US$ per litre. It covers mainstream fuels such as coal, natural gas, gasoline, diesel in a large number of countries, including all EU Member States. Corrective tax rates represent a benchmark to assess the degree to which actual energy taxation would compensate for externalities (climate change, local air pollution, congestion, accidents, ad road damage) and to highlight the need for policy action. The IMF considers the difference between actual and corrective tax rates as a fuel subsidy[30]. An Excel sheet is made available for indicator calculation and parameters can be modified.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Addresses a major policy debate on whether taxation fully reflects the different social costs of fuels, also with specific reference to the different fiscal treatment of diesel and gasoline.
	Non-Ambiguity:	▪ All criteria used are extensively defined. The externalities included do not necessarily lend themselves to be corrected by means of fuel taxation and no cross-check has been made that these have not already been partly addressed through other taxes.
	Responsiveness:	▪ Pigouvian indicators measure whether tax rates capture the social costs of externalities. Those considered in building the indicator would be differently responsive to policy action. They are mainly useful as tools to highlight a need for policy intervention rather than for instrumental purposes.
	Comprehensiveness:	▪ Corrective tax rates are intended to be self-explanatory tools to highlight the need for intervention. They would benefit from parallel assessment of the degree to which externalities have been internalised in certain areas (e.g. by taxes which do not have a direct impact on the retail price)
Analytical soundness	Analytical Soundness:	▪ The indicator captures the rationale behind Pigouvian taxation but cannot solve the related attribution problem when different taxes cover the same externality
	Robustness in assumptions:	▪ The cost component related to avoided mortality is crucially sensitive to changes in assumptions about the value of life. Changes in the underlying assumptions can radically modify the policy message of the indicator.
	Robustness over time:	▪ As there can be several sets of methodological assumptions behind these indicators, differences may arise with similar exercises carried out in the past in some Member States. Estimates keep changing as the methodology refines, although

[29] See the most recent publication Coady, D., Parry, I., Le, N., and Shang, B., Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates, *IMF*, Washington, 2019. First publication: Parry, I., et al., Getting Energy Prices Right: From Principle to Practice, *IMF*, Washington, 2014. An excel file is accessible in an earlier publication and downloaded from the "Pricing database tool".
[30] Cf. Factsheet #30 below.

		not significantly. There are differences also in the way costs of air pollution are estimated when compared to similar studies (see Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities below). The issue with time robustness is likely to make comparison over time difficult, especially when estimates of externalities are to be adjusted.
	Transparency:	▪ This is possible an example of best practice in methodological transparency and all necessary metadata and assumptions have been extensively published. The algorithm for indicator calculation is made public and can be modified.
	Communicability:	▪ While the overall message of the indicator is perfectly understandable to the layman, the way the indicator has been built can be fully understood by a specialist reader.
	Credibility:	▪ The indicator comes from the IMF and has been debated in the economic literature.
	Independence:	▪ Most of the sources used for calculation come from the scientific literature.
Measurability	Geographical Coverage:	▪ All 27 Member States are covered although a few of them with reference to some data only
	Intra EU Comparability:	▪ Perfectly comparable between Member States, Assessment of congestion costs is subject to bias in data availability.
	Extra EU Comparability:	▪ Comparable and available for most extra EU Member States. Subject to the same bias in data availability on certain items. Impact of non-deductible VAT on energy taxes is not considered and this can bias international comparability.
	Frequency:	▪ The indicator does not have a real frequency and can use data referred to slightly different time periods
	Timeliness:	▪ Totally unsuitable to monitor the impact of any policy because of major in-built lags in data responsiveness
	Regularity:	▪ The indicator has been published twice without any regularity.
	Sustainability:	▪ It is unclear at the moment if further updates will be published in the future, although there are expectations that this could be the case.
	Completeness:	▪ The indicator includes the two major road fuels. No estimate has been attempted for marine or aviation fuels because these do not contribute to ground levels of pollution.
	Level of detail:	▪ Extremely detailed in the range of factors influencing the cost of emissions considered.
	Range of available versions:	▪ The indicator can be recalculated and modified at will, based on different assumptions, as the algorithm is made available as an excel spreadsheet.

Strengths	**Weaknesses**
▪ Indicator of conceptual use to highlight need for policy action. ▪ Homogenous methodology allows worldwide comparisons ▪ Possibility of changing assumptions in the excel file attached	▪ Crucially dependent on how value of statistical life is estimated and related health costs internalised by private insurances. ▪ Poorly compatible with similar EU studies ▪ Updated irregularly

Factsheet 23 – CORRECTIVE TAX RATES ON EMISSIONS

Category: Corrective Tax Rates

Source: International Monetary Fund, Database[31]

Complementary to the above, the indicator provides corrective tax estimates by emissions, expressed in US$ per tonne of pollutant (SO_2, NO_X, $PM_{2.5}$). Country-specific corrective tax rates are provided, including for all Member States. Corrective tax rates indicators represent a benchmark to assess the degree to which taxation rates cover the externalities generated.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Addresses a major policy debate on whether taxation fully reflects the different social costs of fuels, also with specific reference to the substitution between coal and natural gas for power generation and heating purposes.
	Non-Ambiguity:	▪ All criteria used are extensively defined. The indicator makes a distinction between emissions where emission control systems are possible and others where the externality is necessarily incorporated in the underlying fuel.
	Responsiveness:	▪ Pigouvian indicators measure whether tax rates capture the social costs of pollution. Since these are expressed as average cost value rather than marginal social costs there can be a substantial lag between the implementation of any tax reform and long-term health results because of inertia in data. By their own nature are not well suited to measure the impact of policy action. They are mainly useful as tools to highlight a need for policy intervention.
	Comprehensiveness:	▪ Corrective tax rates are self-explaining as tools to highlight the need for intervention and have limited need complementary data. In this area they would not particularly benefit from degree of internalisation in other overlapping taxes, but possibly congestion charges.
Analytical soundness	Analytical Soundness:	▪ The indicator perfectly captures the rationale behind Pigouvian taxation.
	Robustness in assumptions:	▪ All indicators based on avoided mortality are crucially sensitive to changes in assumptions about the value of statistical life and whether this has been adapted by age group and reflect the age structure of societies. Changes in the underlying assumptions can radically modify the policy message of the indicator. Different scenarios are envisaged for the possible impact of emission pollution controls, which is one of the most complex issues to be translated into a monetary indicator format.
	Robustness over time:	▪ The indicator has proven reasonably consistent over time a sensitivity analysis has been carried out to this aim and results vary together with improvements in the underlying datasets and conversion parameters.
	Transparency:	▪ This is possibly an example of best practice in methodological transparency and all necessary metadata and assumptions have been

[31] See Factsheet #19, footnote #29.

		extensively published. The algorithm for indicator calculation is made public and can be modified.
	Communicability:	▪ While the overall message of the indicator is perfectly understandable to the layman, the way the indicator has been built can be fully understood by a specialist reader.
	Credibility:	▪ The indicator comes from the IMF and has been debated in the economic literature.
	Independence:	▪ Most of the sources used for calculation come from the scientific literature.
Measurability	Geographical Coverage:	▪ All 27 Member States are covered although a few of them only in part.
	Intra EU Comparability:	▪ Perfectly comparable between Member States, although this depends on scenario assumptions about the recourse to emission control technologies
	Extra EU Comparability:	▪ Comparable and available for most extra EU Member States. There can be changes in the methodology as far as China is concerned.
	Frequency:	▪ The indicator does not have a real frequency and can use data referred to slightly different time periods.
	Timeliness:	▪ Unsuitable to monitor the impact of any policy because of major in-built lags in data responsiveness.
	Regularity:	▪ The indicator has been published twice without any regularity.
	Sustainability:	▪ It is unclear at the moment if further updates will be published in the future, although there are expectations that this could be the case.
	Completeness:	▪ The indicator includes all the main fuels affected by carbon emissions or air pollution considerations, but peat. No data on biofuels available
	Level of detail:	▪ Extremely detailed in the range of factors influencing the cost of emissions considered.
	Range of available versions:	▪ The indicator can be recalculated and modified at will, based on different assumptions, as the algorithm is made available as an excel spreadsheet.

Strengths	**Weakness**
▪ Indicator of conceptual use to highlight need for policy action. ▪ Homogenous methodology allows worldwide comparisons ▪ Possibility of changing assumptions in the excel file attached	▪ Crucially dependent on how value of statistical life is estimated and related health costs internalised by private insurances. ▪ Poorly compatible with similar EU studies ▪ Update irregularly ▪ No coverage of biofuels

Factsheet 24 – SUSTAINABLE TRANSPORT INFRASTRUCTURE CHARGING AND INTERNALISATION OF TRANSPORT EXTERNALITIES

Category: Corrective Tax Rates

Source: DG MOVE, Report[32]

An *ad hoc* monumental study was published for the first time in 2019 by DG MOVE to assess the degree to which taxes and charges on transport cover its main related externalities and infrastructure costs. As far as transport uses are concerned, the Report complements, in a much more detailed and granular way, the information on corrective tax rates for energy products published by the IMF.

The report includes a number of indicators on transport fuel revenues and corrective tax rates. In particular, five direct comparisons at the Member State level between taxes and externalities are published with reference to infrastructure costs and a number of external costs (congestion for road transport, accident costs, environmental costs such as climate change, air pollution, noise, well-to-tank and habitat damage). Some of these external costs, i.a. climate change and well-to-tank, are relevant to the scope of this Study. The product scope includes (i.a.) road petrol, road diesel, rail electricity and rail diesel, and inland waterway transport diesel.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Addresses the extent to which EU transport taxes and charges internalise externalities (and infrastructure) costs. This responds to a growing demand for evidence of compliance with the 'user-pays' and 'polluter-pays' principles have been respected.
	Non-Ambiguity:	▪ All concepts used are extensively described, indicators to measure the degree of internalisation of taxes and charges on different transport modes defined as average cost, marginal social cost, and average cost for infrastructure. Based on available information, it appears that upstream taxes and charges (e.g. RES or ETS borne by electricity producers) are not accounted for, which might distort comparison with fossil fuels
	Responsiveness:	▪ The indicators are entirely conceived to provide benchmarks for reference to signal need for intervention rather than to assess the impact ex post as some of these externalities might depend on multiple factors over and above demand for transport.
	Comprehensiveness:	▪ Indicators from the studies are conceived to be internally consistent and self-explanatory without any need for complementary sources. Would require parallel estimate of corrective tax rate for being more of use for energy taxation purposes
Analytical soundness	Analytical Soundness:	▪ The indicators of internalisation were conceived for other purposes consider fuel transport taxes and electricity transport taxes in general as a part of transport taxation and it is often difficult two disentangle the attribution problem. So while internalisation indicators can provide the level of

[32] Project carried out by DG MOVE which includes several reports, such as: (i) Transport Taxes and Charges in Europe and (ii) Handbook on the external costs of transport. Cf. European Commission DG MOVE, Study on Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities, Publications Office of the European Union, Luxembourg, June 2019.

		the overall gap, the issue of allocating the gap between the various taxes remains open.
	Robustness in assumptions:	▪ The studies extensively review the robustness of its externality cost estimates through best practice methodology, and does elaborate scenarios for marginal social costs, but does not provide range of values for variables crucially impacting on results (VSL). 50% of the costs of accidents are considered as not covered by the insurance system.
	Robustness over time:	▪ The methodology for assessing externalities is described in the Handbook on the external costs of transport. Its assumptions and methods are reviewed periodically, as new scientific evidence appears. There is no vintage data recalculation as this is deemed irrelevant for benchmarks and reference values to be used in prospective terms. There can be discrepancies in estimates of the unit cost of externalities with other sources, notably IMF also because definitions may vary. The issue with time robustness is likely to make comparison over time difficult, especially when estimates of externalities are to be adjusted.
	Transparency:	▪ The methodology on which the inventory is built is extensively described and published; all data on tax/charge structures, levels and revenues and externality cost components are available on an Excel Database.
	Communicability:	▪ While the overall message of the indicator is reasonably understandable to the layman, the way indicators are built is built is extremely complex and aimed at the specialist reader.
	Credibility:	▪ Consulting firm working for the EU Commission. The report is aimed to represent a reference piece of information for externality assessment and internalisation across the EU.
	Independence:	▪ Primary data are provided by international sources (e.g. ACEA Tax Guide, Eurostat, OECD, etc.); and from national sources (e.g. Ministries, etc.) and have undergone a validation process.
Measurability	Geographical Coverage:	▪ All EU 27 Member States and other non-EU countries are covered for road and rail transport and IWT. Taxes related to maritime shipping and aviation are collected at the point level (i.e. airports, ports, etc.).
	Intra EU Comparability:	▪ The comparability across EU countries is good. Primary data sources used for compilation of the indicators may differ in terms of quality and due to non-harmonised definitions.
	Extra EU Comparability:	▪ Data availability and comparison with other jurisdictions is limited to few non-EU countries provided for reference in the study, i.e. Norway, Switzerland, US, Canada and Japan.
	Frequency:	▪ Parts of these studies are published and updated on a multiannual basis.
	Timeliness:	▪ Reference data are usually with a two-year delay
	Regularity:	▪ No regularity in publication can be observed
	Sustainability:	▪ It is unclear at the moment if further updates will be published in the future, although this appears likely
	Completeness:	▪ The inventory is fully comprehensive in terms of fiscal revenues and charges by type of transport mode for both transport and stationary purposes. VAT on energy taxes is calculated and included although not available for the single products

	Level of detail:	▪ Estimates of revenue and data on taxes and charges are available aggregated in five categories of transport mode (i.e. road, rail, inland waterway, maritime and aviation). Transport fuel tax revenues are provided in aggregated, but not by type of fuels where only rates are available.
	Range of available versions:	▪ Data both adjusted and not adjusted for PPS are presented as well.
Strengths		**Weaknesses**
▪ Provides benchmarks for comparisons on transport fuel taxation by product and typology of use. ▪ State of the art review of transport taxes and of externality assessment methodologies		▪ Not specifically conceived as an energy taxation assessment instrument requires recalculations to assess impact of changes in energy tax rates. ▪ Would require extensive robustness assessment to make it comparable to parallel IMF estimates of corrective tax rates on fossil fuels and cost of air pollution emissions ▪ Possibly ambiguous in estimating electricity taxes for GHG emission comparisons. ▪ Updated on a multiannual basis

Factsheet 25 – CORRELATION BETWEEN ENERGY TAX RATE / CARBON PRICE AND ENERGY / CARBON INTENSITY OF GDP

Category: Correlation and Model-based Indicators

Source: OECD, Report[33]

The OECD publish various indicators to correlate the energy tax rate and the carbon pricing policies with energy and carbon intensity of GDP

1) In the Taxing Energy Use, the relation between energy tax rate and energy intensity is calculated. This indicator remedies the dependence of implicit/effective tax rates on energy intensity and is estimated by extrapolating the anticipated energy intensity of an economy (i.e. the share of energy consumption to GDP) from the economy effective tax rate. A strong inverted correlation between the level of energy taxes and energy intensity of GDP can be found for about half of Member States.

2) In the Effective Carbon Rates, the relation between the carbon pricing gap and the carbon intensity of GDP (also decomposed in the carbon intensity of energy and the energy intensity of GDP) is calculated. Again, a strong negative correlation exists between carbon pricing policies (i.e. a low carbon pricing gap) and carbon intensity of the economy.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Those are mainly conceptual indicators to strengthen the case of an inverse relation between the level and coverage of energy taxes / carbon price and degree of energy-and carbon-intensity of an economy.
	Non-Ambiguity:	▪ This remains a correlation that does not necessarily imply a causation, as acknowledged in the analysis.
	Responsiveness:	▪ The indicator is not conceived for an instrumental use. Energy and carbon efficiency can be driven by other factors than energy taxation or carbon pricing, but the indicator is aimed to single out countries where this relation is more evident and identify outliers.
	Comprehensiveness:	▪ Self-sustained as it does not require other indicators on the drivers behind energy efficiency and carbon intensity because of possible double counting.
Analytical soundness	Analytical Soundness:	▪ The indicator is not intended to assess the effectiveness of increases in energy taxation / extension of carbon pricing as drivers of energy efficiency and carbon intensity to highlight structural features in the economy.
	Robustness in assumptions:	▪ The indicator is used to demonstrate a statistically significant correlation between the independent and dependent variables considered. Does not depend on any other particular assumption
	Robustness over time:	▪ For the correlation between energy tax rate and energy efficiency, a first reference to the indicator was made in 2013 and its calculation

[33] OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris; and OECD, Taxing Energy Use 2019: Using Taxes for Climate Action, OECD Publishing, Paris, 2019.

		and its components have been refined over time. ▪ For the correlation between carbon pricing and carbon intensity, 2015 edition used the share of emissions priced above 0 (30) EUR/tCO_2. 2018 edition uses the carbon pricing gap.
	Transparency:	▪ Easy to replicate and recalculate based on the data made available. No need for detailed methodological description.
	Communicability:	▪ Requires some expert knowledge of basic statistical inference principles. Presentation of the analysis per carbon intensity of energy / energy intensity of GDP is complex, with multiple dimensions in a single graph (e.g. isocarbon curves)
	Credibility:	▪ OECD is a reputable official source.
	Independence:	▪ Indicators are based on public databases and fully replicable. Degree of independence from Government not a particular relevant issue.
Measurability	Geographical Coverage:	▪ Data are provided for 44 OECD countries and selected partner economies, including 22 EU Member States. Non-OECD EU countries (BG, CY, HR, LT, MT, RO) are not covered.
	Intra EU Comparability:	▪ Data are comparable between 22 Member States countries.
	Extra EU Comparability:	▪ Data are comparable and available for 19 non-EU Member States (other OECD members and G-20 countries).
	Frequency:	▪ Data are published on a three years basis; latest update to the Taxing Energy Use was made yearly.
	Timeliness:	▪ The indicator is based on ETR (related to IEA energy consumption data published with reference to two-three years before) and carbon price (which use tax, permits, and emissions data up to 3 years above).
	Regularity:	▪ Explicit analysis of this indicator is made in the last publications of Taxing Energy Use and Effective Carbon Rates.
	Sustainability:	▪ At the moment publication continues and updates have not been suspended.
	Completeness:	▪ The indicator is calculated on the basis of the average effective tax rate / carbon pricing gap. No further level of data breakdown available
	Level of detail:	▪ The indicator is recorded as a whole, but being available disaggregated data on both ETR and consumption by fuel and sector, a more detailed analysis could be done.
	Range of available versions:	▪ None.

Strengths	**Weaknesses**
▪ Gets rid of the ranking problems of ETR and carbon pricing and shows Member States where higher ETR/carbon pricing corresponds to lower energy or carbon intensity and therefore presumably higher energy and carbon efficiency.	▪ Correlation does not necessarily imply a causal relationship between variables.

Factsheet 26 – ENERGY TAXATION AND SUBSIDIES IN EUROPE

Category: Assessment of Energy Subsidies

Source: International Association of Oil and Gas Producers, Report[34]

The report measures net transfers received by three energy value chains: oil and gas, coal, and RES (wind and solar). This indicator aims at measuring the net tax burden borne by various energy fuels – as opposed as to a growing number of studies and databases focusing only on the subsidies received. Also, it broadens the taxes to be considered in the analysis, by including two horizontal non-energy taxes – VAT and corporate tax – among the relevant revenues.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Attempts to impact on the current policy debate on fossil fuel subsidies by highlighting that fossil fuel industries are actually net contributors in terms of public revenues, while RES are net beneficiaries.
	Non-Ambiguity:	▪ Subsidies are defined only as transfers or expenditures, by the government or indirectly mandated; therefore, tax expenditures and other forms of exemptions / reductions are not accounted for.
	Responsiveness:	▪ The indicator estimates "government net transfer", measuring the impact of policy action, as it measures the net total effect on public finances of government fiscal policies and mechanisms affecting a particular energy source.
	Comprehensiveness:	▪ Includes horizontal forms of taxation (corporate and VAT); but not horizontal forms of support (e.g. R&D support, labour cost incentives).
Analytical soundness	Analytical Soundness:	▪ The indicator measures the net taxes collected from three energy value chains. It is unclear why VAT on business entities is not considered neutral and the definition of the scope of taxes / transfers is questionable
	Robustness in assumptions:	▪ The indicator is based on comprehensive approach – a cash-flow approach. It estimates all material sources of revenue raised from different energy sources. This eliminates the need to select an arbitrary benchmark to compare to.
	Robustness over time:	▪ Two publications, the latter of which is an update with the new data of the same methodology.
	Transparency:	▪ The methodology is fully described and it is based on public databases and sources on energy and company taxation and energy subsidies. When data are not available for the full country set, extrapolation is carried out from available data. Neither aggregated figures per country, nor a detailed list of taxes / subsidies and their monetary value is disclosed, this may prevent its replicability.
	Communicability:	▪ While the overall message of the indicator is understandable to the layman, the way the indicator has been built can be understood by a specialist reader.

[34] NERA Reports, Energy Taxation and Subsidies in Europe: An Analysis of Government Revenues from and Support Measures for Fossil Fuels and Renewables in the EU and Norway. Reports for the International Association of Oil and Gas Producers, 2014 and 2018.

	Credibility:	▪ The indicator is provided by the NERA economic consulting for the International Association of Oil and Gas Producers, hence an interested party to the debate.
	Independence:	▪ The scope and definition of the indicators seem to lean towards an approach potentially more favourable to business.
Measurability	Geographical Coverage:	▪ Data cover all EU, but national data not available
	Intra EU Comparability	▪ No cross-country comparison is possible, as only aggregated data are presented.
	Extra EU Comparability:	▪ No cross-country comparison is possible, as only aggregated data are presented.
	Frequency:	▪ There are only two editions in 2014 and 2018. 2018 estimates refer to 2015, while 2014 estimates refer to annual data from 2007 to 2011.
	Timeliness:	▪ Time lag is excessive to monitor the impact of any policy.
	Regularity:	▪ The indicator has been published twice.
	Sustainability:	▪ It is unclear whether the publication will be continued.
	Completeness:	▪ The indicator includes five of the main energy value chains (oil, gas, coal, wind and solar)
	Level of detail:	▪ Only aggregated data are available.
	Range of available versions:	▪ The indicator cannot be recalculated.

Strengths	**Weaknesses**
▪ It assesses net transfers, other than subsidies received by the oil and gas, coal, and RES (wind and solar) value chains.	▪ The indicator includes horizontal forms of taxation (corporate and VAT), which inflate tax, but not horizontal forms of support (e.g. R&D support, labour cost incentives). ▪ Specific decisions on the treatment of certain forms of taxation (e.g. input VAT) to final consumption, appears not in line with common practice.

Factsheet 27 – EUROPE'S FOSSIL FUEL SUBSIDIES

Category: Assessment of Energy Subsidies

Source: ODI, Overseas Development Institute and Climate Action Network Europe, Report[35]

The report and the database provide a list of subsidies to fossil fuels, defined as "any financial contribution by a government, or agent of a government, that is recipient-specific and confers a benefit on its recipients in comparison to other market participants", in line with WTO practice.

Data are available for production activities (coal, oil and gas, electricity) and consumption (transport, household, commerce and industry, agriculture) in few Member States, the United Kingdom and two European Institutions.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ Builds upon existing database on subsidies, extending it into two other areas: public finance institutions, and state-owned enterprises. In doing so, it fostered OECD to consider the former in its inventory.
	Non-Ambiguity:	▪ Criteria used are well defined, but are the inventory remains not properly robust to the definition of the benchmark, so that different methodologies vary total amounts by one order of magnitude.
	Responsiveness:	▪ Increase in top statutory rates can result in an increase in the amount of subsidies, even though the policy is expected to result in positive environmental impacts.
	Comprehensiveness:	▪ The definition of subsidies is taken from WTO practice as any distinctive benefit. As such it includes a broader set of subsidies.
Analytical soundness	Analytical Soundness:	▪ Most of subsidies are retrieved from existing repositories. Those provided by public finance institutions and state-owned enterprises are accounted at face value, rather than based on their incremental advantage (as the OECD suggests).
	Robustness in assumptions:	▪ Estimates of tax expenditures are sensitive to how benchmarks are defined.
	Robustness over time:	▪ As a single publication, there cannot be any standardised methodology over time.
	Transparency:	▪ Transparent methodology and list of subsidies are provided.
	Communicability:	▪ The study appears as relatively simple to communicate to the general public.
	Credibility:	▪ The indicator comes from a network of NGOs rather than from international institutions.
	Independence:	▪ The inventory is based on data obtained from national government sources (e.g. budgets, national lists of subsides), finance institutions, enterprise financial accounts, the OECD inventory, and additional research by local antennas.
Measurability	Geographical Coverage:	▪ Data are provided for few EU Member States (CZ, FR, DE, EL, HU, IT, NL, PL, ES and SE); the United

[35] ODI, Phase-out 2020, Monitoring Europe's fossil fuel subsidies, Overseas Development Institute and CAN Europe, 2017.

		Kingdom and two European institutions (EBRD and EIB).
	Intra EU Comparability:	▪ Within the mentioned group, comparability of direct transfers is possible, comparability of tax expenditures estimates is not, given that the database relies on nationally-established benchmarks, which can vary widely.
	Extra EU Comparability:	▪ Data availability and comparability do not cover extra EU countries.
	Frequency:	▪ The report covers the period 2014-16.
	Timeliness:	▪ Policy action is immediately captured (1-year time lag).
	Regularity:	▪ Several reports published over the year.
	Sustainability:	▪ it is unclear at the moment if further updates will be published in the future.
	Completeness:	▪ It reviews three types of fossil, including fiscal support (i.e. budget expenditure, tax exemptions and price and income support), public finance and state-owned enterprise investment. It expands the repository by including R&D support or provision of goods or services below market value.
	Level of detail:	▪ It covers a detailed classification of subsides by production value chains (coal, oil and gas, electricity) and consumption activities (transport, household, commerce and industry, agriculture).
	Range of available versions:	▪ No alternative versions are available.

Strengths	**Weaknesses**
▪ The report covers additional measures: the support by public finance institutions and investment by state-owned enterprises, which are measured at face value.	▪ The methodology adopted for estimating subsidies from state-owned enterprises and public finance institutions is not in line with the suggested best practice. ▪ The choice to rely on national benchmarks might impact on cross-country comparability of data.

Factsheet 28 – SUPPORT AND TAX EXPENDITURES FOR FOSSIL FUELS

Category: Assessment of Energy Subsidies

Source: DG ENV, Report and Database[36]

The report and the database identify and quantify EU28 government support to fossil fuels. Support measures include both budgetary support and tax expenditures, accruing to consumers and producers. The database covers all Member States, providing the total amount of fossil fuel subsidies per type of fuel, per type of support, per policy measure.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The report includes various types of public subsidies for fossil fuels measured against an external benchmark – the 2011 proposed minimum ETD rate – which is however outdated.
	Non-Ambiguity:	▪ Definition of subsidies is clear and broad (direct support to producers, R&D subsidies, public investment in energy infrastructure, fiscal incentives for exploration, tax expenditures, consumers).
	Responsiveness:	▪ Having a fixed exogenous benchmark, the indicator is policy actionable, as an increase in tax rates will not result in an increase of estimate subsidies.
	Comprehensiveness:	▪ Though the definition of subsidies is extensive and broader than most of other database (e.g. investment in energy infrastructure is normally not accounted for), the study only covers fossil fuels.
Analytical soundness	Analytical Soundness:	▪ The inventory directly measures the amount of direct budgetary transfers for the production and consumption of fossil fuels.
	Robustness in assumptions:	▪ Based on an external benchmark (i.e. minimum excise rate and the standard VAT rate). A sensitivity analysis is performed using the highest prevailing tax rate, with substantially higher results.
	Robustness over time:	▪ One-off study.
	Transparency:	▪ There is very comprehensive methodological information available inclusive of details. The methodology is fully described and all data and assumptions are published in the study.
	Communicability:	▪ Easy to understand and communicate also to a non-specialist public.
	Credibility:	▪ The inventory comes from a Commission report for DG ENV.
	Independence:	▪ The inventory is based on secondary information (IEA, OECD, national documents) collected by national antennas. When necessary, national governments were contacted for clarification purposes.
Measurability	Geographical Coverage:	▪ Data are provided for all EU Member States.
	Intra EU Comparability:	▪ Data are comparable across EU countries. Limited comparability with other subsidy inventories, due to the tax expenditure benchmark.

[36] DG ENV, Enhancing comparability of data on estimated budgetary support and tax expenditures for fossil fuels, Final report, European Commission, August 2014.

	Extra EU Comparability:	▪ Data are not provided for other countries.
	Frequency:	▪ One-off study
	Timeliness:	▪ 1 to 2-years lag.
	Regularity:	▪ No regularity, the publication is a one-off study.
	Sustainability:	▪ No follow-up studies.
	Completeness:	▪ Estimates of producers' support is highly complete, including also public investment in energy infrastructure – an item not covered in most of similar inventories. Consumer support is specific for sectors/households, and fuels.
	Level of detail:	▪ Data are provided per group of fossil fuels.
	Range of available versions:	▪ Not applicable
Strengths		**Weaknesses**
▪ The introduction of an external benchmark for measuring tax expenditures allows data for comparison across EU countries, something which is not possible if national benchmarks are relied into.		▪ The benchmark proposed may no longer be relevant and the use of current minima might be possible only within a common taxation area, such as the EU, and hence it is not applicable to subsidy inventories which go beyond the EU. ▪ There is not assessment whether the benchmark is considered appropriate, either in terms of subsidy external costs (as per the IMF approach to fuel subsidies) or policy commitments (as in the OECD carbon pricing gap).

Factsheet 29 – INVENTORY OF FOSSIL FUEL SUBSIDIES

Category: Assessment of Energy Subsidies

Source: OECD, Report and Database[37]

The report and the database provide a list of 1200+ policies "conferring a benefit for the use or production of fossil fuels". The definition of support is intendedly broader than 'subsidies', and include both direct budgetary transfers as well as tax expenditures. The database relies on nationally-established benchmarks, which vary from country to country. The fuels covered include both primary fossil fuels (e.g. oil, coal, natural gas), as well as secondary products (e.g. gasoline, diesel). The inventory does not cover public credit assistance to energy companies, though its latest edition describes a methodology which could be used in the future.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The repository complements the analysis and indicators on energy taxes by providing information on fossil fuel subsidies, focusing both on direct and tax expenditures. The inventory is widely used at international level as a measure of the countries' progress against the reduction and removal of fossil fuels.
	Non-Ambiguity:	▪ Criteria used are well defined, but are the inventory remains not robust to the definition of the benchmarks, as national benchmarks are adopted.
	Responsiveness:	▪ Increase in top statutory tax rates can result in an increase in the amount of subsidies, even though the policy is expected to result in positive environmental impacts.
	Comprehensiveness:	▪ It represents the most detailed bottom-up repository of subsidies, even though it may not account for those administered via other forms of taxation (e.g. via corporate or personal income tax).
Analytical soundness	Analytical Soundness:	▪ The inventory directly measures the amount of direct budgetary transfers for the production and consumption of fossil fuels. The measurement of tax expenditures is done indirectly, based on national estimates or OECD calculation against variable benchmarks.
	Robustness in assumptions:	▪ The value of tax expenditures, and thus the total value of subsidies of which they represent a large share, is thus sensitive to the definitions of benchmark.
	Robustness over time:	▪ The inventory remains consistent over time.
	Transparency:	▪ Notable degree of transparency in the methodology and in the availability of data.
	Communicability:	▪ Easy to describe and very easy to understand and communicate also to a non-specialist public.
	Credibility:	▪ The indicator comes from the OECD, which is a reputable source.
	Independence:	▪ The inventory is based on data obtained and collected by the OECD itself from public or government sources. Its validity is reinforced

[37] OECD, OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018, OECD Publishing, Paris, 2018.

		by the periodical peer review exercise, to which jurisdictions can participate on a voluntary basis.
Measurability	Geographical Coverage:	▪ Data are provided for the 44 global jurisdictions, including 22 EU Member States part to the OECD. Sub-national subsidies are available for a subset of countries. Non-OECD EU countries are not covered.
	Intra EU Comparability:	▪ Within the mentioned group, comparability of direct budgetary transfers is possible, comparability of tax expenditures estimates is not, given that the database relies on nationally-established benchmarks.
	Extra EU Comparability:	▪ Data 22 non-EU counties other than 22 EU Member States. Comparability of direct budgetary transfers is possible, comparability of tax expenditures estimates is not, given that the database relies on nationally-established benchmarks.
	Frequency:	▪ Database include annual data.
	Timeliness:	▪ Policy change can be captured one to two years thereafter
	Regularity:	▪ The inventory has been published three times (2013, 2015 and 2018).
	Sustainability:	▪ At the moment publication and updates have not been suspended.
	Completeness:	▪ The inventory broadly defines subsidies, including both direct budgetary transfers as well as tax. Tax expenditures include rebates, exemptions and reductions on VAT and excise (on the consumption side), and on producers' taxes, such as corporate tax and royalties, on the production side. It does not yet incorporate loans from public financial institutions
	Level of detail:	▪ The inventory includes both primary fossil fuels (e.g. oil, coal, natural gas), as well as secondary products (e.g. gasoline, diesel).
	Range of available versions:	▪ No multiple versions, but data available for tailoring the analysis; no sensitivity to multiple benchmarks

Strengths	**Weaknesses**
▪ The inventory contributes to improve and increase the amount of information Available on fuel subsidies and provide a consistent bottom-up methodology. ▪ Its validity is reinforced by the periodical peer review exercise, to which jurisdictions can participate on a voluntary basis.	▪ The OECD choice – to rely on national benchmarks – strongly impacts on cross-country comparability of data. ▪ The estimate of tax expenditures can sometimes react improperly to the environmentally friendly policies, such as the introduction of a carbon tax (with some exemptions) or the increase in top excise rates without affecting reductions and exemptions.

Factsheet 30 – TOTAL AMOUNT OF FOSSIL FUEL SUBSIDIES

Category: Assessment of Energy Subsidies

Source: International Monetary Fund, Database[38]

The database provides an estimate of per-country and per-fuel subsidies granted to fossil fuels based on a top-down approach. The indicator estimates total subsidies as the sum of: (i) the pre-tax subsidies, which measure, via a price-gap approach, the difference between local market prices tax inclusive, and an international reference price; and (ii) post-tax subsidies, that is the difference between the local market price and a price which reflected external cost and revenue requirements. Producer subsidies are included in pre-tax subsidies, and are relatively small.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The database addresses a critical question in the comparison of subsidies across countries, by introducing an explicit external benchmark based on the costs of the externalities associated to energy consumption. To the contrary, as it also depends on the international fuel price level, it provides spurious findings when used to assess the effects of subsidy policies over time.
	Non-Ambiguity:	▪ All criteria used are extensively defined. Only the third component – revenue considerations for the equalisation of VAT rate – can appear debatable. Arguable, the overall tax rate, including VAT, could be equal to external costs, rather than deeming VAT as additional to external cost-compensating taxes.
	Responsiveness:	▪ The definition of subsidies adopted by the IMF is policy-actionable: if taxes increase, the amount of subsidies decrease ceteris paribus.
	Comprehensiveness:	▪ Needs to be complemented with data on price variations to differentiate the impact of change in market conditions from that of policies.
Analytical soundness	Analytical Soundness:	▪ The indicator is based on the Pigouvian rationale for the taxation of pollutant activities. Therefore, it measures both a 'classical' form of subsidies, that is the price-gap, as well as the non-compensation for external costs.
	Robustness in assumptions:	▪ Economic assumptions to calculate subsidies and reform impacts – e.g. elasticities – are retrieved from the relevant literature, and transparently reported and discussed in the tex.
	Robustness over time:	▪ The methodology remains consistent over time.
	Transparency:	▪ There is very comprehensive methodological information available. All data and assumptions are published in excel format, which allow for estimating existing subsidies, but also to calculate what the optimal rate of taxation is and how distant the current tax rate is. As a result, calculations can be replicated (and adapted for various types of policy analyses).
	Communicability:	▪ While the overall message of the indicator is understandable to the layman, the way the indicator has been built can be understood by a specialist reader.

[38] IMF working Papers, Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates, 2019.

	Credibility:	▪ The indicator comes from the IMF and has been debated in the economic literature.
	Independence:	▪ The data needed to estimate this indicator are drawn by numerous reputable sources (e.g. IEA, OECD, IMF, IIASA).
Measurability	Geographical Coverage:	▪ Data are provided for all EU 27 Member States.
	Intra EU Comparability:	▪ The indicator is designed to reflect local conditions and is comparable across EU Member States.
	Extra EU Comparability:	▪ Apart from Member States, comparable data are also provided for other 158 countries.
	Frequency:	▪ Data are published on a biannual basis (2015 and 2017).
	Timeliness:	▪ Time lag of 2 years, but some data are older (e.g. on exposure to pollutants).
	Regularity:	▪ The indicator has been published twice.
	Sustainability:	▪ It is unclear at the moment if further updates will be published in the future, although primary data have already been collected and the publication is likely to be replicated.
	Completeness:	▪ The indicator includes all major fossil fuels fossil fuels (petroleum, coal, natural gas, and electricity) for each covered jurisdiction (185 countries).
	Level of detail:	▪ Extremely detailed in the range of factors influencing the external costs and thus the fossil fuel subsidies.
	Range of available versions:	▪ The indicator can be recalculated and modified, as the algorithm is made available as an excel spreadsheet.

Strengths	**Weaknesses**
▪ The IMF estimation of fuel subsidies is the only one relying on an externality-based approach: the tax must reflect all external costs generated by the fuel consumption, and a standard VAT rate.	▪ Measuring the externalities, which are very diverse, represented a conspicuous challenge and parameters could be debated.

Factsheet 31 – PHYSICAL ENERGY FLOW ACCOUNTS

Category: Energy Consumption

Source: Eurostat, Database[39]

The database records the flows of energy (in terajoules and fully compatible with the ESA), from the environment to the economy (natural inputs), within the economy (products), and from the economy back to the environment (residuals), using the accounting framework of physical supply and use tables. While this database does not cover energy taxes as such, it could be used as a 'denominator' to calculate implicit / effective tax rates.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ PEFA measures the contribution of the environment to the economy and the impact of the economy on the environment in terms of natural resources. It provides policy-makers information to monitor these interactions as well as a database for strategic planning and policy analysis to identify more sustainable paths of development.
	Non-Ambiguity:	▪ The database as well as all its dimensions are precisely defined.
	Responsiveness:	▪ Unlike taxation, energy consumption responds much more slowly to policy factors
	Comprehensiveness:	▪ The database is comprehensive, recording physical energy flows arising from the activities based on residence principle. Non-resident activities are not included; discrepancies exist between Member States.
Analytical soundness	Analytical Soundness:	▪ The data series is embedded with national accounts and explicitly enable an integrated analysis of economic and energy variables, recording the entire flows of energy sources (from environment to economy, within, and from economy back to environment).
	Robustness in assumptions:	▪ Not applicable to databases.
	Robustness over time:	▪ Before 2017 data were on a voluntary basis, methodology and questionnaire changed slightly and since 2017 has remained consistent due to clear statistical concepts and definitions. Data are not revised systematically in between annual releases.
	Transparency:	▪ Not applicable to databases.
	Communicability:	▪ Not easy to understand to a layman. PEFA tools can be used only by specialists.
	Credibility:	▪ Data are collected by Eurostat, by means of a questionnaire, with deadline 30 September according to EU Regulation.
	Independence:	▪ Data are transmitted by national authorises to Eurostat and then validated using IT tools for the checking of formal compliance, consistency and plausibility.
Measurability	Geographical Coverage:	▪ All EU Member States, UK and Norway are covered.

[39] Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts – Annex VI. Eurostat, Physical energy flow accounts (env_pefa), metadata available on https://ec.europa.eu/eurostat/cache/metadata/en/env_pefa_esms.htm.

	Intra EU Comparability:	▪ Comparability across Member States is granted by clear statistical concepts and definitions, but limitation might occur on primary data sources. NSI collect data from national energy statistics but auxiliary sources (e.g. national accounts, transport statistics, balance of payments) can be used in case scope and level of detail provided in national energy data bases are not sufficient to the compiler.
	Extra EU Comparability:	▪ Data are available only for UK and Norway and not fully complete.
	Frequency:	▪ Data are published on an annual basis for the period 2014-2017. Some indicator series might date back from 2009 for some Member States (e.g. IT).
	Timeliness:	▪ Data are transmitted for the pre-previous reference year (i.e. t+2).
	Regularity:	▪ Data have been regularly released on an annual basis since 2015.
	Sustainability:	▪ Sustainability of data provision is guaranteed by a binding act.
	Completeness:	▪ The database is complete only for three reference years (2014-2017) and all Member States of the EU. Data gaps (at NACE 2-digit - on emission relevant use of energy, transformation use and end use) exist for some countries due to confidentiality of data.
	Level of detail:	▪ Detailed statistics on energy supply and use (in TJ) at NACE 1-and 2-digit level) for 31 energy products (or groups). No further NACE disaggregation.
	Range of available versions:	▪ Not applicable to databases.
Strengths		**Weaknesses**
▪ Differently from other consumption databases, it is likely more fit to calculate physical ITR per sector		▪ Not easy to use and accessible only to statistical experts who have a good knowledge of energy statistics and energy accounts.

Factsheet 32 – PURCHASES OF ENERGY PRODUCTS

Category: Energy Consumption

Source: Eurostat, Database[40]

The data series is provided in the annual detailed enterprise statistics database and records the total costs of energy inputs by NACE sector for industrial users. It covers purchased fuels, excluding self-generated energy and feedstock. While this database does not cover energy taxes as such, it could be used as a 'denominator' to calculate the share of taxes over total energy expenditures.

Key Indicator Features	Ways of Measurement	Overall Assessment
Policy relevance	Policy Relevance:	▪ The purchases of energy products series answer questions such as: which energy products are bought in this economic activity and how much is spent on their purchase? However, it does not account for self-generated energy and feedstock, which are important component of energy consumption in certain industries (e.g. petrochemicals).
	Non-Ambiguity:	▪ Criteria used are well defined.
	Responsiveness:	▪ Costs of energy products depend on both exogenous (e.g. fuel price) and policy endogenous factors.
	Comprehensiveness:	▪ Limited to industrial users and for energy products purchased as fuels. The database provides high-detailed data, covering the NACE sectors C, D and F (i.e. manufacturing and constructions)
Analytical soundness	Analytical Soundness:	▪ Data series measure actual cost of energy purchased within the business. All taxes are included, except deductible VAT
	Robustness in assumptions:	▪ Not applicable to databases.
	Robustness over time:	▪ Data are comparable over time and across countries only from 2005 onwards. Data from 1999-2007 period are also available but collected with a different methodology (also within the period).
	Transparency:	▪ Not applicable to databases.
	Communicability:	▪ Reasonably easy to understand to a layman.
	Credibility:	▪ Data are published by Eurostat, and collected by the National Statistical Institutes (NSI) among enterprises, through statistical surveys, the business register or administrative sources.
	Independence:	▪ Data are transmitted by NSI to Eurostat and validated before publishing. Logical checks between different variables are performed and the consistency of data over time is checked as well.
Measurability	Geographical Coverage:	▪ All EU Member States, United Kingdom, Norway and Switzerland are covered. Although gaps exist, data are extensively disaggregated until 3-digit levels, covering most Member States.
	Intra EU Comparability:	▪ Comparisons across Member States are sometimes limited by methodological factors (e.g. statistical survey usually include all large enterprise and provides for a stratified sampling only for small enterprises, while business register

[40] Annual detailed enterprise statistics for industry (NACE Rev. 2), metadata available on https://ec.europa.eu/eurostat/cache/metadata/en/sbs_esms.htm; and Multi-yearly enterprise statistics - purchases of energy products (NACE Rev. 1.1) metadata on https://ec.europa.eu/eurostat/cache/metadata/en/sbs_pu_esms.htm.

		contains basic characteristics as NACE activity code, employment, turnover, used for sample stratification in general, and administrative sources they are used to comply with the SBS regulation requirements).
	Extra EU Comparability:	▪ Data are limited to only UK, Norway, and Switzerland.
	Frequency:	▪ Data are collected on an annual basis since 2005 onwards. Previous series from 1997-2007 is available on a biannual basis
	Timeliness:	▪ Preliminary data are normally collected within 10 months after the end of the reference year and the most definitive data within two years.
	Regularity:	▪ Preliminary data are published one year after the end of the reference year (T+1) and Final data are published two years after the end of the reference year (T+2).
	Sustainability:	▪ Sustainability of data provision is guaranteed on the basis of legal obligation.
	Completeness:	▪ The database covers only purchased fuels. Energy products purchased as a raw material or for resale without transformation are excluded.
	Level of detail:	▪ Purchases of energy products series are broken down by NACE division (2-3 digits) level.
	Range of available versions:	▪ Not applicable to databases.
Strengths		**Weaknesses**
▪ Easy to access and use. Data series have a suitable level of disaggregation which could be made compatible with the energy taxation per industrial sector series		▪ Separate data on type of fuels is not available, limiting information of total expenditure to energy products as a whole.

ANNEX B – NATIONAL ENERGY TAXATION INDICATORS

This Annex aims to provide an overview of energy taxation indicators used by the Member States. This was done to obtain an understanding of the indicators used by national administrations, as well as their application and usage in policymaking and the issues associated therewith. To this purpose, the annex surveys two main aspects:

1) whether and how the ***indicators produced at the European and international level*** reviewed by this Study are being used by Member States authorities for policymaking purposes[41]; and

2) whether ***other national energy taxation indicators*** have been developed and used by the Member States[42].

In order to retrieve the information about the use of energy tax indicators covered by the Study and any additional indicators, two main sources have been resorted to: ***Member States' contributions*** to the Study and the ***National Energy and Climate Plans (NECPs)*** submitted by Member States within the framework of the Energy Union governance. This Annex therefore results from a combination of primary and secondary sources providing a comprehensive snapshot. More in detail:

- **Contributions from Member States.** Member States have been directly surveyed via a workshop and a written questionnaire. First, this was discussed with participants during the workshops held digitally on June 5th. Considering the topic at hand, representatives from both the Ministries of Finance and the Environment were invited. Then, questionnaires were distributed to the participants to be filled out either before or after the workshop. The questionnaires tackled, among other things, questions about the use of energy tax indicators in their respective countries and the existence of national indicators beyond those already identified at the European and international level. The questionnaires did not only inquire whether energy tax indicators are used or not, but also the way they are eventually used in a policymaking context. Thirteen questionnaires were returned by eleven Member States[43]. Contributions from the questionnaires are reported anonymously.

- **Review of National Energy and Climate Plans (NECPs).** In addition, the NECPs were reviewed to identify whether and how energy tax indicators – either produced by international organisations or by the Member States – were used for strategic policymaking purposes. The most important reason to focus the research on the NECPs is their central relevance in the EU energy policy and by their loose similarity with the European Semester mechanism. After the Energy Union strategy[44] was set out by the Juncker Commission in 2015, the 'Clean energy for all Europeans' was one of the several policy packages that followed. This package included the Regulation on the governance of the energy union and climate action

[41] The review does not cover the usage of energy balance indicators – i.e. #29 Physical Energy Flow Accounts and #30 Purchases of Energy Products – unless they are used to build other energy taxation indicators.

[42] National indicators are considered as such when they differ characteristically from indicators developed at the European or international level. When it can be reasonably deduced that a national indicator applies the same concept and/or data as one of the indicators already identified, it will be discussed as an instance of usage of an existing indicator. Those cases will be highlighted in the text below.

[43] The questionnaire, the workshop documents and the list of participants are included in Volume 3 – Technical Annexes.

[44] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank a Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM/2015/080 final, Brussels, 25.2.2015.

– the so-called Governance Regulation[45], stressing the need of cooperation and coordination between both the Commission and Member States and among Member States, in order to meet the 2030 EU energy and climate targets. Furthermore, it emphasises the importance of regular and consistent reporting. Therefore, the Governance Regulation introduced the NECP as the key document underpinning the participative governance of the EU energy union. Every Member State is obliged to submit a draft NECP[46], which is assessed by the Commission and reviewed, before a final version is to be submitted by the end of 2019. In the NECPs Member States lay down their 10-year plans to meet the EU energy and climate targets. The submitted NECPs cover the period 2021-2030 and are the first of this kind under the Governance Regulation. Energy taxation represents a cross-cutting issue there. Hence, a review of the role of energy tax indicators in the NECPs has been included in the research as a proxy for their use for strategic policymaking purposes. Final NECPs are available for all 27 Member States.

Indicator usage at the national level

Results are presented here by families of indicators[47], each time starting from primary contributions and then as complemented by the review of NECPs.

Energy Taxation Revenues

As for the first indicator family, those on ***energy taxation revenues***, ten out of eleven Member States submitting the questionnaire state to use at least one of these indicators[48]. Overall, these contributions from the Member States suggest that energy tax indicators are first and foremost used to monitor and evaluate tax revenue levels and wider budgetary developments. Four Member States monitor both Eurostat and DG TAXUD indicators regarding energy and transport taxation revenues. Two more use two (energy taxation revenues and transport fuel taxation as % of GDP) and three indicators (the same and energy taxation revenues as share of total tax revenues) respectively. One Member State does take into consideration the energy tax revenues as a share of total revenues, but reports that there is no active monitoring ongoing, while another uses both indicators on energy taxation revenues (as % of GDP and as share of total tax revenues) to understand how changes in the tax policy impacts on the tax burden of its whole economy, for example for by assessing tax burden shift from labour to energy taxes. While a few Member States signify that the indicators enter legislative and/or policymaking considerations, information on specific policymaking usage of the indicators has not been reported.

Additionally, some of these Member States do not use the indicators for defining national energy tax policies, but primarily just for comparison with other countries. This is e.g.

[45] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council; hereinafter: "governance regulation".

[46] The Member States are expected to cover the following areas within the NECPs: (i) energy efficiency; (ii) renewables; (iii) greenhouse gas; (iv) emissions reductions; (v) interconnections; and (vi) research and innovation. See European Commission website on NECPs: https://ec.europa.eu/info/energy-climate-change-environment/overall-targets/national-energy-and-climate-plans-necps_en; last accessed on August, 2020.

[47] Cf. Section 4 in the main Report and Annex A above.

[48] I.e. (i) Revenue from Energy Taxation as a % of GDP (Eurostat); (ii) Revenue from Energy Taxation as a % of GDP (OECD); (iii) Revenue from Energy Taxation as a Share of Total Revenues (Eurostat); (iv) Energy Taxes by Paying Entities and Industrial Sector (Eurostat); (v) Transport Fuel Taxation as a % of GDP (DG TAXUD); and (vi) Transport Fuel Taxation as a Share of Total Revenues (DG TAXUD).

the case of one Member State using the Eurostat indicator on revenue from energy taxation as a percentage of GDP and transport fuel taxation as a percentage of GDP (DG TAXUD); two others indicate the use of revenue from energy taxation both as a percentage of GDP and as a share of total tax revenues (both from Eurostat). The same is noted by two other Member States, which use the aforementioned indicators and also the other DG TAXUD-indicator on transport fuel taxation as a share of total tax revenues.

The review of the NECPs resulted in limited additional information on the use of revenue tax indicators in individual Member States:

- in the Latvian NECP, the share of tax revenues from energy consumption and GHG emissions on the general budget revenue is being monitored. It is not stated explicitly whether the data used corresponds to the Eurostat data, but it appears to be the same indicator produced by Eurostat.

- Slovakia considers the Eurostat data on tax revenues from energy products.

- Portugal outlines data on the share of environmental taxes on the total tax income. Even though environmental taxes is a broader category than energy taxes, they also specify the share of energy taxes on those environmental taxes, indicating that the relevant data for the 'energy taxation revenue as a share of total revenues' indicator is being collected and monitored – as per the Eurostat indicator.

Neither from the Member States contributions nor from the NECPs arose information on the existence of additional national indicators different from those identified at the European/international level. While some countries noted that they use data on energy taxation revenue from their national statistics, those correspond to Eurostat or DG TAXUD indicators. Therefore, while the data might be more granular for certain applications, which is also in line with what reported at the workshop, it is reasonable to assume that they originate from the same collection process as the data flowing into Eurostat / DG TAXUD indicators, but the level of national detail can be different.

Implicit and Effective Tax Rates

Based on the Member States' contributions, it would appear that European and international indicators on **implicit and effective tax rates** are being monitored less often than energy taxation revenue indicators. In the questionnaires, slightly less than half of respondent Member States, note to use at least one of the EU and OECD indicators for policy monitoring purposes. Two Member States state to monitor the OECD effective tax rate on energy, with another one also follows the DG TAXUD nominal implicit tax rates on energy. These indicators are being used for assessing taxation on energy products and for the comparison of energy taxation levels with other countries. A Member State, which also uses the DG TAXUD's nominal implicit tax rates, does indicate that its findings are being incorporated into policy decisions, but no details are provided, while two more report using the OECD and the DG TAXUD/Eurostat indicators for analysis and evaluation of tax measures.

Within the NECPs, one indicator from this broad family is widely mentioned by Member States and frequently reported, namely the Eurostat data on natural gas and electricity prices and their components, including energy taxes. Twenty-one Member States indicate monitoring energy prices and composition b means of the indicator collected and published by Eurostat. More in detail:

- Austria, Croatia, the Czech Republic, Hungary, Ireland, and Malta explicitly portray Eurostat data within their reports, while Slovakia mentions the indicator without including actual data and Spain presents a breakdown of natural gas prices as sent to Eurostat but not of electricity prices. This indicator is mostly used to compare electricity and natural gas prices between households and industrial users, or with other EU countries. Ireland, for example, breaks down each component and ranks the Irish position for each component in comparison with the other Member States.

- Fourteen other Member States[49] report on the components of energy prices, either not specifying the source of the data or using different national statistical sources, which however correspond to the Eurostat data and structure of its indicator. Cyprus and Romania do not include a specified tax component in their breakdown and some other Member States, such as Latvia or the Netherlands, only provide rough indications of the price components. Again, the primary application of this indicator is the comparison of the burden on final consumers. Some Member States, Denmark for example, use the indicator to identify how high the share of energy taxation is on the final price and to justify a reduction of said tax, in order to reduce prices for final consumers.

Beyond the Eurostat data on prices and their components, only one other European indicator from this family is explicitly mentioned within the NECPs, namely the implicit tax rate from DG TAXUD/Eurostat. Slovakia uses this indicator, together with the one on tax revenues, to assess the functioning of their energy taxation, namely to identify room for an environmental tax reform and the harmonisation of the energy and CO_2 tax regimes in order to increase tax revenues and provide incentives to reduce CO_2 emissions. The reasoning behind it is that tax revenues from environmental taxes and the implicit tax rate on energy are both low in Slovakia, while heating and industrial energy use are the main sources for emissions. Therefore, a general tax raise for fuels purposed for heating and manufacturing could increase revenues and reduce emissions, provided taxes on unit-linked consumption are being indexed for inflation, in order not to have a decline in revenues over time.

The review of the Member States contributions and the NECPs did not reveal the existence of additional national indicators belonging to this broad family. Member States appear to use only the existing European or international indicators as outlined.

Carbon Pricing

Within the questionnaires, four Member States indicate to use an indicator on carbon pricing that, unsurprisingly, in most cases was the OECD indicator on effective carbon rates. One Member State also uses the IMF indicator on the effective carbon price and the OECD indicator on the carbon pricing gap; and one Member State only the IMF one. In one case, the share of emissions priced above a certain threshold (OECD) is also monitored. From the Member States contributions, it is difficult to understand how the indicators concretely are used for policymaking purposes. Examples of reported uses include comparison with other Member States, or informing internal analyses and the national debate on tax measures and carbon pricing. Other Member States have a critical view of carbon pricing indicator. In one case, because of the limited coverage to OECD Member States, in another because national carbon pricing policies date further back than the indicators, so that national definitions of carbon contents have been given at a variance with international prevailing practices which makes reference values of other countries as generally low, thus making comparisons little informative.

The NECPs generally do not discuss carbon pricing in detail and consequently do not reveal additional information on the usage of energy tax indicators from this family. Several NECPs do discuss policymaking considerations surrounding existing CO_2 taxation or its introduction. It is worth noting that in a few cases, for example the German or Swedish NECP, possible energy savings from carbon taxation are calculated by using CO_2 tax rates together with the related price elasticities of the products they refer to.

[49] Belgium, Cyprus, Denmark, Estonia, Germany, Italy, Luxembourg, Latvia, Malta, Netherlands, Portugal, Romania, Slovenia, and Sweden.

On additional national indicators, two more contributions are worth mentioning:

- after the adoption of the Paris Agreement in 2015, Belgium initiated a national debate on carbon taxation going beyond the EU ETS[50]. While a separate national energy taxation indicator was not developed, a benchmark analysis was produced, taking into consideration a range of information on energy and carbon pricing. This includes reports, data, and indicators from the IMF, OECD, and the World Bank. Furthermore, they rely on experiences from other countries, such as Sweden or France, to assess the impact of carbon pricing, in particular in the building and transport sectors.

- France, on the other hand, introduced carbon taxation in 2014 and then started an evaluation of whether it is working in accordance with its mitigation targets[51]. The analysis is based on the OECD indicators on effective carbon pricing and the carbon pricing gap, but also references the 'Elfe model', a model allowing to link tax data to energy consumption data, and therefore to the CO_2 emissions associated to energy consumption (through considering taxes on fossil fuels). The model uses a similar approach as the OECD, with a few differences. Firstly, the model does not only take into account domestic emissions but also emissions stemming from international transport, aviation and maritime, if the bunkering takes place in France. Secondly, emissions deriving from biofuels are counted as zero in the model, differently from the OECD main variant of this indicator.

Corrective Tax Rates

Very little information could be retrieved on the indicators on corrective tax rates (IMF). Only one Member State indicate a use of these indicators, IMF corrective tax rates on both fuels and emissions. However, it has also reported that neither indicator is used regularly and that they are primarily employed for ad-hoc analyses purposes. Also, another Member State mentions using these indicators not for setting rates, but for internal benchmarking purposes and as an input to policy discussions. None of these indicators is specified within the NECPs either and no additional national indicator falling into this family could be identified.

Assessment of Energy Subsidies

Member States generally discuss fossil fuel subsidies within their NECPs, but not all of them detail a list of their energy subsidies or provide estimates of their value. From the NECPs, it emerges that a majority of the Member States uses the subsidy indicators developed in the European or international arena, with the OECD inventory of fossil fuel subsidies being the most widespread. More in detail:

- The Czech Republic, Estonia, Finland, and Hungary outline in their NECPs that they assess their subsidies following the OECD indicator, even though with some additional notes. The Czech Republic underlines its reporting of subsidies as part of their OECD membership, but further refers to the definition of the International Energy Agency (IEA) for identifying fossil fuel subsidies. This is an interesting point as the IEA generally uses a different approach than the OECD to measure fossil fuel subsidies, but this is not discussed in more detail in the Czech NECP. Finland

[50] Belgian National Debate on Carbon Pricing, Final Report, June 2018, edited and distributed by Belgian Federal Climate Change Section of the Federal Public Service Health, Food Chain Safety and Environment, in close collaboration with Climact, PwC and SuMa Consulting. Available at: https://klimaat.be/doc/National_Carbon_Pricing_Debate_-_Final_Report.pdf; last accessed: 24.11.2020.

[51] Ministère de la transition écologique et solidaire, Commissariat général au développement durable, May 2020, 'La tarification du carbone est-elle alignée avec nos objectifs climatiques?'; available at: https://ree.developpement-durable.gouv.fr/IMG/pdf/thema_essentiel_fiscalite_carbone_cgdd_mai2020.pdf; last accessed: 24.11.2020.

combines the OECD indicator with previous national studies, hence providing additional caveats to the use of these estimates: (i) the benchmarks used to estimate the subsidy depend on the respective tax expenditure and hence, they cannot be fully compared to each other; and (ii) the benchmarks applied are not mentioned within the NECP, and it is mentioned that there is no common view within Finland on which subsidies should be considered as such. This is in line with the wider debate on energy subsidy indicators and the use of benchmarks to measure tax expenditures[52].

- Italy, Luxembourg, and the Netherlands all report in their NECPs having commissioned or being in the process of creating an overview of subsidies in their countries. Italy has asked the Ministry of the Environment to create a 'Catalogue of Environmentally Damaging Subsidies and Environmentally Advantageous Subsidies'. Their assessment of energy subsidies is based on their self-report within the G20 Peer Review of Fossil Fuels Subsidies, which is based on the OECD definition[53]. The Netherlands indicate that a list will be developed in cooperation with the OECD and IEA. With this list, they aim to include a wider understanding of fossil fuel subsidies, covering also lost revenues from energy tax exemptions or differentiated tariffs.

- A noteworthy case is Ireland. Within the NECP, the use of an indicator for the estimation of potentially environmentally damaging subsidies is not described, but some more detail is provided in a document published by the national statistical institute[54]. Therein, it is suggested that Ireland would be looking at the new Eurostat data collection module on potentially environmentally harmful subsidies[55]. This module is based upon work of the OECD, IEA, and IMF, and in the second half of 2019, data were collected for the first time.

Denmark and Croatia also use an indicator already identified, namely the DG ENER report[56]. Croatia outlines it in comparison to other EU Member States, because their fossil fuel subsidies are primarily targeted towards reducing costs for domestic competitors and thereby increasing their competitiveness. For Denmark, the NECP talks about a six-part assessment on energy taxation and subsidises that has been published between 2016 and 2018 and has informed later policymaking. While the precise nature of the assessment and the used indicators is not explained, the topics covered, such as 'development in tax and subsidy base' or 'the extent of non-regulated externalities of energy consumption' suggest a thorough engagement with energy taxation indicators for policymaking purposes.

Belgium, Germany, and Sweden appear to not rely on the indicators produced at the international level and explicitly discuss their own estimates of energy subsidies within the NECPs or related documents.

- In their inventory of tax expenditures, Belgium describes that, for the estimation of expenditures on energy and electricity, a reference rate for each product type is first determined; then, the difference between the reference rate and the

[52] Cf. Section 5 of the main text for further information.
[53] G20 Peer Review of Fossil Fuels Subsidies, Self-Report Italy, November 2018; available at: https://www.oecd.org/fossil-fuels/publication/Italy%20G20%20Self-Report%20IFFS.pdf; last accessed: 24.11.2020.
[54] Central Statistics Office, Research Paper, 'Fossil Fuel and Similar Subsidies 2012-2016'; available at: https://www.cso.ie/en/media/csoie/releasespublications/documents/rp/fossilfuelandsimilarsubsidies/Fossil_Fuel_and_Similar_Subsidies.pdf; last accessed: 24.11.2020.
[55] Cf. Section 7.5 of the Main Text.
[56] Trinomics Report for DG ENER on Energy Prices, Costs, and Subsidies.

reduced rate is quantified, and multiplied by the volume of consumption to assess the tax expenditures[57].

- Germany lists their energy subsidies and the estimation thereof in the NECP and references to their report on subsidies (‘*Subventionsbericht’*), where this is discussed in more detail[58]. In this report, it is discussed that the subsidy definitions of the WTO, OECD, IMF and World Bank have been taken into consideration and also applied, but overall their definition is considerably broader than the one used according to German law. The definitions of the said international institutions raise additional delimitation and quantification problems, in particular external effects should also be included in the consideration and quantified.

- Sweden discusses their calculation of the tax expenditure just as Belgium, but does not specify the definition used for fossil fuel subsidies. In its NECP, Sweden outlines that the calculation of the tax expenditure is based on multiplying the tax reduction by the tax base, all based on accrual accounting.

Finally, Spain includes a detailed breakdown of energy subsidies in their NECP and notes in their contribution that a national indicator is used, but no further information on the methodology could be retrieved. From the Member States contributions, no information emerged on the use of indicators to estimate energy subsidies, with the exception of France reportedly using the OECD definition to assess their energy subsidies.

Overview

The aim of this Annex was to identify additional national indicators of energy taxation and whether and how indicators developed at European and international level are used in national policymaking. To this purpose, Member States have been asked to contribute directly through a workshop and a questionnaire. The overall picture that emerged from their contributions is that ***Member States are users of the existing indicators rather than developers*** of additional indicators, as there are very limited instances of the latter. In any case, the few additional national indicators on e.g. carbon pricing and energy subsidies explicitly take into consideration and build upon the existing indicators developed by EU or international bodies.

In addition to the Member States contributions, the NECPs of all 27 EU-countries have been reviewed, due to their importance in the governance of the Energy Union. The overall picture provided by Member States contributions was confirmed by the NECPs, within which several cases of the usage of European and international indicators could be identified, while a limited number of new or refined national indicators was retrieved.

From the review of the Member States contributions and the NECPs, it appears that indicators from most families are being used by individual countries[59]. ***The most commonly used indicators are those on energy taxation revenues, implicit/effective tax rates, and energy subsidies.*** Although some countries question the feasibility of certain indicators, mentioning for example the poor or unclear definition of energy or transport fuel taxation, hence their difficult comparison. A similar criticism has been voiced about implicit tax rates and estimates of fossil fuel subsidies, stating their interpretation is not only difficult but also depends on national reporting. However, the indicators developed at the European and international level within these

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[57] Federal Tax Expenditures Report, Update 28.11.2018, Doc 54 3293/004; available at: https://finance.belgium.be/sites/default/files/Statistieken_SD/Inventaris/Inventory_federal_tax_expenditures_2017.pdf; last accessed: 24.11.2020.

[58] Bundesministerium für Finanzen, ’27. Subventionsbericht des Bundes, 2017-2020‘; available at: https://www.bundesfinanzministerium.de/Content/DE/Downloads/Broschueren_Bestellservice/2020-03-01-Subventionsbericht.pdf?__blob=publicationFile&v=15; last accessed September 2020.

[59] The only indicator family for which no usage or national indicator could be identified is the ‘correlation and model-based indicators’ family.

families are used by several Member States for policymaking purposes. Member States did indicate to use indicators for purposes such as comparison with other Member States, evaluating the functioning of tax systems, assessing the burden on consumers and across sectors, or informing national debates towards tax reforms.

Indicators on corrective tax rates find limited national usage. Slightly more commonly used are the indicators on carbon pricing, but Member States officials also raise some criticism, noting for example that other negative externalities (e.g. air pollution) should be covered by energy tax and that the indicators are less useful for comparative purposes for countries with a system of carbon pricing aimed at more ambitious emissions reductions. Nonetheless, the indicators are sometimes used, and also inspired national elaborations for in-depth debates in countries like France or Belgium.

ANNEX C – POLICY QUESTIONS

C.1. INTRODUCTION

In this annex, a review of the definition of energy taxation and the data gaps, as well as extended answers to the four policy questions included in the ToR, are presented; a summary thereof is included in Sections 5 and 6 of the Main text.

First, Sections C.2 and C.3 analyse the definition of energy gaps and the existing data gaps. This is preliminary to the subsequent policy analysis, since many of the features, issues and limitations of the energy tax indicators can be traced back to such a definition and the datasets. Then, in Section C.4 to C.7, the policy questions are answered and namely:

- whether and how existing indicators measure the extent to which public budgets rely on energy taxation as a means of ***revenue generation*** (in Section C.4);
- the methodologies to calculate ***implicit and effective tax rates*** for the economy as a whole, at the sectoral level, and for the various fuels and types of activity (in Section C.5);
- whether and to what extent consistent indicators on ***carbon pricing*** exists, and how they are related to energy tax policies (in Section C.6);
- whether and to what extent the current information base and indicators allow assessing ***coherence*** of energy tax policies with other EU goals, such as in the areas of energy efficiency, energy security, and pollution reduction (in Section C.7)

Finally, the main salient features of existing datasets will be reviewed in Section C.8.

C.2. THE MEANING OF ENERGY TAXATION

Introduction. This section will review the rationale behind the inclusion of taxes within the scope of energy taxation. First the basic principles behind the current classification are outlined. Then the scope of energy taxes is reviewed in more detail, and finally the relation between energy and carbon taxes is described, together with the existing limitations in how ETS revenue data are recorded for national accounting purposes.

C.2.1. The Official Statistical Definition of Energy Taxation Revenues

Regulatory Environment. Energy taxation has been defined as one of the four subcategories of environmental taxation, together with transport, pollution and resource taxes. Since 2011 statistics on environmental taxation revenues have been enshrined in EU Regulation 691/2011[60]. This has sanctioned two main principles, also agreed at the UN level for statistical and national accounting purposes, and namely:

- first, an ***energy tax is defined as a tax whose tax base has a negative impact on the environment***[61]. There is no requirement, however, that the tax base should be specifically expressed in terms of sources of environmental pressure (e.g. emissions, pollutants). Different proxies of related inputs or outputs (fuel consumption, etc.) can be used instead. So, the achievement of

[60] Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts, OJ L 192, 22.7.2011, p. 1–16; hereinafter "Regulation (EU) No 691/2011".

[61] It is considered an environmental tax whatever tax is earmarked for an environmental purpose irrespective of its tax base. This second criterion, however, has had so far limited practical consequences.

environmental objectives depend on a number of intuitive but implicit assumptions on how the tax base is supposed to trigger a potential environmental impact.

- secondly, to ensure to the highest extent possible comparability with the European system of national and regional accounts (ESA), a ***tax is considered as such whenever it is so classified for ESA purposes in the national accounts***. This means, notably, that government finance statistics can certainly be used as a major source of information for data gathering and classification, but, as a rule, tax data reported under the ESA will prevail as the main source of information. As will be seen, this is not without major consequences in terms of data comparability.

Implementation details of this Regulation have then been spelled out in Eurostat guidelines[62] (hereinafter indicated as the guidelines) drafted in collaboration with DG TAXUD and the OECD. The latest version of these guidelines dates back to 2013[63].

Pigouvian Rationale. The criterion to define a tax as environmental is the pass-through impact on ***the relative prices of the tax base for consumers***. This is an *a priori assumption* to identify eligible taxes, but has nothing to do with the possibility that in reality the tax is passed backwards to energy producers (e.g. OPEC countries) and has little or no impact on prices[64]. If ***pass-forward to consumers is assumed by definition***, the size of related environmental benefits would, therefore, depend on price elasticities of the tax base considered and on how this ultimately interacts with the underlying factor of environmental pressure. The missing link is that since there is no such thing as a ***consumer index of energy prices***, so there cannot be an indicator of how much energy taxation is actually passed-forward onto consumers and therefore contributes to increases in prices and reduction in consumption. A full pass-through and a stable level of industrial prices are implicitly taken for granted in the current definition, which can be misleading in certain circumstances or for certain policymaking purposes.

The impact of taxation on the underlying factors of environmental pressure can be assessed from two different perspectives that can confound the meaning of the underlying indicators. In economic terms energy taxation can be seen either as a way to pay for ***environmental externalities*** of energy consumption, or it can represent an environmental policy tool to help change consumers' behaviours and favour ***product substitution*** e.g. with renewables. In the first case taxation is fair when it pays for all related externalities. In the second one, taxation is effective when consumption habits change. In the economic jargon this is tantamount to say that taxes can be used to achieve a certain level of Pigouvian prices, at which externalities are paid for, or as a component of the Baumol prices required to reach a certain level of environmental objectives. Consequences on revenue raising may also differ (see Box 1 below). and also related indicators should be read differently.

Box 1 The Tension between General and Environmental Taxation Objectives

Taxes are primarily aimed to raise revenue for the Government budget. To minimise distortion of economic activities and maximise taxation efficiency whenever there is the risk of a substantial informal economy, fuel excises have been introduced since the first World War as proxies for optimal consumption taxes. This is because the consumption of their tax bases is relatively inelastic to price and so are poorly distortive of the economy. The final objective of environmental taxation, instead, is conversely to purposefully distort economic activities towards a given goal

[62] Regulation (EU) No 691/2011.

[63] Eurostat, Environmental taxes. A statistical guide. 2013 Edition, Eurostat manuals and guidelines, Publications Office of the European Union, Luxembourg, 2013. https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-13-005.

[64] There is awareness in policymaking about this possibility and equalisation tax rates that vary based on a reference benchmark in the price of raw oil (e.g. West Ural§§) have been proposed, This misalignment between definitory and actual impact on prices has given rise to the still controversial concept of a possible externality caused by fluctuations in international energy prices, that energy taxation should further compensate for (see section C.7).

and seek a large environmental benefit. Price elasticities should then preferably be high because this means that consumption behaviour will rapidly change and therefore the tax base and related tax revenues will rapidly shrink, which is exactly the opposite of optimal taxation principles and the rationale behind introducing excises in the first place. In other words, those rapid technological advances in energy efficiency of carbon-free sources and in renewable energy generation that a high carbon tax rate would seek to promote would make the related tax revenues uncertain and eventually erode the tax base itself. So, there is an inverse relation between the revenues gathered by the tax and its success in achieving the intended environmental objective. This makes comparisons with GDP ambiguous. The higher the revenues from a carbon tax are, the less this has managed to foster the very same technological innovation and Porter effects it was intended to do as a rationale behind its introduction. Pigouvian taxation principles are an ex post rationalisation of energy excises, considered environmental taxes that would be justified to the extent they pay for related underlying externalities. However, the definition of environmental taxes does not require defining which externalities these taxes are supposed to compensate for. A debate has arisen on the criteria for the identification of these externalities, i.e. whether linked to policymakers' intentions or based on other criteria (e.g. proportionality) including the effects of taxation in terms of impacts on consumer behaviour.

Actually, fair Pigouvian prices can be difficult to estimate because tax bases (e.g. fuels) can have several impacts on different externalities (e.g. congestion, noise, air pollution, road accidents, carbon emissions, sulphur pollution, etc.) together with many other different taxes and attribution problems may then arise, and even more so comparatively. This is an inevitable constraint in defining and comparing tax rates to compensate for the cost of externalities. Since concrete impact on environmental pressure is mediated by the different incentive mechanisms conveyed by how tax rates are defined, ***the externality can be clearly identified when it represents the tax base itself*** (e.g. carbon content, congestion fees) or by earmarking practices. Otherwise, as a rule, the cost of which externality any given tax is aimed to internalise, if any, remains untold and largely speculative. In the current definition of environmental (and therefore energy) taxation there is no reference whatsoever to the specific motivation behind taxation or link with the definition of the tax base and the design of the underlying tax rate, although this has not always been easily accepted by all Member States and some still have reservations particularly as far as excises are concerned[65].

Limits. The scope of this official definition of energy taxation only partly fits with a number of possible policy information needs, including: 1) overall taxation from the viewpoint of the taxpayer (the so-called tax burden); 2) taxation as a tool to generate net revenues for the general budget 3) taxation as a tool to reduce carbon emissions, 4) and finally all the aspects unrelated to environmental damage, as for instance energy security, energy poverty or affordability. The sheer definition of energy taxation has been increasingly challenged. For instance, since taxes aimed at reducing carbon emissions cut through different environmental taxation categories, the OECD has been working on the new analytical category of climate change taxation to complement that of energy taxation considered already analytically outdated and unable to capture new trade-offs. Another limit of the current definition is that since the concept of environmental taxation was simply superimposed on existing energy taxes, the guidelines remain ambiguous on ***taxation of energy products providing environmental benefits***. Member States may identify the revenues from taxing

[65] So, for instance, for the UK to be considered as environmental a tax had: *1) to be explicitly linked to the government's environmental objectives; 2) the primary objective of encouraging environmentally positive behavioural changes; 3) to be structured in relation to environmental objectives and follow proportionality principles*. Based on these criteria excises on petrol and diesel, for example, were not categorised as energy taxes from an environmental perspective, because their revenue raising purpose was considered as prevalent vis-à-vis other possible behavioural change-related objectives. Also, in Norway there was a debate on distinguishing between environmental taxation, which are only Pigouvian taxes with an environmental goal, and environmentally related taxes, a term which refers to the taxes with an environmentally relevant tax base. It was found that the revenues from environmental taxation (in the strict sense) were only one fifth of the revenues using the tax base-definition. Bruvoll, A., On the measurement of environmental taxes, Statistics Norway, Discussion Papers No. 22, 2009.

renewable sources or biofuels where they deem this feasible and if they so wish, but the matter is left to their total discretion and national practices can vary in this respect. The guidelines do not mandate any distinction between taxation of carbon-free energy sources as nuclear taxes or taxes on hydropower either.

C.2.2. The List of Energy Taxes

Scope. A list of what could be considered as an *"energy tax"* was agreed already back in 1997 by Eurostat, DG TAXUD, the OECD and the International Energy Agency (IEA). This list has been slightly updated in 2011 and 2012 to take into consideration the Emission Trading System (ETS). ***It currently includes five main categories of taxes*** that have been variously accepted in the common practice: 1) taxes on transport fuels i.e. energy products for transport purposes – that are universally accepted as such; 2) taxes on fuels for heating and stationary energy purposes that also create little problems; 3) taxes on electricity can be misreported because of the difficulties related to distinguish them from RES charges; 4) carbon taxes, as well as 5) revenues from ETS that can also be misunderstood or not assimilated to energy taxes, because their tax base is different and closer to pollution taxes and are not even necessarily related to energy production. This definition still creates some confusion in Member States' reporting practices and until recently was not universally adopted by all indicator producers. It is only with the new edition of its energy taxation revenue statistics that the OECD has included ETS revenues in its energy taxation database.

Carbon taxes are conventionally considered as energy taxes mainly because they have been used as substitutes for them. For practical reasons taxation is, in fact, based on the carbon content of energy products irrespective of concrete emissions. This is because for most refined fuels or natural gas the carbon content is a given and CO_2 emissions are essentially invariant to how the fuel is burnt. The carbon content of coal and peat is more variable and reference to a benchmark can give rise to some minimum arbitrage between sources. Although motivated by practical considerations, recourse to carbon content instead of emissions is not entirely policy neutral. Different fuels can be characterised by different carbon emission profiles when assessed with reference to their lifetime use. This includes so called indirect well to tank emissions resulting from fuel processing and distribution. This has led Finland to move its carbon taxing base from objective carbon content to study-based estimated lifetime emissions. Moreover, in the long run, carbon capture technologies are not incentivised as a way to reduce the tax base, as conversely happens with taxes on pollutants strictly speaking, or the ETS.

What is included in the list of energy taxes is therefore a group of taxes ***largely dominated across the EU by excises on fossil fuels***, which still account for the bulk of energy taxation revenues. This is followed by electricity where, on the contrary, the bulk of the energy-related tax burden is usually represented by VAT and RES charges that remain outside the current scope of the official definition of energy taxation, and carbon taxes where these have been implemented, of which the ETS has represented so far a relatively small share, although bound to increase in the future if the Paris pledges are to be met. All the remaining energy taxes are composed of a plethora of specific production taxes generating very little revenue. Moreover, while the tax bases and design of energy taxes and ETS is relatively homogenous between Member States, carbon taxes can have slightly different designs, scope and the related carbon price can greatly vary. Remaining energy taxes cover a totally inhomogeneous plethora of possible tax bases and are charged for different reasons.

Tax Identification Criteria. The identification of energy taxes remains based on ESN SEEA definitions as implemented in the ESA 2010 guidelines, which suit the original aim of general taxation policy: to identify sources of net revenues for the Government[66] and

[66] It differs from a charge as this is requested to specifically cover the cost of a service provided by Government. Resource rent taxes are taxes for the exploitation of Government property (e.g. mining, subsoil, wood, etc.)

follow the same accrual-based accounting rules. So, ***a tax is distinguished by a charge or a fee based on the proportionality principle***[67]. So, when RES financing is funded by means of dedicated fees and off-budget mechanisms, these should not be considered as a component of energy taxation, provided they are strictly proportional to refund the cost of the service, which can make the distinction blurred in practical terms. If the same incentives are paid by means of general taxation or indirectly funded by raising energy taxes including on electricity, they would be included in the scope of general and energy taxation respectively. The same ambiguity can characterise taxes or fees levied on public service obligations or strategic stockpiling.

Energy Production Taxes. Once a product has been identified in the list of tax bases (e.g. electricity), then all taxes that could increase its price either directly (e.g. taxes on imports) or – at least in theory - indirectly (e.g. taxes on inputs or on assets used to produce or distribute electricity) are also considered as energy taxes, provided that they are specific to the activity concerned. A pass-through effect on prices is therefore again presumed. So, ***indirect taxes on production factors*** such as taxes on nuclear fuels or on nuclear power stations or on hydropower water or on electric pylons, just to mention examples in different Member States, have been considered as energy taxes although their link with related externalities can be complex and not straightforward (see Box 2 below). This, however, does not extend as far as to cover *ad hoc* profit taxes, so for instance the recent Latvian tax on extra profits from RES does not qualify as an energy tax. The current Eurostat guidelines ***recommend excluding all these profit taxes from energy taxation***. The rationale behind is that they have a distant and uncertain effect on the volume or price of the underlying tax base(s), as they might not translate into price increases for the final users, which would at any rate be difficult to demonstrate. So, they are conventionally assumed to have no such effect and remain outside the scope of energy taxation, although national classification practices vary also in this respect and there have been cases of seemingly profit taxes classified as energy ones (see appendix to section C.8).

Box 2 The Complex Relations Between Taxes on Inputs and Externalities

The link between the tax base of taxes on inputs and the environmental benefit however is not immediately straightforward and can even give conflicting results when multiple environmental objectives are there. This well illustrates the difficulties that can arise when taxes are translated in terms of externalities as will be seen later for corrective tax rates and negative implicit carbon prices[68]. A tax on nuclear energy can be justified by the environmental externalities of nuclear energy but can be counterproductive to reduce GHG emissions. Taxes on electrical pylons or hydropower water can be justified by the nature conservation perspective or to preserve landscapes, but make little sense if the objective is to reduce GHG emissions, and so on.

C.2.3. Taxes on Greenhouse Gases

GHG Taxes. Out of analogy with carbon taxes on fuels, ***all taxes on GHG non-fuel related emissions have been considered by the Eurostat guidelines as carbon and therefore energy taxes***. This has created some confusion with the classification

[67] Proportionality principles underlie the OECD definition according to which a tax covers *any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular relevance. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments and not directly related to the discretionary provision of a service* (OECD, 2001). Conversely, the terms charges and fees are commonly used to cover compulsory payments general government that are "commensurate" to pay or reimburse the service provided. Levy is a more general term covering taxes as well as charges and fees.

[68] The World Bank subscribes to the IMF definition of energy subsidies and defines as a negative implicit carbon price the difference between the actual tax rate of fossil fuels and their corrective tax rate, when the second is larger than the first. For the sake of simplicity, it therefore attributes all the difference to insufficient carbon pricing.

of taxation of emissions of fluorinated gases[69]. A proposal has been formulated by the OECD to reclassify these as pollution taxes by means of an internal tax reclassification scheme. The same confusion can also be found with taxes on indirect greenhouse gases such as nitrogen oxides (NO_X)[70], particulate matter (PM) and sulphur oxides (SO_X)[71] that should be classified as pollution taxes even if they often result from energy-related combustions and may contribute to raise energy prices. The OECD has also proposed in to reclassify ***taxes on pollutant emissions to air as a subcategory of pollution taxes***.

In parallel, ***not all taxes aimed at curbing greenhouse gases are classified as energy taxes***. Here the additional principle of commensurability of taxation to emissions apply to distinguish carbon taxation as energy taxes from other types of taxes. For instance, in a number of Member States vehicles can be taxed based on their specific CO_2 emissions by means of one-off registration or annual taxes on vehicles. So, taxation of vehicle ownership remains the main tax base. As long as all these taxes are not commensurate to actual CO_2 emissions from concrete use these are considered as transport taxes and not as greenhouse gas or energy taxes. Similarly, congestion charges or city tolls that are aimed at indirectly reducing air pollution together with their main impact on traffic, can be treated differently from Member State to Member State, but are eventually considered as transport taxes and not as pollution taxes.

ETS. ETS differs from carbon taxes, as is priced in principle on ***actual carbon emissions and not on carbon content*** although in practice the distinction can be more blurred[72] Revenues are classified as energy taxes out of analogy with carbon taxes (an analogy not accepted by all Member States), although also their scope does not coincide with energy combustion. There are several industries where a substantial share of GHG emissions are process-related rather than combustion-related (e.g. cement, lime, glass, ammonia). Process emissions also cover waste gases that are a source of energy for IEA. Also, in this case the OECD has proposed reclassifying revenues from ETS between energy-related that will remain as a part of energy taxation and process-related ones that will be moved under pollution taxation. ETS pricing affects energy production midstream into the production process mainly as far as fuels used for electricity production are concerned, and these represents the bulk of ETS emissions, and, more marginally, in refining and processing of oil and natural gas in refineries (5% of GHG). Although the size of the pass-through might vary based on the features of the underlying markets,[73] it is assumed as a full 100% one.

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[69] The Spanish carbon tax applies to fluorinated GHG emissions (HFCs, PFCs, and SF6) only and should be considered under all regards a "carbon tax" because it targets GHG gases and is included as such in the World Bank Carbon Price Dashboard. Nevertheless, it remains classified as a pollution tax in the NTL database.

[70] Nitrous oxide emissions from the production of certain acids and emissions of perfluorocarbons from aluminium production are also included in the ETS mechanism. These sources however typically account for less than 2% of the total covered emissions. It would not be possible to tax N20 based on content, as emissions depend on the combustion process.

[71] Sulphur dioxide is actually not a 'normal' greenhouse gas (GHG), but rather an aerosol that raises the Earth's albedo and actually contributes to atmospheric cooling. Today, the largest industrial emitters of SO_2 are coal burning power plants. SO_2 taxes can represent a special case of energy taxes whenever they consist in a specification of a fuel tax rate based on the sulphur content. There is no incentive to reduce emissions at the user's level, but upstream in the refining process.

[72] In fact, under the ETS, carbon emissions are *de facto* assessed by applying pre-determining GHG conversion factors to fuel consumption. Therefore, the estimates of carbon emissions start from agreed-upon protocols identifying the share of the carbon content of the fuel input which remains 'embedded' into the industrial output or sequestered (and thus not emitted). There is therefore a strong relation between assessed emissions and carbon content.

[73] For instance, in the field of electricity, numerous studies have investigated the pass-on rates from power producers of the carbon shadow-costs. The most pessimistic studies assume a 100% pass-on rate, comes to a figure of 10 euro/MWh for a 20 euro/tCO_2eq allowance price. However,

ETS revenues are recorded in the national accounts in a very peculiar way. After several years of discussions and open disagreements within the International Standards Working Group for National Accounts (ISWGNA) of the UN Statistical Commission that eventually finalised its position in 2011,[74] ETS revenues have been considered as ***non-recurrent taxes – i.e. taxes levied each time goods are used***. To comply with accrual recording principles, related revenues should therefore be recorded at the time the emissions occur and the allowance is surrendered. No revenue is obviously to be recorded for EUA that governments issue free of charge, but there is a need to take free allowances into account when determining the amount of revenues to be recorded under the accrual principle, as both allowances issued for free and those issues under the auctions will be surrendered for the emissions recorded. Also, a delay usually occurs between when the allowances are introduced in the market (through auction or for free), the moment the emission ensues, and the moment when the allowance is surrendered. The price of allowances can vary in the meantime. Moreover, the auction revenues may arise in one country, but the allowances be surrendered for emissions in another country, resulting in discrepancies to the adjustments needed to match the accruals and the territoriality principle. In the absence of precise information on each individual allowance (original seller, sale price and exact time and place of surrender), some simplifying assumptions are used where tax revenue is determined based on the number of allowances surrendered in a year, multiplied by the average price of the stock of allowances issued (considering both the allowances auctioned and those issued for free).

Most importantly from the EU viewpoint, as the ETS is a shared mechanism, there is an intra-EU trade component[75] that is also accounted for in a simplified way to comply with the territoriality principle. The 2011 international guidance ***allows ignoring the difference between ETS allowances auctioned and surrendered when the first amount is lower than the second***. This corresponds to the case where residents buy ETS allowances issued from foreign governments for the extra allowances they use. In this case, *"taxes"* paid to foreign governments are not recorded as such. So, at the Member State level revenues for auctioning Governments are correct, but the "tax" burden for residents is underestimated. Conversely, when the amount issued is higher than that surrendered, the difference should be written off. The resulting record is correct from the point of view of the costs borne by residents, but underestimates the revenue for Government, because some of the payments actually received for allowances are not recorded as taxation revenues. This is due to the fact that these are recorded as taxes on production paid by non-residents on production factors abroad and therefore do not comply with the ESN and ESA 2010 territoriality principle, but they remain income for Government all the same. This admittedly suboptimal compromise was also justified by the fact that, at that time, most EUAs were released for free and

several studies show that the pass-on rate will be 100% only during the time where power demand exceeds the baseload and a fossil fuel plant sets the marginal price. In those periods where non-carbon energy carriers set the marginal price in the electricity market, it is not likely that power operators will be able to factor in the value of the certificates. One study for Germany and the Netherlands hence comes to a pass-on rate of 40-60 %. The International Energy Agency (IEA) points to the Nordic electricity market (Nordpool) as one region where electricity trade has been successfully liberalised and where pass-on of ETS costs should be expected. One Finnish study concludes that due to the significance of hydro and nuclear power in Nordpool the average pass-on rate should be in the region of 40%, e.g. 4 euro/MWh for a 20-euro allowance price. See Prof. Mikael Skou Andersen, *Europe's experience with carbon-energy taxation,* Sapiens, Vol. 3, No. 2, 2010: https://journals.openedition.org/sapiens/1072.

[74] For a detailed review of the debate at that time see OECD, *Revenue Statistics*, 2012.

[75] At present 90% of the allowances auctioned are distributed to the EU Member States according to their share of verified emissions, and the remaining 10% are allocated for solidarity purposes to those with the lower GDP per capita. Also, the allocation of free permits is not homogeneous across sectors of activity, such that the geographical distribution of free allowances diverges from the geographical distribution of auctioned allowances. Since both free and auctioned allowances can be bought abroad this means that the amount of revenues attributed to one country may differ from the amount surrendered to that country because of intra-EU trading of allowances.

the issue of estimating the international flows of allowances within the ETS was deemed too complex to justify the effort in terms of their financial significance.

However, the amount of ETS auction revenues has been increasing rapidly, and related distortion in data reporting has become more apparent. It is unclear at this stage whether a revision of the UN recommendation ***to better reflect how the EU ETS really works*** in the light of its growing importance as a source of both revenues and costs is in the process of being discussed within the UNSC, as the issue has not ranked high as a priority in the past. Table 2 overleaf reports the way Member States record their revenues from ETS for energy taxation purposes and evidence from auction cash flow records. At times, the full proceeds from auctions in a given financial year are indicated. Alternatively, in the majority of cases the figures reported are always lower. This is likely to depend on compliance with the territoriality principle, but other reasons including diverging accounting practices, cannot be ruled out.

In fact, to further complicate things, a couple of Member States used not to separately report their revenues from ETS in their national tax lists as energy taxes, and include them ***in other tax categories not even classified as energy taxes***[76]. This aspect has greatly improved and the revenues from ETS are now separately reported in the NTL and labelled appropriately (with the exception of Greece). All in all, this peculiar accounting procedure allows to ignore the international trade dimension and get rid of the related territoriality problem with taxes paid to Governments unrelated to where the *"emission good"* is used, but distorts the possible calculation of both taxation revenues and implicit tax rates both nationally and, in particular, at the different NACE sector level. While awareness about the issue is limited, its salience is bound to grow in the near future, as revenues from auctions and intra-EU trade of EUA are also expected to increase, because free allocation of allowances has decreased from 60% of the total before 2013 - when the share to be auctioned was decided by each Member State- to some 43% in the third period 2013-2020, when almost 100% of the allowances issued to power generators had to be auctioned, and the amounts to be auctioned to the remaining sectors was set to increase over time. This is particularly so, as the unit price of EUA has been boosted by the reserve mechanism and increased cap reduction rates.

As can be seen from the Table 2 below, unrecorded revenues in the statistical accounts have increased from € 3.7 bn in 2017 to € 10 bn in 2018 EU-wide, i.e. ***some. 4% of total energy taxation revenues EU-wide***. There is, moreover, some evidence that Member States consider for their internal budgeting purposes revenues from auctions as expendable items in the year they are raised and fund related expenditure accordingly and do not wait for their nominal debt to expire with the surrendering of the EUA, which further casts doubts on the policy significance of these statistical data. This is even more so, because irrespective of whether revenues come from residents or non-residents, the revised EU ETS Directive provides that at least 50 % of auctioning income should be earmarked for climate and energy-related purposes, but this share can actually be much higher depending on the national circumstances, and funds appear to be allocated accordingly in the national budgets as regularly monitored by the EEA.

Table 2: Differences between Proceeds from ETS Reported for National Accounting Purposes and Revenues from ETS Auctions in the Same Year – in Mn €

MS	Definition in the NTL	2017		2018		% Difference 2017	% Difference 2018
		Eurostat	DG CLIMA	Eurostat	DG CLIMA		
AT	Emission trading allowances	63.3	79.4	151.2	210.4	-20.3%	-28.1%
BE	Emission permits	112.4	144.3	193.4	381.5	-22.1%	-49.3%
BG	The revenue of emission trading permits	127.1	130.4	308.3	368.2	-2.5%	-16.3%
HR	Emission permits	22.7	27.2	36.7	71.5	-16.5%	-48.7%
CY	ETS Permits	6.5	6.6	26.0	26.0	-1.5%	0.0%

[76] Not all Member States accept, in line of principle, that ETS revenues should be considered as energy taxes and therefore have reservations on their statistical classification.

CZ	Tax on Emission Allowances	198.3	199.8	582.3	584.4	-0.8%	-0.4%
DK	Carbon dioxide emission tax	54.4	71.7	189.8	189.8	-24.1%	0.0%
EE	Revenue from the sale of emission permits	23.6	39.4	39.4	140.0	-40.1%	-71.9%
FI	Income from auction of emission allowances	75.0	95.3	113.0	251.8	-21.3%	-55.1%
FR	Emission permits	235.0	313.4	314.0	829.6	-25.0%	-62.2%
DE	Emissionsberechtigungen	895.0	1,146.8	1,505.0	2,581.7	-22.0%	-41.7%
EL*	(not separately reported)	n.a.	198.0	n.a.	523.5	n.a.	n.a.
HU	Sale of emission allowances	64.1	85.2	82.8	225.4	-24.8%	-63.3%
IE	Carbon Credits	11.5	53.6	10.9	142.1	-78.5%	-92.3%
IT	Emission permits	549.0	549.7	1,454.0	1,453.3	-0.1%	0.0%
LV	Revenue from state-owned ETS permits auction	5.1	15.4	6.6	40.7	-66.9%	-83.8%
LT**	(not separately reported)	n.a.	31.5	n.a	80.4	n.a.	n.a.
LU	Emission permits	6.9	6.9	18.3	18.3	0.0%	0.0%
MT	Emission Trading Permits	3.7	6.0	8.9	15.7	-38.3%	-43.3%
NL	Emission permits	200.0	190.7	261.0	504.2	4.9%	-48.2%
PL	Emission allowances	138.1	506.0	498.4	1,211.6	-72.7%	-58.9%
PT	Carbon trading rights	103.1	100.3	217.7	265.6	2.8%	-18.0%
RO	Revenues from the sale of emission permits	260.4	260.8	496.6	719.1	-0.2%	-30.9%
SK	Emission permits	57.4	87.1	63.5	229.9	-34.1%	-72.4%
SI	Emission permits	33.6	25.1	66.7	66.3	33.9%	0.6%
ES	Allowances of GHG	452.0	493.6	723.0	1,306.0	-8.4%	-44.6%
SE	Emission trade permits	29.2	51.5	45.4	136.3	-43.3%	-66.7%
	TOTAL	**1,284**	**4,916**	**2,399**	**12,573**	***-73.9%***	***-80.9%***

Notes. *Some Member States recur to the ETS terminology and refer to allowances in their national tax list, while others use the statistical definition of emission permits that, strictly speaking, would have a different meaning, and refer to the permits to operate irrespective of the level of emissions.*
** Greece records ETS revenues among the other taxes related to pollution received by LAGIE.*
*** Lithuania reports ETS revenues among pollution taxes*
Source*. Eurostat data refer to National Tax Lists (tables 9 ESA 2010) - individual taxes, updated on 29 October 2019 available on Eurostat's website and on DG TAXUD's website; and DG CLIMA data refer to authors' calculation based on EUA Primary Auction Spot Report – History available on the European Energy Exchange (EEX) platform.*

C.3. MISSING DATA ON ENERGY TAXES AND CHARGES

Introduction. This section reviews in more detail the constraints that current energy taxation datasets create for other information needs. It will first describe alternative possible definitions of energy-related taxation to better identify net revenue transfer flows to Government in financial terms. It will then enter into more detail in the three more controversial subjects in the current definition of energy taxation, and namely VAT on energy taxes, oil and gas production taxes and RES charges, for which taxation revenue data are missing from the current datasets on both theoretical and feasibility grounds. Throughout the section issues of lack of correspondence between the scope of energy taxation and that of related energy subsidies will be highlighted.

C.3.1. Energy-related Taxation as Net Transfers to Government

Identification of Net Revenue Flows. A radically different approach to the definition of energy-related taxation has been followed in a study commissioned by the International Association of Oil and Gas Producers to press their case and counter the political arguments based on aggregated estimates of energy subsidies. The proposed methodology exclusively focuses on the net revenue flows dimension from the point of view of public finances to build the case that energy subsidies are more than compensated by energy-related taxation revenues. ***The purpose of the exercise is to subtract energy-related budgetary support and tax expenditure from all corresponding tax revenues to come to an estimate of net transfers to Government budgets***. In this one-to-one correspondence between the scope of taxes covered by subsidies and the related sources of tax revenues no consideration is given to and the benchmark to which subsidies are measured. Available aggregate estimates in monetary terms are simply compared to nominal revenue values. This, according to the authors, would make it possible to build reliable indicators for cross-sector, cross-fuel and cross-country comparisons. In practice, the approach is exactly the opposite to that followed in the statistical definition of energy taxation. It starts from the OECD classification of fossil fuel subsidies. From there, all related sources of Government revenues are identified and estimated, then net transfers are calculated based on the following algorithm (see Figure 1 below). Mandated transfers such as RES charges, that are effectively required by government policies, are deducted from the algorithm as a total, without considering direct contributions to, or demands on, government finances, because they are considered as financial costs for society.

Figure 1: Proposed Algorithm to Come to Net Financial Flows

Government Revenues: ▪ Upstream revenues: taxes, license fees, royalties, dividend payments, corporation tax revenues ▪ Corporation tax on midstream and downstream activities –e.g. energy transformation (power generation and refining), storage, transportation and retail ▪ Excise duties and other energy taxes ▪ Value added tax
(-) Government Expenditures: ▪ Upstream government expenditures – support to current production ▪ Government transfers for power generation, energy transport and storage ▪ Consumption support by means of tax expenditure (often to selected vulnerable groups – e.g. low-income households, SMEs or energy intensive industries) ▪ Government payments to cover historic liabilities (exclusively in coal industry –e.g. labour compensation)
(-) Mandated Transfers: ▪ Support schemes for renewable energy sources (e.g. FITs or renewable energy certificates)
= Total: ▪ Net transfers received from (provided to) each energy source

Source*. Authors elaboration from NERA Economic Consulting "Update on Energy Taxation and Subsidies in Europe: An Analysis of Government Revenues from and Support Measures for Fossil Fuels and Renewables in the EU and Norway"*

Related Indicators. The study above produced only aggregate indicators for the EU and Norway that can be considered among that particular family of indicators, the ***revenue/cost net of subsidies indicators***, that in their implicit tax rate format would find some echo and be taken up in subsequent studies also for DG ENER.[77] To be able to produce their proposed indicators the authors, as all the others that followed a similar approach, had to develop their own proprietary dataset of energy-related taxation revenues, as well as of energy related tax expenditure. This has never been published with the partial exception of Romania and Bulgaria. They were forced to produce their own dataset, because it would not have been possible to carry out related calculations based on existing public ones. This is because taxation revenues from gas and oil production, as well as revenues from VAT on energy products are not included in official statistics and this creates major feasibility constraints. Also, the way mandated transfers such as RES are dealt with would cause some operational and feasibility problems.

C.3.2. VAT on Energy Products

Eurostat and SEEA Principles. The Eurostat environmental taxation guidelines are at a variance with the higher UN SEEA principles just on one facultative and debated point, namely the treatment of VAT. The UN SEEA 2012 guideline[78] proposes that ***the non-deductible part of VAT directly or indirectly charged on households as a surtax***

[77] See, for instance, Trinomics, Study on Energy Prices, Costs and Subsidies and their Impact on Industry and Households, Final Report, for DG ENER, European Commission, published in 2018; hereinafter "Trinomics (2018), for DG ENER".
[78] UNSD *et al*., System of environmental economic accounting 2012: central framework, United Nations, New York, 2014.

on energy taxes[79] ***could eventually be considered as a component of energy taxation***. This includes the VAT charged on fuel or electricity excises and on carbon taxes in Member States that have adopted them.[80] This was to ensure better data comparability with those Countries outside the EU that fail to include energy taxes within the tax base for VAT-equivalent taxes and therefore avoid double taxation, thus reducing the total tax burden on final energy prices. So, in the UN view, different components of the same VAT tax base could be dealt with differently and only the net price before other forms of indirect energy taxation should never be included within the scope of statistics on energy taxation. This is because if one follows the additional price criterion, the remains international consensus that accounting VAT *per se* does not represent a specific energy tax. Therefore, it would not influence the level of relative prices in the same way as environmental tax bases should do to be considered as such, except eventually for the part charged on energy taxes themselves.

Feasibility Constraints. At the EU level and for internal EU statistical purposes it was decided to ignore this UN-proposed facultative distinction, and rule out any VAT additional calculation also because, following the VAT Directive all Member States have to charge VAT on energy taxes so no major differences could be anticipated in comparative terms. This was due to prominently ***feasibility-related considerations*** that militated against embarking in the exercise. VAT revenues would have to be estimated using information on VAT rates combined with market estimates on the total sales of the different energy products, while both excise exemptions and VAT concessional rates should have been considered. This would have been difficult and labour-intensive and would have required substantial data gathering on energy prices and consumption data at a more detailed level of granularity than currently reported in the Energy Balances (e.g. by type of gasoline or diesel fuel).

The estimated revenue from this non-deductible part was deemed too small to be worth the effort. If carbon and energy taxation should substantially increase in the future, the argument about the irrelevance of VAT surcharges would appear increasingly questionable. When energy taxes already represent a major share of prices this choice has already proven unsuitable to policymakers' information needs. A study[81] recently carried out for DG MOVE has felt the need to include also non-deductible VAT on fuel excises in its estimate of transport-related taxes. To do that consultants had to recur to their own dataset and estimates, as related data were not available from public sources.

VAT Subsidies. The same differential price principle is extensively applied from the point of view of subsidies and considered as a form of tax expenditure. In fact, concessional VAT rates have been extensively used as instruments to decrease energy costs for households instead of regulated prices.[82] Concessional VAT rates for households variously apply to electricity and natural gas for 15 Member States out of 27, and can be available for other heating fuels. Related tax expenditure can be substantial also in macro-economic terms[83] and have a major impact on the effective

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[79] Out of analogy one would conclude that the VAT on ETS certificates that almost unanimously the VAT Committee has deemed due for both ETS certificate emissions (IT does not) and transactions - should be considered as a component of environmental taxation to the extent that they are conventionally assumed to have a pass-through effect on final prices.
[80] So far ten Member States have introduced a carbon tax in their legislation. Its scope in terms of coverage of carbon emissions, however, hugely varies from some 3% of the total to some 50%. Their year of first implementation ranges from 1990 to 2015. https://taxfoundation.org/carbon-taxes-in-europe-2019/
[81] See DG MOVE, Transport taxes and charges in Europe. An overview study of economic internalisation measures applied in Europe, European Commission Directorate-General for Mobility and Transport, Publications Office of the European Union, Luxembourg, 2019.
[82] See Trinomics (2018), for DG ENER.
[83] In the past, when it was a Member State, in the UK all fuel and power for households' domestic use, i.e. heating and electricity, had a reduced VAT rate of 5%, clearly well below the standard rate first of 17.5% then of 20%. Actually, the foregone tax revenue was estimated equivalent to as high as 0.25% of GDP.

tax rates of the consumers concerned. Moreover, they are currently considered as ex post tax subsidies by the IMF in their estimates of subsidies. In their current calculation of these ex post subsidies ***the IMF considers the VAT difference on the industrial price*** only and deem it unfeasible to track VAT on final consumption prices worldwide although this may cause issues with global data comparability.

C.3.3. Taxes on Oil and Gas Production

Reasons for Exclusion. The Eurostat guidelines recommend that ***taxes on oil and gas production should be excluded from energy taxation statistics***. Irrespective of any consideration on whether any such thing like a pass-through on final prices can be assumed to be in place and therefore these taxes can be deemed to exert any environmental impact on final consumption, this is also mainly because of practical reasons: (i) the revenue from these taxes is significant in just a few Member States so that comparison for benchmarking purposes would be distorted by these usually large sources of fiscal revenues; (ii) the mechanisms in place to capture the extraction rent can substantially vary from Member States to Member States also due to government ownership of oil and gas production companies, so that the amounts of taxes paid in this area might not be really representative and comparable but simply reflect different ownership systems; iii) tax revenue from oil and gas production can be fairly volatile over time, as it follows the prices of oil and gas. This would distort time series and the identification of underlying trends.

However, the OECD in its recent reclassification of environmental taxes has opted to include both oil and gas production taxes and taxes on mining (as part of the broader category of resource rent taxes) as memo items to allow comparisons of orders of magnitude with the more traditional categories and allow an appreciation of possible impact of decarbonization on Government budgets in terms of net revenue flows.

Related Subsidies. These classification principles are not necessarily ***consistent when assessed from the perspective of energy subsidies***[84], because in the area of resource taxation, subsidies are usually recorded as such. The magnitude of this tax expenditure will obviously depend on the volume of energy production in each country. IMF data show very small pre-tax subsidies in the EU, although with some exceptions in Countries characterised by coal mining. In the past it was estimated that in Germany, before coal production was discontinued, coal subsidies could be worth up 0.01% of GDP.[85]

C.3.4. Quasi Fiscal Measures and Renewable Energy Incentives

Reasons for Exclusion. Quasi fiscal measures and renewable energy incentives are ***not within the scope of energy taxation, as they do not usually represent taxes but charges according to the proportionality principle***[86]. This is irrespective of the fact that earmarking for environmental purposes would qualify them as environmental taxes. In the field of electricity there can be two types of RES charges[87]. One to compensate energy producers for the additional cost of producing renewables when compared to prevailing electricity market prices and one to compensate the network

[84] Even the ETD so far has had specific energy excise exemptions for fossil fuels used in the production process in coal mining, oil extraction, refineries, etc. as a way to subsidise these activities.
[85] OPEC, OECD, and World Bank *Analysis of the Scope of Energy Subsidies and Suggestions for the G20 Initiative,* Joint Report prepared for submission to the G-20 Summit Meeting Toronto (Canada), 26-27 June2010.
[86] To enable Member States to reach the renewable energy targets set by Directive 2009/28/EC (EU, 2009a) all possible support schemes can be used. These are defined as any instrument, scheme or mechanism promoting the use of RES.
[87] IEA in their statistics on energy prices and taxes has introduced a third category, and namely renewable taxes to pay for investment in RES. These are raised in Slovenia, Hungary and Luxembourg only.

operator for the inefficiencies that the intermittent supply of renewable energy sources may cause to the smooth operation of the grid. Not all Member States provide a separate calculation of these costs as components of network charges or clarify whether they are charged on consumers through RES charges, network charges or reimbursed by Government through taxation. Direct incentives to renewable energy producers can be calculated through different mechanisms that can be considered as off-budget even if the level of fees is decided by Government with some discretionary power and exemptions and rebates defined as if they were taxes, as it can frequently happen with large industrial users. The Eurostat guidelines fully acknowledge that from a purely fiscal policy viewpoint the additional price for consumers, the revenues for producers and the effects for the environment are identical under these different schemes even if they are nominally devised as taxes for RES investments. Conceptually, one could consider that when a law results in higher prices than would otherwise be paid, the resulting transaction could be classified into a 'normal payment', and an imputed tax paid by the buyer and an imputed subsidy received by the seller, although this can cause calculation difficulties in some possible schemes.

Feasibility Constraints. To simplify complicated assessments and relieve feasibility constraints on subsidy calculation, ***the Eurostat guidelines have recommended being very restrictive about imputing renewable energy incentives as energy taxes***. These off-budget incentives should be incompatible with the rationale behind carbon taxation (see section 8). In fact, Member States that do finance RES in full or in part through general taxation (FR, FI, DK, MT, LU) are usually Member States that have either introduced a carbon tax or extensively rely on energy taxes paid by non-residents. There can also be a parallel formal earmarking process. For instance, since January 2016, renewables support in France has fallen under the general State budget, through a dedicated purpose fund the financing of which is decided each year by the Parliament through the Finance Law. This is currently funded by internal taxes on fossil fuels. In other cases, the purpose of support is not so explicit. In the Czech Republic State budget funds are used to generically cover "operating support" for electricity, although a renewable energy source levy also exists.[88] Germany is reported to have extensively used energy taxation revenues to indirectly fund renewables, although a levy also exists.

Uneven Reporting. When it comes to reporting renewable energy "taxes", however, ***national data recording practices do apparently vary***, reportedly because of vertical consistency with previous national accounting principles. It may happen that an electricity excise tax whose surcharge is explicitly earmarked to finance renewable sources (e.g. SI) is not considered as an energy tax for NTL statistical purposes, maybe because the whole amount is transferred back to the national electricity company to finance renewables. But a fee expressly devoted to finance renewables apparently is, if directly paid to Government (HR). Then, if the excise tax is part of a broader tariff for system operation that also includes renewables, cogeneration and even coal plant subsidies, this is recorded as energy taxation (e.g. SK), possibly because renewables are no longer connected to the grid. Renewable energy fees bundled with electricity excises are also reported (IT). Finally, there can be federal states (e.g. BE), where green certificates to finance renewables are managed at the regional level and end up in regional surcharges on the price of electricity and are reported as environmental taxes.

Other Sources. As mentioned in the Box 3 below, together with the CEER Status Review of Renewable Support Schemes that represents one of the main sources of information on RES but ***depends on heterogeneous underlying methodologies for data estimate***, since 2017 there has been another EU statistical source to monitor

[88] The RES support scheme is financed in the Czech Republic by a combination of a surcharge levied on electricity consumers and contributions from general budget. In order to remedy past discrimination against foreign green electricity the Czech Republic has committed to investing also around €20 million in interconnection projects. The amount reflects the total surcharge previously levied on the estimated imports of green electricity in the Czech Republic in the period 2006 – 2015 to finance RES. https://ec.europa.eu/commission/presscorner/detail/en/IP_16_4083.

renewable energy charges while providing a breakdown of related price increases for household and non-household consumers. However, as Eurostat warned in its guidelines, the alternative "fiscal policy" approach of always considering RES surcharges as taxes is not without its own difficulties. The estimate of the renewables charges on households and businesses has appeared as far from trivial and fraught with difficulties so that data are still missing for the three largest renewables users.

Box 3 Other Statistical Sources of Information on RES

Statistics on prices of gas and electricity have been substantially strengthened in Commission Regulation 2016/1952. This was to improve the transparency and comparability of gas and electricity prices charged to industrial end-users and provide more reliable data on the fragmented household markets.[89] Detailed information on the taxation component of prices is gathered for each consumption band, although based on different categories than those in use for energy taxation. This includes carbon taxes, ETS and other air pollution taxes but no separate indication of electricity excises. Information taxes and charges as a component of price data are to be provided with separate reference to:

1. Value added tax.
2. Taxes, fees, levies or charges relating to the promotion of renewable energy sources, energy efficiency and CHP generation.
3. Taxes, fees, levies or charges relating to strategic stockpiles, capacity payments and energy security; taxes on natural gas distribution; stranded costs and levies on financing energy regulatory authorities or market and system operators.
4. Taxes, fees, levies or charges relating to air quality and for other environmental purposes; taxes on emissions of CO_2 or other GHG.
5. All other taxes, fees, levies or charges not covered by any of the previous four categories: support for district heating; local or regional fiscal charges; island compensation; concession fees relating to licenses and fees for the occupation of land and public or private property by networks or other devices.

The annual consumption volumes for each consumption band shall be transmitted once per year, together with the price data for the second semester. Experience so far, however, shows that these data are simply missing in some major Member States that account for the largest share of RES financing (DE,[90] IT,[91] ES) and for certain classes of consumption. Although these should represent consumption levies charged at the consumer level, there seemingly remain among national data providers different understandings of the contents of the different categories.

It is worth noting that as one additional possible form of support, Member States may currently apply total or partial excise exemptions or reductions to electricity generated by specified renewable sources and electricity produced from combined heat and power generation, if environmentally friendly - and these policy measures would impact on their effective rates of energy taxation and should be recorded as incentives to promote carbon-free energy and reduce air pollution. However, ***they are not necessarily recorded as such in the existing subsidy datasets.***

[89] The collection of natural gas and electricity prices for the household sector had been carried out on a voluntary basis since 1985. In 2013, this was in danger due to the absence of a legal basis and the reporting burden for gas and electricity enterprises. The May 2013 Energy Council requested an analysis of the composition and drivers of energy prices and costs with a focus on households, SMEs and energy-intensive industries. The Energy Union Package (Feb. 2015) called for the analysis of energy prices and costs to be published in 2016 and every two years thereafter. Reporting of natural gas and electricity prices for the household sector was made mandatory under the 2016 regulation.

[90] Germany got a derogation because at first the data collection moved from BDEW to the Federal Bureau of Statistics, that needed time to adapt to the new procedures. Secondly, to be legally enabled to execute the data collection by a state authority, there was the need to change the relevant law (*Preiststatistikgesetz*/Act on Price Statistics) which happened only in December 2019. Therefore, Germany did not submit data for 2017 and 2018.

[91] In this database, Italy accounts for renewables charges under the 'energy and supply' component.

C.4. ENERGY TAXATION AS A GENERATOR OF GOVERNMENT REVENUES

Introduction. This section reviews the problem of estimating the contribution of energy taxation to the generation of ***Government net revenues available for spending***. This will be assessed from the viewpoint of a possible strengthening of carbon taxation in a scenario where it is assumed that supply of fossil fuels is inelastic and therefore prices are not passed backwards to fossil fuel producers. It will first describe net revenue estimation from a static backward-looking perspective when taxes are fixed and in a dynamic forward looking perspective when they are increased or a new tax is introduced. This will lead to a review of the policy significance of current ET indicators both for their intended original conceptual uses, and to instrumentally assess revenue recycling policies - the so-called "double dividend" made eventually possible by a substantial increase in the revenues from carbon taxation. Indicators from studies recently appeared will be described and a preliminary assessment of related data gaps outlined.

C.4.1. Net Revenues from Energy Taxes

Revenue Estimation. Net revenue estimation from energy taxation from a purely fiscal perspective can be seen in static or in dynamic terms. From a static viewpoint most of the considerations already exposed above on the correspondence between revenues and related subsidies to come to net financial flows apply. From the point of view of Government - whatever the scope of energy taxation is - it is <u>net revenues</u> available for spending that matter. ***Energy taxation data only partially capture all relevant elements to make this estimate possible*** for different reasons that have been partly anticipated before and will be further elaborated in the Box 4 below which tackles the problem in a dynamic perspective.

Box 4 Dynamic Estimates of Net Revenues from Energy Taxes

The problems posed by the estimate of net revenues can be appreciated also in dynamic terms. Any increase in energy taxes can either result in an increase in prices paid by consumers or reduces prices and income for producers or actually any combination of the two depending on demand and supply elasticities. To simplify things, future net revenues for Government can be estimated based on two broadly equivalent extreme scenarios. In the first scenario all tax pass-through is assumed to be passed backward to producers within an economy. This is exactly the opposite effect assumed by the definition of energy taxation. Producers' income bears the cost of the tax because producers' prices decrease. This loss of income results in a tax-offset, as energy taxation reduces taxable incomes and related fiscal revenues. So the net revenue from energy taxation is given by the future nominal gross revenue from the tax itself minus the lost offset income taxation. The general level of prices is assumed to remain constant as tax is entirely passed backwards and what changes is just the relative level of prices of energy products. In the alternative approach all tax pass-through is assumed to be passed forward to consumers. This results in a general increase in the level of prices. Nominal income is not affected to the extent that it is assumed as indexed to the general level of prices. In this model it is families that consume a higher than average share of energy or carbon intensive goods in their basket who bear the tax. This is tantamount to the Pigouvian scenario where those who consume more polluting products in relative terms as compared to their total consumption pay the tax, but the general level of prices does increase. The problem with estimating subsidies to net off related revenues is that they are often calculated both as if there were no tax-offset and as if the general level of prices remained constant while both assumptions are mutually exclusive. For computational reasons, some Governments prefer calculating the offset,[92] but nothing hinders having recourse to an input-output table to estimate the increase in the general level of prices.

Statistical data on energy taxation revenues are net of tax subsidies on energy taxes themselves, but related income taxation values are lower than they could have been of an unknown amount if tax offset values are not calculated. So ***nominal revenues overestimate net real revenues for Government***. These tax offsetting effects

[92] For instance, US Office of Tax Analysis applies a 25% energy taxation offset, although it warned that since carbon-tax revenues are projected to be larger, a revision of the offset estimate may be warranted. US OTA, *Methodology for Analysing a Carbon Tax*, Working Paper 115, 2017.

depend on the magnitude of the impact on price variation on the economy and vary from Country to Country and possibly also with the size and nature of the tax increase. However, the assumption that the level of general prices remains fixed is hardly compatible with the pass-forward scenario underlying all energy taxation revenues definition and with an assessment at nominal value. The effect can be neglected as long as VAT concessional rates are granted in areas where underlying energy taxes are negligible. But if carbon taxation should increase revenue raising upstream and this is conventionally attributed pass-forward, without considering the parallel increase in the level of prices and energy taxation-dependent VAT revenues then there is an increased risk that estimates are misleading and poorly robust. Those who introduce elasticities in subsidy estimation use a combination of the two approaches. To further compound complexity we understand that some Member States have taken this into consideration and base all their calculations on a full pass-backwards methodology and estimate related subsidies accordingly for budgetary impact assessment of net energy tax revenues, which would create additional comparability problems. While discussions are ongoing to agree on a common methodology for estimating energy subsidies, no consensus is likely to be reached in the near future[93].

C.4.2. Aggregate Energy Taxation Indicators

Conceptual Use. Apart from grouping taxes under the common label of the Pigouvian theory of environmental taxation, ***there is little theoretical framework behind what the concept of aggregate environmental taxation should mean***. For net revenue calculation purposes aggregation would make sense only if the offset were the same for all the taxes included. The conceptual purpose of energy taxation indicators was to highlight either the generic "greening" of the taxation system or, as energy taxes are generally regressive because of income offsetting effects (or the relative weight of energy products in the consumption basket), "*an environmental reform of the national tax system where there is a shift of the burden of taxation from conventional taxes, for example on labour,*[94] *to environmentally damaging activities, such as energy use or pollution.*"[95] This can mean two different things: 1) other taxes are modulated to make energy taxation revenue neutral, 2) taxation revenues are recycled to compensate for or reinforce the likely distributional impacts of energy or carbon taxation.

Relevance. This generic "*greening of a (national) tax system*" has been mainly measured through two indicators: the revenues from energy taxation (ET) as a share of GDP, and the revenues from ET as a share of the total tax revenues (TR), variously inclusive of social security contributions. ***These are still the two reference indicators*** published respectively by Eurostat and DG TAXUD (in its Taxation Trends Report) to comment on the Member States energy tax systems. A separate similar ET/GDP indicator is also calculated by the OECD[96]. To highlight the importance of transport fuels on total energy taxation revenues DG TAXUD calculates separate indicators for them by extrapolating Excise Duty Tables (EDT) data as a basis for revenue calculation, although with limitations in data comparability across Member States. From the *greening reform* perspective, the ET/GDP ratio originally appeared a more robust indicator, because the TR benchmark could be distorted by the tax policy of a Country. Increasing energy taxation revenues was considered as a valuable objective *per se* and this would be better

[93] For a review of progress reached so far and the staged implementation of the programme in the next two years, see United Nations, *Measuring Fossil Fuel Subsidies in the Context of the Sustainable Development Goals*, 2019 https://wedocs.unep.org/bitstream/handle/20.500.11822/28111/FossilFuel.pdf?sequence=1&isAllowed=y.

[94] The EU Sustainable Development Strategy dating back from the early 2000 still recommends that Member States should shift taxation from labour to energy consumption and/or air pollution, to contribute to the EU goals of increasing employment and reducing negative environmental impacts in a cost-effective way.

[95] See, EEA, *Market-based Instruments for Environmental Policy in Europe*, 2005, p. 158.

[96] OECD are lower than the EU ones in a dozen of Member States for the reasons highlighted in the appendix to section 9.

captured with reference to the whole economy, rather than in mere relative budgetary terms. The ET/TR ratio could simply hide a decrease in other taxes. In reality, the two indicators are better appreciated in combination, as GDP growth can also be distorted by exogenous factors (e.g. Ireland). No indicator of ET per capita has ever been proposed or published. The IMF just publishes a parallel indicator on energy subsidies on a *per capita* basis.

Responsiveness. These ET indicators, however, have some limitations for a political use and are ***only partially responsive to their intended aim***. An increase in ET revenues does not always proceed from a *greening tax system*, or signal an ongoing environmental tax reform[97] either through the introduction of new taxes, or the increase in the existing tax rates. Aggregate ET revenues can simply result from an increase in the consumption of the underlying tax base due to decreases in industrial energy prices or rebound effects. The indicator is also only partly robust to assumptions on the total energy intensity of the underlying economy. Member States that historically have a legacy of energy-intensive industries may raise significant revenue from energy taxes and this does not have any particular environmental significance in comparative terms. All these limitations have represented one of the driving forces towards the creation of implicit/effective tax rates that are already normalised by energy consumption levels.

Ambiguity. The indicators can become ***more ambiguous when renewables are not taxed or when the tax base used for environmental action shifts***.[98]. The trend towards clean energy tax preferences in other non-energy related tax bases (e.g. taxes on carbon emissions for vehicles) represents actually one of the driving forces behind the OECD search for new tax classification schemes.[99] Most importantly, fiscal incentives to product substitution by exempting renewables or biomasses, as the Swedish example reported in the Box 5 overleaf demonstrates, result in the indicators actually decreasing rather than increasing. Opinions can vary on the feasibility of the approach in different national contexts, depending of the size of the price gap to be bridged by the tax. So, recent studies and environmental reviews to reduce carbon emissions for certain typologies of consumption, notably heating, have concluded that with present technological constraints the contribution of energy taxation reform would be minimal in certain Countries.[100] Others, more extensively relying on district heating, can find carbon taxation as worth trying as the recent German example shows.

Box 5 Trends in Aggregate Energy Taxation Revenues in Sweden

Sweden has access to sizeable renewable energy sources from forestry as well as to low-carbon nuclear electricity. Natural gas only plays a marginal role as source of energy. After the oil crises the Country has heavily promoted district heating also by means of CHP as a way of reducing its dependence on oil. Fiscal policy in Sweden is generally deemed to have played a major role in the decarbonisation of both heating and transport. Indeed, environmental taxation has been at the

[97] This was already extensively discussed when the concept of energy taxation was introduced. See among others, OECD, Environmentally Related Taxes in OECD Countries. Issues and Strategies, OECD Publishing, Paris, 2001.

[98] The point is extensively discussed in OECD, *Taxation, Innovation and the Environment,* Paris, 2010.

[99] This has become increasingly evident with the design of possible future fiscal policies to support transport decarbonisation. There the distinction between taxation of transport fuels and taxation of vehicles based on driven kilometres – a transport tax in all respects – could hinder important taxation trends and dynamics

[100] In a 2017 study on the role of fiscal policy in relation to the decarbonisation of heating in the UK concluded that the role of taxation would be ancillary rather than central. This would not deliver the scale of emissions reductions to which politicians were committed. The authors commented that "higher gas prices and carbon taxes could change the relative attractiveness of gas heating, while cost reductions in renewable electricity, electricity storage, steam reforming, or CCS might narrow the gap between gas and the low-carbon options. But that requires a heroic set of optimistic assumptions, given the size of the gap to be bridged". Robinson, D. (with annexes by Keay, M. and Hammes K.), *Fiscal policy for decarbonisation of energy in Europe,* The Oxford Institute for Energy Studies, Paper 22, 2017.

centre of Swedish fiscal policy debate since the early 1980s, and the Government already at that time intended using energy taxation revenues as a means of reducing taxes on labour. In 1991, Sweden pioneered the introduction of an economy-wide carbon tax based on the carbon content of fuels, with a limited number of industries exempted from the tax and widespread scope for reimbursements to reduce tax offsetting. At that time, the carbon tax alone accounted for about 2.4% of total tax revenues and energy taxation was constantly increasing, thus providing incentives for product substitution particularly for heating and transport purposes.

Sweden is one of the few Member States where energy taxation has not increased in absolute terms from 2007 till 2018 and that does not rank particularly high by all aggregate energy taxation indicators in comparison to other Member States. Nevertheless, the Country remains singled out by IEA and other sources among the best environmental performers in terms of both GHG reduction and energy efficiency. This has been ultimately achieved without increasing energy taxation revenues, but by using carbon taxes to modify the relative level of prices and provide incentives to favour renewables. Basically, renewable sources from biofuels and biomasses are exempt from carbon taxes. When the tax is not sufficient to bridge the gap as in the case of ETS on electricity are additionally encouraged through certificates. So the more the energy system moves in that direction of renewables, the lower the amount of taxes collected is. To keep revenue neutrality for tax offsetting purposes increases in energy excises have been compensated by the abolition of the nuclear capacity tax, as well as other taxes on hydropower capacity broadly considered as assimilable to renewables as low carbon sources. It is possible that revenues from energy taxation have recently increased because since January 2019 Sweden has introduced the highest level of carbon taxation in the world, and accrual revenue figures are not available yet.[101] According to IEA, the tax base for energy taxes is actually expected to further shrink as a result of decarbonisation. As decarbonisation has been largely based on the use of forestry resources and black liquor from pulp and paper factories it is possible that this shrinking has also been – at least in part compensated - by forestry levies and income from State-owned forests.

The Swedish example demonstrates that any assessment of the degree of dependence of Government revenues on energy products, would also require complementary indicators on the success in promoting product substitution from a fiscal perspective, such as for instance the ***tax expenditure for subsidising biomasses or renewable source***s by means of exemptions or rebates, and for electricity used for vehicles. Such statistics are currently left at the Member States discretion. A simple ratio with energy taxation revenues could capture the progress in the underlying erosion of the tax base.

Robustness and Comparability. The general ET/TR indicator lends itself to a number of ***paradoxes, because revenues are not entirely*** netted off when related reimbursements are formally provided through rebates on another tax (typically a profit or income tax) or as Government transfers, which ultimately hinders its robustness and comparability for net revenue assessment purposes. This is compounded by the distortive effects of comparability issues in the underlying dataset, and namely:

- the sheer decision of financing RES by means of an equivalent energy or carbon tax rather than through an unrecorded off-budget mechanism, increases the indicator without any real substantial reason, as burden on consumers and net revenues for Government remain the same, but simply because the increase in the numerator is proportionally higher than that in the denominator. As RES financing has moved in and out of the budget, the robustness of the indicator over

[101] According to World Bank Carbon Pricing Dashboard estimated revenues from the Carbon Tax in Sweden would be decreased as compared to 2018.

time has been challenged accordingly.[102] The amounts at stake can definitely have a macro dimension,[103] although they are bound to decrease in the near future;

- also because VAT on energy taxes is currently not included as a component of energy taxation, the simple recourse ***to concessional VAT rates***[104] as a subsidy artificially increases the value of the indicator by decreasing the denominator while net Government revenue flows from ET also decrease. After the 2008 crisis, it appears likely that the parallel impact of granting concessional VAT rates has further increased the related ET/TR indicator out of a mere statistical illusion in a sizeable number of Member States;

- because of compliance with the UN SEEA principles ***revenues from ETS auctions*** are fully recorded only for Member States with a relatively worse GHG reduction performance, which further puzzles the understanding of energy taxation as indicator of a greening economy. The current recording system underestimates actual revenues for all the others;

- finally, current revenue data on the numerator are recorded at their net value, i.e. net of rebates and exemptions recorded on the same tax but not of ***off-tax subsidies***. Energy tax refunds for households can be provided as a bulk sum[105] from the budget or as reimbursements channelled through income or profit taxes.[106] Whenever these indirect reimbursements provided through other taxes are not netted off from the relevant energy tax revenues in the numerator, the indicator is artificially inflated and distorted in comparison with Countries providing similar subsidies only by means of ordinary rebates on the relevant energy tax.

C.4.3. Revenue Recycling

Limits of ET-based Indicators. With all its shortcomings in identifying net revenues the ET/TR indicator still remains today ***the only available indicator to monitor revenue recycling***. Those who aim to conceptually emphasise the” double dividend” argument compare this indicator with the juxtaposed share of labour taxes and social security contributions on total taxation revenues to highlight parallel trends. This juxtaposed indicator can be communicated in a fairly intuitive way, although it can be misleading on distributional impacts, as impact of revenue recycling through income or

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[102] To the extent RES financing through taxation could gain ground with the introduction of carbon taxes, these problems could further be compounded in the future. As mentioned before, the Czech Republic has reportedly moved some of the costs of financing renewables to taxation, and the issue has been debated over time, among others, in Germany, Denmark and Spain that has actually changed its regime. For instance, in the past The Netherlands experienced a rapid growth in the volume of electricity generated from renewables, so that the additional costs had to be partly met from the general budget.

[103] To convey a flavour of the orders of magnitude a Ecofys (2011) study for DG ENER estimated the total amount of RES as roughly equal to some one quarter of total energy taxation figures in Germany or as high as one third in Spain. Subsidies to heating only in Sweden could account for some 20% of total energy taxation in that period.

[104] Concessional VAT rates are rates below the standard VAT rates applying to all goods and services. They are allowed for social reasons or to promote merit goods in well identified cases. In the field of energy, they can be granted on electricity and heating fuels. They represent a consumption subsidy.

[105] In the Netherlands a tax credit applies to each electricity connection as a bulk sum. The energy supplier deducts the tax credit from the energy bill even if the annual energy tax is lower than the tax credit.

[106] For instance, this is what happens for haulage services in Italy or with agricultural excises in Germany. In a famous past example, Sweden used to have approximately 25 per cent lower costs for its carbon tax than the amount nominally paid to Government, because of deductibility of paid taxes from the profit taxes of companies. See EEA, *Environmental taxation and EU environmental policies,* Report No. 17, 2016.

labour taxes or social security contributions are far from being equivalent. It remains actually one of the key EEA environmental indicators and the only taxation-related one.

New Information Needs. It is only with the more recent emphasis on carbon taxation that the double dividend theory has come under more empirical scrutiny from an instrumental viewpoint and increasing consideration has been paid to monitoring concrete Member States ***revenue recycling and earmarking practices***. There can be several different rationales behind revenue recycling. Experience in a number of jurisdictions shows that under certain conditions a reduction in income taxation could even increase net revenues in the early years of carbon taxation and favour tax acceptance while these effects would fade out in later years. Then there can be revenue compensatory aims. The distribution of a carbon tax before revenue recycling can be variously regressive depending on the methodology used to assess impact on net income after tax. This can be variously redressed by recycling schemes and practices can also vary over time. The IEA has recently introduced on a permanent basis the monitoring of social taxes as a component of its energy and taxation statistics. These are defined as those taxes and levies from energy products whose revenue is used to support social policies (social tariffs, the education system, etc.). Finally, revenue recycling can be used to finance renewable energy sources, as consumer charges can represent a distortion to ideal taxation and even discourage decarbonisation.[107] This is a weak version of a more extreme position,[108] according to which the extra revenue to finance renewables should always come from the budget,[109] and should be raised in the least distorting way consistent with distributional objectives –i.e. either through income taxes or a uniform VAT rate - and not by regressively[110] charging electricity.

Related Studies. This has spurred interest in the subject and the publication of the first ***studies to highlight concrete revenue recycling practices*** also in reports for the Commission.[111] Recent OECD research[112] has highlighted that for most of the OECD Countries (including the 21 EU Member States) a total some 30% of ET revenues are currently recycled both through formal earmarking or other forms of political commitment. Patterns of recycling differ by type of ET and only taxes that were broadly interpretable as carbon prices (i.e. fuel excise and carbon taxes, as well as the ETS)

[107] The argument runs that taxation RES and quasi fiscal measures could slow decarbonisation in three ways. First, it could penalize electricity in comparison to fossil fuels. Second, taxes and levies can introduce distortions into electricity markets, especially if they are collected through volumetric charges on energy sales (per kWh), as these can discourage consumers from increasing their demand when wholesale prices are low, for instance when intermittent renewables are operating. Since demand flexibility is precisely what is required to integrate renewables, the collection of taxes and levies in this way raises the cost of further penetration of renewables. Third, increasing electricity prices above certain levels can create consumer dissatisfaction with the electricity sector, the government, and with the process of decarbonisation.

[108] Newbery, for instance argues: "*It thus follows that the revenue needed to finance renewables and other public goods should come from general taxation raised in the least distorting ways consistent with distributional objectives – either through income taxes or a uniform rate of VAT, and not by selectively charging single products like electricity*". Newbery, *Reforming UK energy policy to live within its means*, Cambridge Working Papers in Economics, September 14, 2015.

[109] Others have concerned that financing by means of budgetary sources could increase the risk of fiscal liabilities through electricity tariff-deficit. This actually reached as high as 3% of GDP in the past in Spain and was one of the reasons why financing by means of budgetary means was abandoned in the Country. On past problems with electricity tariff deficits in Europe and impact on public finances, see Johannesson L. A. *et al.*, *Electricity Tariff Deficit: Temporary or Permanent Problem in the EU?* Economic and Financial Affairs, Economic Papers No. 534, October 2014: https://ec.europa.eu/economy_finance/publications/economic_paper/2014/pdf/ecp534_en.pdf

[110] https://www.autorita.energia.it/allegati/docs/pareri/090422audsen.pdf

[111] For instance, in 2016 9% of fuel taxes in the Czech Republic, 38% in France, 80% in Latvia, 65% in Lithuania, 8% in Luxembourg, and 22% in Portugal had to be allocated in road infrastructure projects and road maintenance. The same applied for 1% of revenues from electricity tax in France and 100% in Romania and Slovenia respectively. The latter is actually not included in the NTL because earmarked to finance renewables. See DG MOVE (2019).

[112] Marten, M. and Van Dender, K., *The use of revenues from carbon pricing,* OECD Taxation Working Papers No 43, 2019.

were considered. Revenues from electricity taxes were not and, according to the authors, had they been, the total share of earmarked revenues could have possibly been even higher, as revenues are often distributed back to electricity providers.

Fuel excise revenues are sometimes recycled for the ***construction and maintenance of road and transport-related infrastructure*** (CZ, FR, PL, PT). Only Finland and the Netherlands recycle energy taxation revenues to offset revenue losses in personal and corporate income. In Luxembourg these revenues are partly allocated to an Employment Fund. In line with expectations, carbon taxes are more frequently earmarked to shift the ***tax burden away from labour and capital***. Revenues in Ireland have been also used to reduce payroll taxes, while Portugal helps relieve large families from paying personal income tax. In France until 2016, all carbon tax revenues were earmarked to a business tax credit. Since 2017 they have now been used to pay for renewable energy sources and what remains is used for tax base shifting. The bulk of ETS auction revenues is conversely spent to boost energy savings among households and businesses, to compensate energy-intensive industries and electricity providers for the higher carbon prices themselves and for the use of renewable energies, as well as to promote electric mobility and public transport. ***Environmental earmarking of ETS revenues*** has even become a controversial regulatory requirement[113] and this is increasingly so as price for EUA increases and related earmarking of revenues can also acquire a macro significance.[114] Revenue fungibility was even reported as an additional factor to allocate at the margin industries under the national carbon tax[115] or under the ETS.[116]

C.4.4. Conclusions - Data Gaps and Feasibility of New Indicators

Renewable Energy Sources. As shown in the paragraphs above, the way ***renewable sources incentives are accounted for*** are possibly at present the most important information gap hindering data comparability in the field of energy taxation indicators, although their importance is bound to substantially decrease in the next years. However, there can be additional sources to help net off ET data to have more robust and comparable ET/TR indicators as concerns both RES costs and impact on budget, and availability of sources on off-tax subsidies. The biennial CEER Status Review of Renewable Support Schemes in Europe provides data on total financial support by type of renewable technology for 23 Member States out of 27.[117] Separate qualitative

[113] In 2008 the Eurofin Economic Policy Committee recommended that climate change policies that have a potential impact on fiscal revenues or have significant budgetary implications should be considered by Finance Ministers. They proposed that revenues from ETS auctioning should be used in line with sound budgetary principles and, specifically, not be subject to mandatory earmarking or hypothecation at the EU level. Economic Policy Committee, *Economic instruments to reach energy and climate change targets*, 2008. https://europa.eu/epc/sites/default/files/docs/pages/report_on_energy_climate_change_final_en.pdf

[114] In 2018 revenues from auctions in Italy reached as high as € 1.4 bn, some 3% of total ET revenues in the Country, and all of them were earmarked to finance environmental actions.

[115] Article 27 of the ETS Directive allows Member States to exclude from the EU ETS certain small installations provided they are subject to measures that will achieve an equivalent contribution to emission reductions. This flexibility is estimated to account for less than 0.5% of emissions under the scope of the ETS overall, but could have been larger in specific Member States.

[116] In Sweden the carbon tax was removed from CHP plants and then reintroduced because the ETS effect on carbon price was deemed too weak. This, according to the Government at that time, had positive consequences not only on total fiscal revenues, but also on the possibility of freely spending them. Malcolm Keay and Klaus Hammes, *Fiscal policy for decarbonisation of energy in Europe.* The Oxford Institute for Energy Studies, 2017.

[117] Data are missing for Belgium where renewables are managed at the regional level and the Federal Government provides data for federal schemes only (but the regional ones could be retrieved from the NTL), Bulgaria where these are considered private company obligations, Slovenia that entirely manages renewables through a State-owned company and Slovakia where system operators stopped in 2013 accepting requests for connecting renewables above 10

indication is given of the Countries relying on budgetary and extra-budgetary sources of finance. An indicator of total renewable energy support per unit of total electricity produced [€/MWh] is published by CEER and is compatible in terms of unit of measurement with Commission implicit tax rates. Data are collected by means of a survey and are considered as horizontally and vertically comparable by the CEER itself that however provides no detail on the underlying methodology followed by Member States to calculate incentives, including, for instance, recourse to cash-based or accrual-based mechanisms. Information presently collected by CEER would not suffice to calculate existing Commission energy taxation revenue indicators net of financing for renewable sources when this is covered by budgetary sources or to add renewable energy incentives for all Member States. No breakdown of financing sources, even as a share of the total, is provided when Member States report both support from general taxation and recourse to dedicated levies (e.g. LU, DK). Comparison with other sources from Commission studies highlight the level of update and accuracy of the CEER dataset in reporting the source of RES financing,[118] as was possible for 2016 and just one major discrepancy could be seen.

Another possible source of information on off-budget financing of renewables, which was not mandatory when the guidelines were released, is represented by ***statistics on the price of electricity and natural gas*** by components and subcomponents including taxation (. So far related information on the renewables taxes and charges has not been provided by four Member States including the three larger subsidisers. As can be seen data are classified at a variance from energy taxation categories, and it is not immediately apparent where electricity excises have been accounted for, as there are countries reporting both zero environmental taxes and zero other taxes.

Table 3: Electricity Prices for Domestic and Industrial Consumers, Price Components in 2018 (€ KW/h)

	Energy and Supply	Network Costs	VAT	Taxes on RES	Capacity Taxes	Env. Carbon Taxes	Nuclear Taxes	Others	Total Energy Taxes
BE	0.141	0.162	0.074	0.035	0.005	0.002	0.001	0.013	0.056
BG	0.060	0.024	0.017	0.000[119]	0.000	0.000	0.000	0.000	0.000
CZ	0.113	0.107	0.050	0.019	0.000	0.001	0.000	0.000	0.021
DK	0.050	0.113	0.078	0.025[120]	0.000	0.123	0.000	0.000	0.147
DE[121]	0.127	0.157	:	:	:	:	:	:	:
EE	0.053	0.064	0.026	0.009	0.000	0.005	0.000	0.000	0.013
IE	0.150	0.128	0.045	0.045	0.018	0.000	0.000	0.004	0.067

kilowatts to the distribution grid because of concerns over grid stability and security of supply. Surplus solar electricity from domestic producers is supplied free of charge into the distribution network. Wind installations are not supported.

[118] Reported values are broadly compatible for most Member States considered and major differences can be noticed only for Spain (€ 8 bn vs. € 5.3 bn). Four Member States state that are reported by the DG ENER study as not requiring end user taxes and fees (NL, SE, RO, CY) are indicated by CEER as relying on separate charges and levies, while data on consumer subsidies are provided on Countries reported by CEER as relying on general taxation (CZ). There are no elements to conclude whether different estimates for LU and DK depend on the separate identification of budget from off-budget support. See Trinomics (2018), for DG ENER.

[119] In Bulgaria 'Obligations to the electrical society' are considered as a part of the price for energy because they are not legally defined as taxes or fees and therefore not shown in the calculations irrespective of their economic nature.

[120] Denmark finances RES mainly through the general budget but includes among taxes on renewables sources the public service obligation fee (PSO) whose purpose is closer to a capacity charge.

[121] As mentioned in the note before Germany has not provided data because of legal issues. According to UNB. the EEG surcharge faced by household consumers in 2016 was €63.54/MWh. Übertragungsnetzbetreiber (ÜNB) (2015): Prognose der EEG-Umlage 2016 nach AusglMechV.Prognosekonzept und Berechnung der ÜNB. Stand. Quoted in Trinomics (2018), for DG ENER.

HE	0.115	0.044	0.025	0.023	0.000	0.000	0.000	0.011	0.034
ES[122]	0.331	0.117	0.099	:	:	:	:	0.023	0.023
FR	0.133	0.159	0.036	0.000	0.025	0.032	0.000	0.000	0.057
HR	0.085	0.090	0.025	0.014	0.000	0.000	0.000	0.000	0.014
IT	0.143	0.095	0.031	:	:	:	:	0.058[123]	0.058
CY	0.208	0.032	0.049	0.010	0.007	0.008	0.000	0.001	0.025
LV	0.050	0.082	0.036	0.042	0.000	0.000	0.000	0.000	0.042
LT	0.035	0.044	0.020	0.011	0.002	0.000	0.000	0.000	0.014
LU	0.071	0.183	0.022	0.025	0.000	0.001	0.000	0.000	0.026
HU	0.045	0.045	0.025	0.000[124]	0.000	0.000	0.000	0.000	0.000
MT	0.326	0.024	0.018	0.000	0.000	0.002	0.000	0.000	0.002
NL[125]	0.120	0.282	-0.009	0.013	0.000	-0.447	0.000	0.000	-0.434
AU	0.083	0.127	0.060	0.072	0.000	0.015	0.000	0.004	0.091
PL	0.051	0.064	0.033	0.006	0.009	0.012	0.000	0.000	0.027
PT	0.062	0.095	0.076	0.118	0.026	0.001	0.000	0.029	0.174
RO	0.056	0.041	0.021	0.013	0.000	0.001	0.000	0.000	0.014
SI	0.059	0.122	0.058	0.080	0.000	0.003	0.000	0.000	0.083
SK	0.060	0.105	0.040	0.022	0.012	0.000	0.003	0.000	0.037
FI	0.092	0.174	0.069	0.000	0.000	0.022	0.000	0.000	0.023
SE	0.062	0.210	0.076	0.004	0.000	0.031	0.000	0.000	0.034
EU27		0.137							

Source*: Eurostat, Electricity prices components for household consumers, annual data (from 2007 onwards): consumption less than 1000 kWh band DA; available* *here***.**

VAT and Off-Tax Subsidies. At present no public dataset on ET revenues incorporates data on VAT on energy taxes. These are available as shares from statistics on energy prices. The IMF calculates estimates on VAT-related subsidies but on industrial prices only. In the past data on VAT concessional rates were reported only in the related official Commission document[126] which, however, does not necessarily provide all the details on how they are implemented,[127] but***since 2018 they have started being recorded also in the OECD inventory of subsidies*** as reported by Member States themselves, but data are incomplete as some Member States have just started their inventory of energy subsidies.

Feasibility and Sustainability of New Indicators. For the time being ***no indicator tracks revenue recycling from energy and carbon taxes***, although the OECD PINE dataset has a separate section on earmarked taxes. The authors of the recent OECD study[128] have published their pilot data starting from 2016 TEU sources. Data gathering

[122] Spain was granted a special derogation by means of an ad hoc Commission Implementing Decision because its price mechanism did not allow for a clear identification of all price components. Network tariffs cover not only network costs but also RES costs. the tariff deficit. TNP and other regulated costs. While network costs can be accurately estimated as a separate price component. the same cannot be said of the others. Therefore. from 2013 onwards all these items have been incorporated within the "Energy and supply" component. except VAT and the Spanish Special Tax on Electricity.

[123] Italy was granted a derogation for reporting the sub-components on "network prices" and on "taxes. fees. levies and charges" for the reference periods 2017 and 2018. Due to that derogation. all the taxes. except VAT. are reported under "other taxes".

[124] In Hungary electricity consumers who are not entitled to universal services. mainly business enterprises. have to bear the entire burden of renewable energy support.

[125] Tax items are negative in the Netherlands because of the way the energy tax refund works.

[126] DG TAXUD, VAT Rates Applied in the EU Member States, Situation as of Various Dates. See: https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf.

[127] Italy, for instance, applies a reduced 10% VAT rate to a threshold amount cubic meters of natural gas supplied annually to each household based on the official number of family members, compared with a standard VAT rate of 22% that applies after the threshold has been reached. Commission inventory correctly reports the rate, but there are not the details on how this is implemented in practice.

[128] Marten, M. and Van Dender, K., *The use of revenues from carbon pricing,* OECD Taxation Working Papers No 43, 2019

largely drew on a miscellanea of *ad hoc* estimates and various sources, and crucially depended on validation from OECD correspondents and Country experts. Authors warned that its ***replication would pose notable feasibility constraints***, as it was noted that existing datasets would not have allowed to systematically disaggregate data according to the proposed definitions. Extensive although not necessarily updated data on Earmarking of ETS revenues are reported in the EEA datasets. the OECD has no plans to make this indicator sustainable in a regular publication to monitor its trends over time in the foreseeable future.

C.5. IMPLICIT AND EFFECTIVE TAX RATES ON ENERGY

In this Section, the analysis deals with ***Implicit and Effective Tax Rates on energy*** – in short, ITR/ETR. While there implicit and effective tax rates have different meaning in other areas of fiscal studies[129] here they are used interchangeably. Implicit and effective tax rates aim at ***measuring the average tax burden on energy consumption***, defined in physical terms (volume, energy content) or monetary terms (energy costs and price).

Measuring the 'average' energy tax burden requires consolidating revenues data over different tax bases. Differently from personal or corporate income taxes, energy taxation faces data aggregation problems, as the tax basis can be expressed in different units (e.g. per litre, kWh, kJ). At product level, expressing the tax burden in monetary terms and calculating the share of energy taxes on prices is always possible.[130] The aggregation in an implicit or effective tax index would be possible, as ***the share of taxes on product prices could be weighted by the monetary value of that product consumption***.

Alternatively, the ***energy content*** (measured in e.g. toe or GJ) has been used as a common denominator to aggregate different tax rates[131]. This can be done in two ways.

1. Starting from ***tax revenues*** and dividing them by the relevant energy consumption. This top-down approach is used e.g. for DG TAXUD's and Eurostat's implicit tax rates. Tax revenues already account for reductions, exemptions, and also tax evasion. When calculated in this way, implicit and effective tax rates do not account for feebates and "off-tax subsidies", i.e. those provided in-cash, in-kind, or administered via other tax bases, unless they are subsequently subtracted, based on the information included subsidy repositories.

2. Starting from ***tax rates*** and aggregating them based on the share of consumption covered by a certain tax rate. These bottom-up estimates need them to be netted off in-tax and off-tax subsidies, based on the information included in subsidy repositories; tax evasion cannot be accounted when using this methodology. This is the case of the OECD's Effective Tax Rates on Energy.

All in all, at the moment, ***no perfect implicit or effective tax rate indicator exists, because in no cases all existing subsidies can be accounted for***, in particular as far as feebates ad off-tax subsidies are concerned. Also, there is no real information on

[129] In the area of corporate taxation, for instance, implicit tax rates "measure […] the actual or effective average tax burden levied on different types of economic income or activities" from an ex post perspective, i.e. after taxes are collected. They are usually calculated as total revenues over the total tax base. Since this indicator could not always realistically capture the tax burden on capital and investment, forward looking effective tax rates were developed, "which, using tax legislation, simulate the tax burden generated by a given tax, and can be linked to individual behaviour. Cf. DG TAXUD, Taxation Trends Report 2019 Edition. Annex B: Methodology and explanatory notes, Publications Office of the European Union, Luxembourg, 2019.

[130] In Section C.2, existing datasets attempting to do this on a number of energy products are briefly described together with their main current limitations in data quality.

[131] This does not mean that different energy products can be perfect substitutes once accounting for their calorific content, due to their other technical features.

whether these subsidies represent such a large amount as to make the actual figures of limited value. In areas where this is more likely to be the case, for instance for energy-intensive industries, various ad-hoc studies have been commissioned by the European Commission to refine estimates and indicators that are normally available.

Overall Rationale. ***ITR/ETR capture the tax burden on energy products and consumers,*** expressed in monetary (€ tax / €) or physical terms (€ / energy unit). Physical ITR/ETR can be calculated relying on the fact that all energy products have a calorific content that can be measured in any energy unit (e.g. GJ or TOE). When calculated starting from tax revenues, they are calculated for a whole calendar year on an accrual basis, consistently with the SEEA methodology.

ITR/ETR can be estimated for:

1. The economy as a whole, as illustrated in Section 7.1;
2. By fuel, as described in Section 7.2
3. By sector or type of activities, as discussed in Section 7.3.

ITR/ETR lend themselves to straightforward political and instrumental uses and provide clues on the impact of taxation on available incomes for households, or on competitiveness for businesses. More in detail:

1. Firstly, ITR/ETR focus on the tax burden dimension and provide information on the ***competitiveness*** of a country (when calculated for the economy as a whole) or sector (when calculated for the various industries).

2. ITR/ETR can be used to measure the ***affordability*** of energy products and the impacts energy taxes thereof, when measure per type of activities and consumers (e.g. ITR/ETR on household consumption, or per various segments of households' income distribution).

3. ITR/ETR per sector, use, or fuel can highlight the ***consistency of the energy tax system*** across various types of energy products, industries and consumers.[132] In particular, ITR/ETR can be used an indicator of the level of subsidisation provided by the energy fiscal system for the various parts of the economy.

4. Finally, sectoral and whole economy ITR/ETR also provide a preliminary indication on the industries or countries that, through heavier taxation, have been particularly incentivised to adopt ***energy efficient*** processes[133].

Feasibility Constraints. Two major feasibility constraints apply to ITR/ETR. First, as discussed, all energy subsidies and feebates should be known and their amount estimated; so far, existing indicators have been refined to include as many subsidies as possible, but none of them claim to have a complete picture.

Secondly, tax revenues must be matched with data on energy consumption. More in details, for all different taxes for which ***both tax revenues and the tax bases (i.e.***

[132] This assessment is based on the key assumption that energy prices – and therefore related taxation - should be directly proportional to their energy content and rather than on other factors, such as availability, cost of transport, energy density, time of consumption, carbon content, or pollution potential. From this assumption, it descends that ITR/ETR would broadly reflect the competitive fiscal advantage of the different energy products. This assumption is however debated in the literature, where, for instance, it is variably argued that energy taxation should be made uniform based on the external costs associated with consumption or part thereof (e.g. the carbon content as a proxy for climate change costs).

[133] This is also, among others, the primary rationale of the ITR indicator according to Eurostat, as taxation is considered mainly as a tool to improve energy efficiency. See on the subject: https://ec.europa.eu/eurostat/cache/metadata/en/ten00120_esmsip2.htm#compar_time1571313891547.

energy consumption) should be known. At aggregate level (economy or sector wide), this can be done by considering existing databases on energy consumption, but this may not always be possible per product or energy use. Alternatively, tax rates and energy consumption data can be resorted to, and this can sometimes be the only available method if estimates of revenues per specific tax bases are not available. However, the introduction of carbon taxes, as any differentiation of tax rates based on product features (e.g. sulphur content, octane, level of consumption), further complicates the estimate, as there can be different prices and rates for the same tax base. This is a well-known problem to all those who follow data gathering for the DG ENER Oil Price Bulletin (discussed here below), as one of their main concerns is whether prices and taxes are representative enough of the underlying market and weighted accordingly.

As for energy consumption, it is typically estimated via energy balances. In the EU, reference is usually based to ***Eurostat Energy Balance.***[134] This database provides consumption data, measured in toe, via a matrix structure based on <u>three categories</u> of users and uses, namely (i) industry; (ii) other sectors encompassing households; and (iii) transport; and <u>nine energy products</u>:

1) solid fossil fuels (anthracite, coking coal, other bituminous coal, sub-bituminous coal, lignite, patent fuels, coke oven coke, gas coke, coal tar, brown coal briquettes);
2) manufactured gases (gas works gas, coke oven gas, blast furnace gas);
3) peat and peat products;
4) oil shale and oil sands;
5) oil and petroleum products (LPG, motor gasoline, aviation gasoline, gasoline-type jet fuel, kerosene-type jet fuel, naphtha, gas oil and diesel oil, fuel oil, industrial spirits, bitumen, petroleum coke, paraffin waxes);
6) natural gas;
7) renewables and biofuels (hydropower, wind power, solar photovoltaic, solar thermal, geotherms, waste, pure bio gasoline, blended bio gasoline, pure biodiesel, blended biodiesel, ambient heat);
8) heat; and
9) electricity.

If the indicator aims at capturing not only taxes on energy consumption, as per the OECD's Effective Tax Rate on energy, but all energy taxes, this introduces a further layer of complexity, because of taxes on production factors and intermediate consumption (e.g. taxes on pipelines, on fuel quality checking mechanism, on nuclear energy, on network pylons). Including those taxes into the estimate can be done in two ways. Either it is assumed that taxes are fully passed-on into consumption price adding to the final tax burden on household and businesses, or ITR/ETR should be interpreted as representing the total tax on the value chain, rather than on the final consumption of energy. When the tax bases of intermediate taxes, including in particular ETS, do not correspond to final users and energy consumption – e.g. a tax on pylons affects both industrial and household users, and both fossil-fuel based and carbon-free electricity – these would have to be allocated through some repartition mechanism, e.g. based on the share of consumption. Recourse to these weighting mechanisms has been proposed

[134] Eurostat, Energy Balance in the MS Excel file format (2020 edition); previous edition available since 2010 edition. <u>https://ec.europa.eu/eurostat/cache/metadata/en/nrg_bal_esms.htm</u>. Cf. also Regulation (EC) No 1099/2008 of 22 October 2008 on energy statistics. This, however, holds true as long as taxes are a proxy for prices, but no longer applies as decarbonisation progresses. For instance, the price of gasoil in Sweden is the highest in Europe and represents an incentive to energy efficiency, but the underlying IETR is not, because tax rates have been designed to promote biofuels that are per se more expensive. Denmark has felt compelled to reduce the excise on electricity for industrial users to the minimum level envisaged in the ETD for the same reason.

as a theoretical possibility in the literature[135], but never concretely implemented due to their burdensome calculation and limited feasibility.

C.5.1. Implicit and Effective Tax Rate for the whole economy

Two main sources can be used to estimate ITR/ETR for whole economies. First, the European commission various series on Implicit Tax Rates, based on revenue data from all energy taxes. Secondly, the OECD's Effective Tax Rates on energy, which is calculated based on rates, and only cover energy consumption taxes.

C.5.1.1. European Commission Implicit Tax Rates

DG TAXUD defines the Implicit Tax Rate (ITR) on energy, defining it as ***'the ratio between total energy tax revenues and final energy consumption'***[136]. The final energy consumption[137] consists of different energy products, which can be 'summed' based on their calorific equivalents. Energy consumption is considered at the ***final consumer level*** and include energy consumed in transport, industry, commerce, agriculture, public administration and households, but not for energy transformation[138].

The Commission is currently publishing ***three indicators expressed on physical energy units***. Two of them are reported by DG TAXUD in its Taxation Trends Report and the third by Eurostat. The first indicator is expressed in nominal terms, while the other two are expressed in real terms and deflated to account for the overall price trend. As no specific deflator for energy prices exists, different deflators have been used to that end. The ITR indicators are the following:

1. Nominal Implicit Tax Rates, by TAXUD

2. Implicit Tax Rates on energy (deflated with the GDP implicit deflator, base year 2010), by Eurostat

3. Implicit Tax Rates on energy (deflated with the final demand deflator, base year 2010), by TAXUD; however, from the 2020 edition onward, the deflator has been aligned to Eurostat's.

In terms of relevance the indicator discounts the same problems as those of energy taxation. The nominal ITRs are significantly dispersed across the EU, ranging from about 400 EUR/TOE in DK and IT to less than 150 EUR/TOE in six Central-Eastern Member States. The average ITR in countries with a carbon tax[139] are about 40 EUR/TOE higher than that in countries which have not introduced such a tax;[140] countries with a carbon tax, however, do not necessarily have a higher than average tax burden, or vice versa.

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[135] Bachus, K., *How to tell green from grey? Towards a methodological framework for evaluating the greening of national tax systems*, Environmental Indicators, Elsevier, 2016.

[136] DG TAXUD, Taxation Trends Report 2019 Edition. Annex B: Methodology and explanatory notes, Publications Office of the European Union, Luxembourg, 2019.

[137] As per the Eurostat definition,"[f]inal energy consumption is the total energy consumed by end users, such as households, industry and agriculture. It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself. Final energy consumption excludes energy used by the energy sector, including for deliveries, and transformation. It also excludes fuel transformed in the electrical power stations of industrial auto-producers and coke transformed into blast-furnace gas where this is not part of overall industrial consumption but of the transformation sector." Cf. Eurostat, Statistics Explained, Glossary: Final Energy Consumption, available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Final_energy_consumption (last accessed on June, 2020).

[138] Transformation of energy from one vector to another typically taking place in the energy industry, e.g. natural gas to electricity, is not considered as final consumption.

[139] UK, FR, SI, IE, SE, PT, ES, EE, LV, FI, PL. World Bank, *State and Trends of Carbon Pricing*, Washington, DC: World Bank Group, 2019.

[140] 248 EUR/TOE vs. 205 EUR/TOE.

For instance, Italy and Greece do not have a carbon tax, but have a high ITR, while Poland and Finland have a carbon tax and a low ITR. The real ITR can more accurately measure the pure variation of the economy-wide tax burden on energy, i.e. not accounting for inflation. DG TAXUD deflates the nominal indicator via the final demand deflator, while Eurostat resorts to the GDP implicit deflator; as of 2020, DG TAXUD aligned its deflator to Eurostat. ***The resulting analysis of data, however, is not robust to the various deflators*** and the two real indicators provide different values and trends over time.

While several physical ITRs exist, no attempt has been made to calculate a monetary ITR on the burden of energy taxation on the total value of energy consumption in a Country. This is because there is no conversion between physical consumption and total monetary expenditures. The value of expenditures in certain products for which an international reference price, e.g. oil, can be retrieved from various sources, but in no case, this can be applied to the totality of energy products consumed in the economy. Indeed, the lack of aggregated value for expenditures in energy products partly depend on the lack of price data series. For energy sources or vectors for which price series exist, e.g. natural gas and electricity, prices are correctly provided per type of consumer or consumption band, and by means of information on the weight of each consumer / band, an average economy price could be calculated. Possibly only the IEA could be in a position to try to build an index based on its existing price database[141].

When an ITR is calculated based on revenue data, benchmarking has limited significance, as the exercise suffers from limits of their underlying datasets, with regard to the comparability of data, due to the national definitions of energy tax, and in particular on the treatment of RES charges, ETS costs, non-deductible VAT. Overcoming these limits in terms of cross-country comparability requires the direct collection of information about energy taxes and rates in each country, and the validation and harmonisation of the data obtained. At the moment, ITRs would hardly capture the nuances of a country's environmental policies, e.g. in terms of product substitution towards more environmentally-friendly source of energy.

C.5.1.2. OECD Effective Tax Rate on energy

The OECD Effective Tax Rate (ETR) was first published on an experimental basis in 2013. It is not based on revenue data, but extensively relies on extrapolations from available tax rates at a given date and energy consumption data as provided by the IEA in its Extended World Energy Balances[142]. IEA data are largely equivalent to the Eurostat Energy Balances. As it is based on IEA energy balance, the ETR adopts the same typology in terms of products and categories of users. To ensure the highest possible degree of internal consistency, when IEA does not provide data on energy consumption estimate (e.g. for agricultural, forestry and fishing in Germany, or domestic aviation and navigation in Estonia) the related ETR is simply not calculated.

The approach followed by the OECD has been refined over time with the introduction of new classification categories and revised vintage versions, but draws on one fundamental idea: it is the ***statutory tax rates at a given date that are translated into rates per unit of energy or €/GJ, accounting for reductions, exemptions, and other subsidies*** as reported in the OECD energy subsidy repository. This repository, however, does not cover off-tax subsidies. Being based on nominal tax rates rather than actual revenues, the OECD ETR cannot capture typical tax burden problems such as the level of tax evasion or the amount of unpaid taxes or arrears, which is not, however, particularly a problem for excises.

[141] IEA, Energy Prices and Taxes for OECD Countries, International Energy Agency Statistics.
[142] There is a time-lag between tax and energy data, the latter referring to one to two years before. However, this is deemed of limited relevance, since energy consumption is relative stable over this period of time. IEA, *World Energy Balances 2019*, OECD Publishing, Paris, 2019.

The ETR does not include all taxes on energy products or production, but only a subset of those identified in the OECD PINE database. Namely, it includes only taxes on energy uses, since those are the taxes "that alter the relative price of energy use and that can in principle be used to reflect marginal environmental damages"[143]. Those taxes are:

1) carbon taxes, i.e. taxes whose rates are explicitly linked to the carbon content of energy products,
2) excises on fuels,
3) excises on electricity, eventually together with the taxes on the fuels used to produce electricity.

ETR calculation uses conversion rates when taxes are expressed in volumetric terms rather than per energy content, and by exceptionally collecting information on prices only when *ad valorem* taxation applies (as it is the case for certain taxes in Spain).

In following this marginal definition of energy taxation, the ETR by-passes the problem of estimating the pass-through of indirect energy production taxes on final prices. To ensure internal consistency with this choice, ETS revenues are not included. This is also due to the fact that it would not be practically possible to convert EUA prices in their energy content equivalent, as it would depend on the installation for which the EUA was surrendered. The marginal approach makes the non-inclusion of feebates and direct subsidies less problematic, as they do not affect the marginal tax rate.

Scope. The ETR is calculated at the country level and for consumption classified by various typologies of use. In the last edition, the ETR is available for the following sectors:

1) road transport
2) off-road transport (including railways, pipeline transport, domestic maritime and aviation uses)
3) agriculture, fishing and forestry (not including road uses),
4) industry[144],
5) the residential and commercial sectors,
6) electricity generation.

Since these figures are calculated based on nominal rates and extrapolated from IEA energy consumption sources to ensure internal consistency of data, the OECD removes the carbon tax from industries where this is not compatible with the ETS at the national level. The carbon tax is considered where it is not mutually exclusive with the ETS.[145]

Level of detail. The OECD database provides an estimate of the ETR per country, per fuel, and sector. More in details, the fuels covered are those accounted for in the IEA energy balance and that represent at least 2% of final energy consumption. These are oil products, including diesel and gasoline, natural gas, coal, biofuel and waste. While the companion report only provides certain analysis per group of country or group of fuels, all data are made available online, including both tax rates and energy consumption, so that ETR can be calculated for any of the products and sectors listed above, or any combination thereof. Data are provided in nominal term, and therefore do not capture inflation.

Two indicators are derived from the ETR, as reported in Box 6, and namely ***the combustion surcharge and the diesel differential***. Both indicators are based on the assumption that differences between ETRs bear policy significance. This view is challenged by the supporters of the alternative corrective tax rate approach, according

143 Taxing Energy Uses (2018), at p. 14.
144 Starting with the second edition of the TEU dataset industry also includes taxes for the auto-generation of electricity that were previously included as part of electricity.
145 For further details, cf. Section 8 below.

to which tax rates should and can vary in function of the cost of the underlying externalities and thus could differ among energy sources. That said, these differential indicators provide an assessment of the tax incentives for consumers to switch between different energy sources, namely combustible and non-combustible fuels, and diesel and gasoline engines.

Box 6 OECD Combustion Surcharge and Diesel Differential

First published in 2019 and based on the data used to calculate the ETR, the OECD computes the ***combustion surcharge.*** This indicator measures the extent to which countries tax combustibles (mainly fossil fuels) more than non-combustibles (e.g. wind, solar and hydro). The indicator suffers from the non-inclusion of RES charges, which would reduce the tax advantage of non-combustibles; the OECD is working to expand the scope of its database with a view to a possible inclusion of RES charges in the future.

The ***Diesel Differential*** measures the difference between gasoline and diesel ETRs. This subject has recently raised considerable attention in the policy debate. The OECD first measured the difference between the two ETRs in terms of energy or carbon content; in the latest edition, the indicator measures the 'simpler' difference in terms of EUR per litre (resulting in a smaller price differential). In this version, the indicator appears mainly descriptive, gauging the diverging or converging tax rate trends between the two fuels over time and across countries.

C.5.2. Implicit and Effective Tax Rate per energy product

ITR/ETR indicators at the product level have hardly been published as such. They cannot be easily estimated through a top down approach as an estimate of the energy tax revenues from the various products is lacking from NTL data. A database exists on the taxation of the various energy products, that is the Excise Duty Tables (EDT) published by DG TAXUD. The EDT dataset provides information on rates of and the revenues from "taxes on consumption (excise duties and similar charges) other than VAT on energy products and electricity". The EDT are populated with information supplied by the Member States. Importantly, though sources are different and comparability should not be taken for granted, ***energy excise duties account for 84% of EU total energy taxes*** in the EU.[146] Monetary ITR/ETR could be available through a bottom up approach starting from price surveys when the tax component is also monitored. This is for instance the case of the Oil Price Bulletin, which provides for an ITR/ETR for gasoline and gasoil only, but could easily be calculated for all the products listed in the bulletin.

Oil Price Bulletin. Since 1994 DG ENER has been publishing the ***Oil Price Bulletin*** weekly consumer prices for petroleum products in EU countries. It includes retail prices of main fuels for transport: gasoline, diesel, LPG, as well as heating fuels with an EU market (e.g. gasoil but not kerosene), as well as fuel oils for industrial uses with and without sulphur. The main original objective of the dataset was not to steer taxation policy, but to improve transparency of oil prices and strengthen the internal market. The dataset includes separate information on retail prices with and without taxes, defined as the sum of VAT and excises and other indirect taxes. The latter are not separately published but reported together. Based on these data an ***indicator on the share of taxes on gasoline and diesel price as transport fuels has been regularly published.*** In 2011 a number of comparability and data quality issues on the Oil Price Bulletin dataset have been tackled by means of a Commission Recommendation taking stock of the results of a survey carried out in 2008. Improvements, among others, referred to price weighting methodologies, the way price discounts are dealt with and incentives on biofuels are accounted for. Following Member States requests, data on LPG were also included.

[146] Comparing excise revenues in the EDT and total energy taxes in Eurostat NTLs in 2018. Some NTLs include excise duties explicitly.

This dataset, however, presents a number of limitations which limit its possibility of representing a comprehensive source of data to assess the degree to which Member States use the fiscal leverage to steer energy consumption patterns:

- because of its very nature of price surveillance mechanism to assess price convergence, it includes only those fuels that have a truly EU market dimension. So, purely domestic markets are not included, and these are usually the target of special taxation policies at times justified by energy availability considerations (e.g. methane for cars in Italy, kerosene for heating in Ireland).

- Then the new level of detail for reporting biofuels is not published, and since data are provided on mainstream consumer products only, it is not always possible to draw information on the comparative level of incentives provided to blended biofuels, as compared to fossil fuels.

- Some breakdown is provided for VAT and other cumulative indirect taxes only, as these are not proportional. No further data breakdown is available by type of indirect tax, whether energy excise, carbon tax or other taxes including sub-national ones. A Table summarising changes in taxation to monitor trends over time is provided for excises only.

- The indicator is not deflated by a proxy of inflation in energy products that is hardly possible to have.

C.5.3. Implicit and Effective Tax Rate by Typology of User

As described in section C.8 below, data on energy taxation are available per economic activity (64 2-digit NACE sectors) and for eight paying entities.[147] However, no indicator is currently published providing for a physical or monetary ITR/ETR based on those data.

Total energy taxes and total energy taxes by paying entity/economic activity largely coincide, though some differences in total values can be noticed.[148] According to Eurostat metadata, "discrepancies might occur due to vintage issues (i.e. given that both data collections have the same deadline some of the most recent revisions undertaken to the NTL cannot be taken into account when compiling or validating the statistics on environmental taxes)."[149] More precisely, discrepancies can be noticed in less than a dozen Member States. In six of them, differences are very small or negligible, below 1.5% of the total. In another couple of cases (Romania and Cyprus), this gap is a bit more significant and averages around 5-6%. Finally, in two other Member States (Belgium and Slovakia), these misalignments can be substantial and reach as high as 25-30% of the total. These discrepancies were particularly experienced in the last data collection round, and have been followed up and, to a large extent, already aligned.

Data by paying entity or economic activity result from an iterative process subject to significant data reconciliation efforts. Importantly, one third of the Member States - mainly but not exclusively in Eastern Europe[150] - cannot provide estimates including taxes paid by non-residents. To the extent to which these are tourists – including in particular fuel tourists – the figures for some of the other categories can be overestimated or substantially distorted (see Table 4 overleaf). The issue has constantly been tackled by Eurostat and over the years more and more countries have been providing their estimates of energy taxation revenues from non-residents. While this

[147] As mentioned above, the latter consist of the following categories: 1) agriculture, forestry and fishing; 2) industry; 3) households; 4) construction; 5) wholesale and retail trade; 6) transportation and storage; 7) services; and 8) non-residents.
[148] Discrepancies make reference to data available for the period 2008-2017 (on average). These discrepancies no longer occur between data on total energy taxes and total energy taxes by paying entity/economic activity reported in 2018.
[149] See. https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax_esms.htm
[150] Denmark, Greece, Spain, Croatia, Hungary, Lithuania, Poland, Rmania, and Slovenia.

issue has been partly resolved and current discrepancies are considered minor except for very small Member States, data are not entirely homogeneous yet.

All in all, data per paying entity and total energy tax revenues are fully consistent for 20 Member States out of 27. For the remaining seven Member States (BG, CZ, FR, MT, NL, SE, and SK), the breakdown of data is not aligned to the respective total, with unallocated amounts remaining (see Table 4). In 2017, the latter could be estimated at EUR 1.03 bn EU-wide, i.e. not a significant amount, equal to less than 0.5% of the total. However, the unallocated amounts are significant in relative terms in Bulgaria, Slovakia and the Czech Republic, reaching some 5% to 10% of total energy taxes.

Table 4: Share of Energy Taxation on Total Revenues, Broken Down of by Paying Entity in 2017

	Agriculture Forestry and Fishing	Industry	Households	Construction	Wholesale and Retail	Transport and Storage	Services	Non-Residents	Unallocated
AT	3.8	14.5	48.1	3.0	3.8	8.6	5.3	13.1	
BE	0.8	10.8	50.9	4.5	2.9	13.2	14.4	2.4	
BG	4.2	12.1	33.6	3.1	4.1	26.9	2.6	3.7	9.6
CY	0.5	9.0	62.4	3.8	5.9	7.8	8.6	2.1	
CZ	4.2	21.8	20.2	4.5	9.8	23.3	8.8	2.1	5.4
DE	2.8	14.4	52.4	3.3	5.5	10.2	8.6	2.8	
DK	2.5	11.4	56.9	3.1	5.5	6.1	14.6	..	
EE	8.1	14.9	32.4	3.9	3.5	27.0	7.6	2.1	
EL	6.4	20.4	43.4	0.8	4.5	14.9	9.6	..	
ES	1.3	16.8	52.6	1.1	5.2	15.3	7.8	..	
FI	2.2	28.4	38.7	2.1	2.3	12.3	12.7	1.3	
FR	2.6	16.1	52.8	2.0	5.0	6.6	10.7	3.1	1.1
HR	6.6	4.7	37.2	3.1	0.9	44.9[151]	2.7	..	
HU	5.5	16.9	40.5	6.3	6.2	19.0	5.6	..	
IE	2.7	7.5	45.5	1.7	6.7	25.4	9.5	1.0	
IT	2.3	16.4	50.5	2.8	6.1	7.0	12.3	2.6	
LT	5.7	8.9	54.4	1.6	19.8[152]	2.0	7.6	..	
LU	0.0	2.8	8.6	5.7	2.7	13.5	6.7	60.0	
LV	8.5	21.1	32.8	3.1	7.3	14.9	11.4	0.7	
MT	0.6	22.9	13.8	1.7	2.7	7.9	2.7	47.5	1.1
NL	3.9	8.1	55.5	3.1	5.4	8.1	14.3	1.7	1.9
PL	4.6	15.6	34.2	2.0	6.8	25.4	11.4	..	
PT	2.2	10.4	46.9	3.4	8.0	17.6	8.3	3.3	
RO	2.0	41.8	29.9	1.3	0.0	25.0	0.0	..	
SE	3.9	14.4	42.3	7.2	7.3	11.2	13.3	0.1	
SI	0.2	22.6	64.8	0.9	2.6	7.9	1.0	..	
SK	4.0	10.5	29.8	3.5	8.8	27.5	7.9	3.1	4.8

Source*: Eurostat database on Energy taxes by paying sector (t2020_rt300).* ***Note:*** *Share of energy taxation on total revenues by household category also includes fuel use for transport purposes*.

However, ***energy revenues data are only partly comparable with consumption data***, making the calculation of the ITR/ETR more complex, and not always feasible. As anticipated above, Eurostat energy balances are structured along three macro categories: two of them, "industry"[153] and "other sectors"[154], identify typologies of

[151] This is almost entirely attributable to land transport and transport via pipeline. which includes other land passenger transport and may cover consumption from tourists and non-residents.
[152] This is almost entirely attributable to tax revenues from the wholesale and retail trade and repair of motor vehicles. that also includes fuel retail and service stations. Since Lithuania does not report for non-residents. this figure may include revenues paid by non-residents and other forms of fuel tourism.
[153] Iron and steel; chemical and petrochemical; non-ferrous metals; non-metallic minerals; transport equipment; machinery; mining and quarrying; food, beverages and tobacco; pulp, paper and printing; wood and wood products; construction; textile and leather; not elsewhere specified.
[154] Commercial and public services; residential; agriculture/forestry; fishing; not elsewhere specified.

users, broadly following the logic of the energy tax database; the third category, "transport",[155] however, does not refer to users, but to a specific use. Accordingly, the last category accounts for all energy sources used as motor fuels, regardless of whether they have been employed by industrial users, in specific industries, or by households. As a result, differentiating between taxes paid on motor fuels and fuels used for other purposes is difficult.

A different consumption database is likely more fit to calculate physical ITR/ETR per sector, and this is the ***Physical Energy Flow Accounts*** (PEFA)[156], a consumption database published by Eurostat. While the object of analysis of the Energy Balance is fuel consumption, and how fuels are transformed and used in an economy, the PEFA records the flows of energy from the environment to the economy, within (per type of users and industrial sectors), and from the economy back to the environment. PEFA structure is compatible with the national accounts methodology, and thus enable an integrated analysis of economic and energy variables, even though the main data series used for energy policies remains the Energy Balance. PEFA provide, at NACE-1 and -2 level, detailed statistics on supply and use (in TJ) for a vast range of energy products.[157] However, for many NACE-2 sectors, data on total energy consumption and per type of products are missing because of confidentiality, and this makes that level of disaggregation not fully usable to build an ITR/ETR based on physical consumption.

Finally, for industrial users, another source should be considered, which provides total costs of energy inputs by NACE sector. This consists in a data series within the annual detailed enterprise statistics database, and namely "***purchases of energy products***".[158] For each industry, at 1- 2- and 3-NACE sector level, total expenditures in energy products are provided. Its data coverage is very good, although data gaps exist, at least for NACE-2 sectors at national level. However, unlike sources on consumption, it only covers purchased fuels, excluding self-generated energy and feedstock, which represents a significant share of energy flows in certain industries.

In any case, the availability of energy consumption databases that could match the NACE-64 structure of the revenue data is not a sufficient condition. Building an ITR would indeed also require assessing whether the additional granularity to be achieved, is well supported by the quality of existing data, or whether this would require an additional data collection.

C.5.3.1. Implicit and Effective Tax Rate per energy intensive industries

The measurement of the ITR/ETR assumes a higher policy relevance for ***energy-intensive industries***. Though the exact definition can vary,[159] energy-intensive industries are those manufacturing sectors and sub-sectors for which energy represents one of the main factors of production, and/or for which energy costs represent a significant share of production costs, and for which competitiveness concerns are higher.

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155 Rail + Road + Domestic aviation + Domestic navigation + Pipeline transport + Not elsewhere specified. "This refers to energy used in all transport activities irrespective of the NACE category (economic sector) in which the activity occurs."

156 Eurostat, Physical energy flow accounts (env_pefa), metadata available on https://ec.europa.eu/eurostat/cache/metadata/en/env_pefa_esms.htm.

157 Hard coal; brown coal and peat; derived gases; secondary coal products; crude oil, NGL, and other hydrocarbons; natural gas: motor spirit; kerosene and jet fuels; naphtha; transport diesel; heating and other gasoil; residual fuel oil; refinery gas, ethane and LPG; other petroleum products; nuclear fuel; wood, wood waste and other solid biomass, charcoal; liquid biofuels; biogas; electrical energy; heat; renewable waste; non-renewable waste.

158 Eurostat, Structural business statistics (sbs), data on purchases of energy products, metadata available on https://ec.europa.eu/eurostat/cache/metadata/en/sbs_esms.htm.

159 According to the ETD, "an 'energy-intensive business' shall mean a business entity, as referred to in Article 11, where either the purchases of energy products and electricity amount to at least 3,0 % of the production value or the national energy tax payable amounts to at least 0,5 % of the added value" (in Article 17).

These sectors usually include production of ferrous and non-ferrous metals (e.g. steel, aluminium, copper, ferro alloys), certain chemical industries, cement and lime, transformation of non-metallic minerals (glass, ceramics), production of pulp and paper.[160]

For these industries, the price of energy is a decisive competitive factor: their capacity to be profitable and remain on the market depends on the cost of energy. As a consequence, for industrial policy reasons, they usually benefit from a number of subsidies – direct transfers such as rebates, or tax expenditures such as exemption or reductions, resulting in a lower ITR/ETR. For those industries for which electricity represents a key production factor, such as the production of ferrous and non-ferrous metals, reductions and exemptions from RES fees are also a competitiveness driver, which is not accounted for in the ETR.[161] According to CEER, no less than 12 countries provide for one or more types of RES fees reduction and exemption for energy-intensive industries.[162]

The amount of comparable cross-country data on this respect subsidies to energy-intensive industries is limited, and even more so when it comes to RES fees, both across EU countries and even more so with respect to non-EU jurisdictions. No indicators, however, are published at this level of analysis. For this reason, the Commission attempted to collect data an define indicators to monitor trends in those sectors via dedicated studies, described below

DG ENER Energy Prices, Costs, and Subsidies. DG ENER attempted to estimate a sectoral ITR/ETR for energy intensive industries in the last edition of its regular report on energy prices, costs, and subsidies. The Study adopts a top-down approach, i.e. relies on existing public and private database to compare energy prices and costs. The Report correctly attempts to define energy-intensive industries at a very granular level, and that is up to 3- or 4-digit NACE level. Only at this level, indeed, some of the heterogeneity of each specific industry and production process can emerge. It then adopts a sound, transparent, and state-of-the art methodology to tackle the problem. However, at this desired level of disaggregation, unsurmountable data gaps exist. In particular: (i) as discussed above, Eurostat energy costs only cover purchased fuels, (ii) energy price at sectoral level, even for NACE-2 sectors, are rarely available, (iii) sectoral energy consumption at 3- or 4-digit NACE level is usually available only for a handful of Member State.[163] Most importantly, and this is the main obstacle that any top-down study in this area must face, data on energy-intensive NACE sectors include both data from 'true' energy intensive plants as well as other businesses in the same industry doing low-energy activities (e.g. conduit societies, project-based entities, R&D joint ventures).[164] Due to the data gaps, and the problems in using NACE-based company lists to define energy intensive industries, the report shows that most of the changes in energy costs in those industries over the last years cannot be explained by identifiable reasons.[165]

DG GROW. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries.[166] This study, regularly published by DG GROW so far, estimates, the prices of and costs of electricity and natural gas for a selection of energy

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[160] Cf. High-level Group on Energy-intensive Industries, *Masterplan for a competitive transformation of EU energy-intensive industries enabling a climate-neutral enabling circular economy by 2050*, Report for DG GROW European Commission, November 2019.
[161] With the exemption of Member States in which RES fees are implemented as excise on electricity or other fuels.
[162] CEER, Status Review of Renewable Support Schemes in Europe for 2016 and 2017, Brussels, Ref: C18-SD-63-03, 2018.
[163] In this respect, it is however unclear the extent to which PEFA data have been accounted for, as it is not mentioned in the Report.
[164] Trinomics for DG ENER, (2018), p. 129.
[165] Trinomics for DG ENER, (2018), p. 156.
[166] The title varies across the various editions.

intensive industries in the EU. Data are collected at plant level, based on a combination of random sampling and cooperation of companies willing to share detailed cost and price data. Energy prices are decomposed into the energy component and a number of regulatory components: network fees, RES fees, and taxes. In the latest version, a differentiation has been introduced between 'prices' as paid in the energy bills, and costs, that also include out-of-bill factors, such as subsidies or self-generation costs and revenues. Hence, it can be used to calculate a refined ITR/ETR for these industries. The report provides estimates for the EU, and three EU regions (Central-eastern, North-Western, Southern). Data are also presented for selected Member States, i.e. those for which sufficient data points are available. The report represents an advanced attempt to measure energy prices and costs for energy intensive industries via a bottom-up approach. Its methodology directly tackles the problem by retrieving cost and price data directly from companies, supported by energy bills when possible, and adopting a narrow sectoral approach which can thus account for the variation in production processes and costs across sectors and sub-sectors. The indicators so estimated are clear in measuring the prices and costs of electricity and natural gas in the industries selected, as well as their energy intensity both in physical (energy/unit of physical production) and financial terms. The identification of the regulatory components of the energy prices provide a guidance for policymakers on the outcomes of existing policies and the impacts of possible changes. However, the drawback of the bottom-up approach is in the sampling strategy. Obtaining detailed price and cost data at plant level requires the cooperation of the industries concerned, and of the companies operating those plants. This implies that a randomised sampling could not be performed. For some industries, the sectoral coverage is high or very high, up to 90% of the EU production, and hence data can be considered representative. However, in other cases, the coverage is lower, and it cannot be ascertained to what extent the estimates are representative of the whole sector.

Critical Assessment. DG GROW's approach overcomes the inherent limits of NACE-based public databases, and focuses only on energy-intensive plants, rather than sectors. It thus provides interesting insights on the costs paid by energy intensive industries, and in particular of the amount RES fees and taxes borne by those large consumers, and on the relative variations of energy prices within the Internal Market. It should however be stepped up by matching this approach to the data collection power that only statistical authorities have, so that the sampling strategy could ensure an appropriate and geographically uniform representativeness.

The most important insights from DG GROW's report is that the real driver of energy costs in these industries, including of the level of fees and taxes, is not the specific industry, but the band of consumption. The more electricity (or natural gas) consumed by a plant, the lower the energy costs, and the fees and taxes borne. This suggests that the industry-based approach, and its existing problems and gaps, could maybe be abandoned by (i) defining what the typical consumption bands are in the energy-intensive sectors; and (ii) assessing energy prices and their components from a consumption band-perspective. This is the approach already adopted by Eurostat's electricity and natural gas price database,[167] which, for various consumption bands, collects data on prices and components (including taxes, fees, and levies). However, its data coverage is full or nearly full for household consumers and for small non-household consumers; for very large non-household consumers, which would correspond to energy intensive industries, the data coverage rapidly falls due to confidentiality or non-availability.

The same bottom-up approach could be in principle used for other energy products, and even for other taxes. The challenge in this case is to adapt existing data and methodology to the perspective of the final user, in this case the energy intensive plants. This may require departing from the existing definitions and approaches. This is for instance the case of ETS. From a plant perspective, the cost of the ETS could be

[167] Energy statistics - natural gas and electricity prices (from 2007 onwards) (nrg_pc).

measured in two ways. First, by estimating the net costs of the emission allowances surrendered in one year, based on the average market price, once those freely allocated are subtracted. Secondly, by measuring net financial flows from buying or selling emission allowances in one year. While the second indicator captures neatly the net cost for the emitter, the former can be more squarely attributed to the production which has taken place over the period considered.

C.5.4. Conclusions

Various attempts exist to measure the ***average tax burden on energy*** via Implicit and Effective Tax Rates. These can be calculated as the average burden per unit of energy consumption, or per its monetary value, starting from actual revenues or from tax rates. Information on all types of subsidies, especially off-tax and feebates, is not available for the moment, so that no indicator currently captures the real tax burden. While there is no estimate on the extent to which the missing subsidies are likely to significantly affect current estimates, the available evidence shows that this data gap could alter ITR/ETR estimates for certain uses or category of consumers, and in particular for energy-intensive industries.

The Implicit and Effective Tax Rates can be used to measure the average energy tax burden on the economy as a whole, or by fuel, sector, or type of activity. In these various declinations, they allow for considerations of competitiveness – of a whole country or specific industries - affordability, as well as for the consistency of the tax system, when interpreted as the homogeneous taxation on a per energy content (or carbon emission) basis.

Various Implicit and Effective Tax Rates for the whole economy are calculated by the European Commission and the OECD. DG TAXUD and Eurostat provide three series for implicit tax rates, in both nominal and real terms. The existing indicators present the average tax burden per energy content (TOE), calculated based on available estimates of total energy tax revenues; to the contrary, no attempt has been done to produce an Implicit Tax Rate in monetary terms, i.e. as a share of total energy expenditures.

The OECD Effective Tax Rate on energy focuses on consumption taxes only (excises on fuels and electricity, carbon taxes) and is calculated starting from tax rates, the consumption to which those rates are applied, and subsidies. However, the indicator cannot account for a number of off-tax subsidies not tracked by this organisation. Even accounting for such a limitation, the OECD Effective Tax Rate represents a deep and policy relevant source of information on the tax burden on energy. It provides, on a per country, per type of users,[168] and per product basis, information on the applicable and average tax rates. In its latest edition, data are provided via national spreadsheets providing data on effective rates and consumption, and thus allow to estimate values across sectors and fuel products on a national basis.

The availability of indicators is way more limited when the average tax burden per energy product or energy sectors is considered:

- On products, the existing revenue data are not sufficiently differentiated, e.g. in the NTL. The Excise Duty Tables are the only EU-wide data source on energy taxation which is organised on a per product basis. However, they (i) account only for one type of energy taxes, and (ii) are populated by national data without central methodological supervision e.g. by Eurostat. A product-based Implicit or Effective Tax Rate, expressed as tax burden on price, has been calculated for transport fuels, in the Oil Price Bulletin.

[168] i.e. road transport; off-road transport; agriculture, fishing and forestry; industry; the residential and commercial sectors; and electricity generation.

- On sectors, taxes by paying entities and economy activity (at NACE-2 level) are regularly published by Eurostat, based on NTLs. However, they have not been used so far to publish an Implicit or Effective Tax Rate per energy consumption or per energy costs, even though databases on those aspects exist which could be made compatible with the structure of the revenue data.

Other than this general source, two attempts have been made by the European Commission to estimate the effective tax burden on electricity and natural gas paid by ***energy-intensive industries***, a key aspect of any analysis of the impact of energy taxation on competitiveness. These were done via a top-down approach, starting from available statistics, as well as bottom-up, i.e. starting from data on prices, costs, consumptions, and subsidies obtained at plant level. The indicators defined bottom-up allow for assessing the effective tax rates in those industries, although (i) available data points are too few to draw conclusions for all, or most, EU Member States; (ii) the Study partly relies on the voluntary participation of a number of plants in selected industries, rather than on typical, randomised, sampling techniques used by national statistical offices.

C.6. ENERGY TAXATION AND CARBON PRICE

Introduction. In this section, the relation between energy taxes and the broader theme of carbon price is explored. Carbon pricing mechanisms are among the most important policy tools used to fight climate change and result from energy taxes and the ETS (as well as national carbon taxes, where introduced). Section C.6.1 explores the underlying theory and policy framework of these tools, the extent to which they can be considered equivalent, and their interaction. Then, an assessment of the existing indicators which comprehensively measure carbon price, as resulting from various policy tools, is carried out in section C.6.2.

C.6.1. The theory and policy framework

Economic agents respond to incentives, reducing consumption of a good when its price increases, and at the same time increasing consumption of similar goods with a lower price (substitute goods). This is the very basic economic framework underpinning the idea that ***'putting a price'*** directly on carbon can reduce carbon emissions, by decreasing consumption of carbon-generating energy sources, and by encouraging the transition from high- to low-carbon energy sources. The first effect operates in the short term and *ceteris paribus*, i.e. given the current investment decisions; the second effect operates in the long-term, when the stock of investments and the technology employed can vary.

Carbon pricing tools, or market-based instruments, are not the only available tools to reduce carbon emissions. Other mechanisms include command and control regulation, standard setting, energy efficiency measures, support to low-carbon technologies and energy sources, or behavioural measures (e.g. nudging, awareness campaigns). Despite a long list of rival measures, carbon price tools are considered effective and efficient for three main reasons: (i) abatement decisions are decentralised, i.e. taken by the emitter, reducing the information asymmetry between the regulator and the regulated; (ii) in equilibrium, the carbon price is equal to the marginal cost of abatement, ensuring allocative efficiency; and (iii) continuous incentives are provided to reduce emissions, thereby stimulating innovation.[169]

[169] Cf. OECD, *Effective Carbon Rates, Pricing Carbon Emissions Through Taxes and Emissions Trading*, OECD Publishing, Paris, 2018OECD.

Several carbon pricing tools exist. Following the World Bank, one could usefully distinguish between those based on an explicit and implicit price.[170] Explicit pricing tools include those ones in which a rate or price is expressed per tonne of CO_2eq, and namely:

1) ***Carbon tax***, that is a tax whose rate "explicitly states a price on greenhouse gas emissions, or that uses a metric directly based on carbon"[171]. With a carbon tax, the price of carbon is fixed and is generally expressed in the tax rate. Reduction of emissions is uncertain.

2) ***Emission Trading Systems (ETS)***, where an authority identifies a number of emitters and sets a ceiling (cap) on total emissions. Then, the same authority issues tradable allowances up to the emission ceiling. Emitters covered by the ETS must surrender one allowance for each unit of emissions and can freely trade allowances among themselves. Allowances can be allocated for free or against a payment (e.g. via an auction), or they can be bought from other participants (secondary market).[172] Under an ETS system, the price is variable and depends on demand and supply of allowances. Reduction of emissions is certain and set by the cap.

3) ***Other tools***, with a much more limited emission coverage at global level, such as offset mechanisms, and results-based climate finance.

Carbon taxes and ETS are the main market-based mechanisms used to put an explicit price on carbon. Hybrid systems also exist, combining elements of these two tools. For instance, and ETS with fixed prices, or a price floor and ceiling, can come very close to a carbon tax; differently, a tax scheme in which tax liabilities can be reduced in case emissions are abated can become similar to an ETS.[173]

Implicit pricing tools include those that indirectly result in a carbon price, even though the relevant price or rate is not expressed per tonne of CO_2eq. This is for instance the case of ***energy taxes***, whose rates are normally expressed per energy content or unit of volume. In principle, any policy imposing a cost on carbon emitting or granting a subsidy to carbon saving activities without explicitly putting a price per tonne of CO_2eq can be considered an implicit carbon pricing tool. These policies, which indirectly put a price on carbon and are usually not accounted in carbon prices, include RES support (see Box 7 below), mandatory or voluntary share of RES on electricity production, and command and control regulation.

Box 7 The implicit price of RES in Germany

In a scholar contribution, Marcantonini and Ellerman analyse the "cost of reducing CO_2 emissions in the power sector through the portion of wind and solar energy for the years 2006 and 2010". In doing so, they estimate a RES carbon surcharge and the implicit carbon price associated with RES incentives. The carbon surcharge measures the ratio between the net benefits due to wind and solar RES and the CO_2 emissions savings generated. To calculate net benefits, i.e. costs (-) minus benefits (+), they account for RES support (-), additional cycling costs (-), additional balancing costs (-), fuel cost savings (+), carbon cost savings (+), and capacity savings (+). The implicit carbon price results from the sum of the carbon surcharge and the ETS costs, and measure the hypothetical carbon price that would make RES market viable, should there be no net benefits associated with its use, including support to generators. Such an implicit price is however not comparable to the pricing mechanisms described above, which represents the additional costs that an emitter is confronted with when deciding whether to emit an additional tonne of CO_2. Rather, these indicators are a useful synthetic measure of the cost of abatement in the RES sector, which can be then used to comparatively assess the cost-effectiveness of various climate change

[170] World Bank, *State and Trends of Carbon Pricing*, Washington, DC: World Bank Group, 2019.
[171] Conway, D. *et al*., *Carbon Tax Guide: A Handbook for Policy Makers*, PMR Carbon Tax Guide - Translations. Washington, D.C.: World Bank Group, 2018.
[172] Kerr, S. *et al*, *Emissions trading in practice: a handbook on on design and implementation*, Washington, D.C.: World Bank Group, 2016.
[173] *Ibid.*

mechanisms and can be seen as the threshold at which a carbon tax rate on fossil fuels would have triggered substitution with renewable sources.

***Source**: Marcantonini, C. and Ellerman, D., 'The Implicit Carbon Price of Renewable Energy Incentives in Germany', The Energy Journal, Vol. 36, No. 4, October 2015, pp. 205-239.*

The main explicit carbon pricing mechanism in the EU is the ***EU ETS***. Established in 2003 and[174] operational since 2005, it currently covers more than 11,000 large stationary emitters and airlines, accounting for about 45% of GHG emissions in the EU. More in details, the ETS covers GHG emissions from power and heat generation (from installations larger than 20 MW), energy-intensive industries (such as oil refineries, steel making, and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids, and bulk organic chemicals), and commercial aviation.[175] Under the current phase, ending in 2020, the cap is established at the EU level and allowances are by default auctioned; however, free allowances are still granted to a number of emitters and they currently represent about 45% of total allowances.[176] The price of the allowances, corresponding to one tonne of CO_2eq, has ranged between 20 and 30 EUR, from mid-2018 onwards[177], and has increased significantly over the last years, following policy interventions aimed at reducing the oversupply of emission allowances through the establishment of a reserve mechanism.

The other relevant EU pricing tool, this time implicit, is the ***Energy Taxation Directive*** (ETD),[178] which partially harmonises the national taxes on energy products and electricity by introducing minimum rates and partly coordinating the exemptions and reductions which should or can be introduced. Minimum rates apply to motor fuels, heating fuels, and electricity, and cover explicitly the most common energy products, as well as any other substitute.[179] Rates are expressed per volume (litres for liquid fuels), weight (kg for LPG), or energy content (GJ for natural gas, coal, and coke; MWh for electricity).

Differently, ***the EU framework does not provide for a carbon tax***. An attempt was made to tax energy products also based on their carbon content when revising the ETD in 2011.[180] Had that proposal been adopted, the taxation of fossil fuels would have been expressed partly per volume / energy content, and partly per carbon content. The proposal, however, has never been approved by the Council and was subsequently withdrawn.

Several Member States have introduced carbon taxes, usually within the existing tax framework, i.e. under the umbrella of the ETD.[181] Currently, 10 Member States provide for a carbon tax: Denmark, Estonia, Finland, France, Ireland, Latvia, Poland,

[174] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, OJ L 275, 25.10.2003, p. 32–46.
[175] The scheme also covers nitrous oxide from production of nitric, adipic and glyoxylic acids and glyoxal and perfluorocarbons from aluminium production.
[176] DG CLIMA, EU ETS handbook, DG Climate Action European Commission, 2015.
[177] European Energy Exchange.
[178] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003.
[179] For motor fuels, the following are explicitly covered: leaded petrol, unleaded petrol, gas oil, kerosene, LPG, natural gas; heating fuels include gas oil, heavy fuel oil, kerosene, LPG, natural gas, coal and coke.
[180] Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, COM(2011) 169 final, Brussels, 13.4.2011.
[181] The ETD does forbid Member States to introduce carbon taxes, as long as minimum taxation rates are respected irrespective of any carbon component). It is at the moment unclear how many Member States apply the carbon tax with the same tax base of the ETD, and this will be further investigated in the next phase.

Portugal, Slovenia, and Spain[182]. Early adopters include Finland, Poland, Sweden, and Denmark, which introduced the tax in the early 90s, while Spain, Portugal, and France joined the club after 2014. The rates vary widely, from more than 100 €/tonne of CO_2eq in Sweden, to less than 1 €/tonne of CO_2eq in Poland. The tax coverage is also defined at the national level; as discussed below, most of the EU countries which embedded the carbon tax in the ETD framework and for which information on overlap is available exempt most of the operators covered by the ETS from the excise carbon component.[183] In addition, Germany is considering applying a hybrid domestic ETS system to the residential and transport sector under the Effort Sharing Regulation[184]. More details are provided in Box 8 below.

Box 8 German Domestic ETS

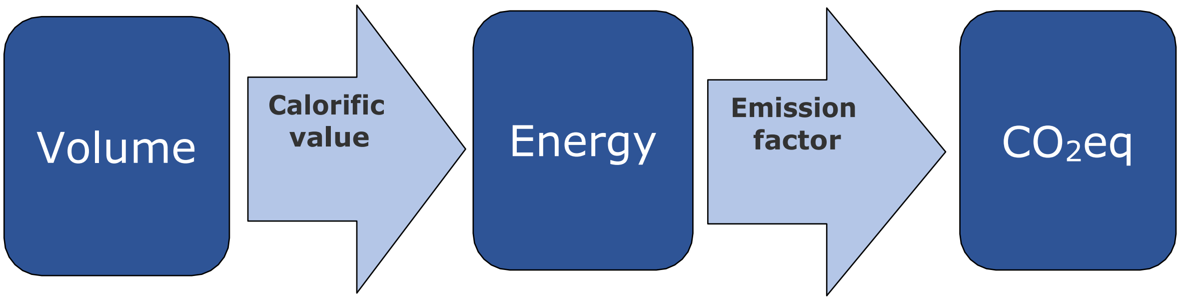
In October 2019, the German government proposed to setup a domestic ETS for the heating and transport sectors. The system would start in 2021 and is planned to follow a hybrid model in which the price of the allowances is fixed. The price will start from 10 EUR/tonne of CO_2eq in 2021 and progressively rise to 35 EUR/tonne of CO_2eq in 2025. Until 2025, thus, the system will be very similar to a carbon tax. From 2026 onwards, allowance prices will be established via an auction mechanism, and must fall within the 35 – 60 EUR/tonne of CO_2eq range. The system will cover emissions from the combustion of fossil fuels (namely heating gas oil, LPG, natural gas, coal, gasoline, and diesel) for heating and transport purposes. With regard to heating purposes, the system covers both households and business customers, excluding business customers which are subject to the ETS. Analogously, the system also excludes aviation, which is also subject to the EU ETS. Participants to the domestic ETS will be fuel suppliers and distributors.

Source*: German Federal Government, Gesetzentwurf der Bundesregierung, Entwurf eines Gesetzes über einen nationalen Zertifikatehandel für Brennstoffemissionen (Brennstoffemissionshandelsgesetz – BEHG); Clean Energy Wire, German government decides tax changes for climate plan,* CO_2 *price details, October 2019; PV Magazine, Bundeskabinett verabschiedet* CO_2*-Emissionshandel für Verkehr und Wärmeversorgung, October 2019.*

Energy taxes, an implicit price mechanism, can be transformed into an explicit carbon price equivalent by using conversion factors. For each fuel, a volumetric unit can be transformed into energy content by means of the calorific value (gross or net). Then, a CO2eq-emission factor, expressed as CO2eq /energy content, transforms the energy content into CO2eq emissions. Conversion factors can vary depending on the quality of each fuel, and from country to country.[185] The variation can be large for solid mined fuels (e.g. coke), less for natural gas, and much smaller for refined products, such as gas oil and petrol. The relation is summarised in Figure 2. Emission factors for Germany are reported in Table 5.

[182] The inclusion of Spain is controversial (see section 3). According to the WB, Spain is to be considered among the countries with a carbon tax. However, the tax currently applies only to fluorinated gases. To the contrary, the OECD does not consider Spain to have introduced a carbon tax. The country imposes, however, a product-specific tax on coal (*Impuesto Especial sobre el Carbon*). Cf. OECD, *Taxing Energy Use 2019: Spain Country Note*, OECD Publishing, Paris, 2019; Tax Foundation, Carbon Taxes in Europe 2019, available at: https://taxfoundation.org/carbon-taxes-in-europe-2019/, (last accessed March 2019).
[183] World Bank, *State and Trends of Carbon Pricing* 2019, Washington, D.C.: World Bank Group.
[184] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance).
[185] OECD, *Revenue Statistics 2019*, OECD Publishing, Paris, 2019; IEA, *World Energy Balance 2019 Edition. Database Documentation*, International Energy Agency, 2019; Eurostat, *Energy balance guide. Methodology guide for the construction of energy balances & operational guide for the energy balance builder tool*, 31st January 2019; IEA, OECD and Eurostat, *Energy Statistics Manual*, OECD Publishing, Paris, 2004.

Figure 2: Equivalence of energy volume, content, CO_2eq emissions



***Source**: Authors' elaboration*

Table 5: Emission Factors for a Number of Fossil Fuels in Germany (in Kg of CO_2eq/ GJ)

Specific Carbon Dioxide Emissions of Various Fuels	
Fuel	**Emissions in kg CO_2eq / GJ**
Wood	109.6
Peat	106
Lignite (average)	101.2
Lignite from Central Germany	104
Lignite from Rhineland	114
Hard coal	94.6
Fuel oil	77.4
Diesel	74.1
Crude oil	73.3
Kerosene	71.5
Gasoline	69.3
Refinery gas	66.7
LPG	63.1
Natural gas	56.1

***Source**: Fachbuch Energiesysteme*

Near-equivalence of energy and carbon taxes. Though energy taxes can be transformed into an equivalent carbon tax for each specific fuel, the ***effect on consumer decisions is not the same***. Namely, the incentives to switch to low-carbon technologies in the long-term are not equivalent. For any given technology, e.g. a diesel car owned by a household or a natural gas boiler used by an industry to produce heat, an increase in energy taxes (e.g. fuel excises) or the introduction of a carbon tax have the same short-term effect: price will increase, and the demand for fuel, i.e. the amount consumed, will decrease.[186] The effect on demand (consumption) will be the same[187].

The equivalence, however, is not given in the long-term, that is when the economic agent can make investment decisions. In the long-term, a carbon tax will steer investment decisions towards low-carbon technologies, as this will reduce the tax burden. Differently, an energy tax will not directly reduce emissions by favouring low-carbon investment over higher-carbon alternatives; rather, it will reduce emission by lowering the overall demand for energy. This is due to the fact that an energy tax usually provides for differences in the corresponding carbon equivalent rates between fuels; if the energy tax rates provided for uniform carbon rates, there would be no difference

[186] This remains valid regardless of the aim of the tax. An energy tax equivalent to 10 EUR/litre of diesel will provide the same incentives to energy users regardless of whether it has been introduced for revenue generating purposes, to promote the use of local transport, to compensate for road congestion, or to account for climate change externalities.
[187] OECD, Taxing Energy Use 2015: OECD and Selected Partner Economies, OECD Publishing, Paris, 2015; hereinafter "OECD TEU (2015)".

between energy and carbon taxes. In any case, the former situation is currently prevalent in the EU. For instance, ETD minimum implicit carbon rates, when expressed per carbon content, are as follows: for petrol, 159 €/tonne of CO_2; for gas oil, 102 €/tonne of CO_2; for natural gas used as motor fuel, 46 €/tonne of CO_2; for natural gas used for heating, 5 €/tonne of CO_2; and for coal for non-business heating, 3.1 EUR/tonne of CO_2.[188] In this case, as carbon equivalent rates differ across fuels, the household, or business, does not have an incentive to buy a low-carbon technology, and the demand for higher-carbon technologies will be higher than under a carbon tax[189]. This is however, at least for the time being, largely theoretical as likely carbon-free product substitutes (e.g. hydrogen) are already not taxed at any rate and the cost gap of carbon capture technologies cannot be yet bridged by carbon taxation.

The joint effect of carbon pricing tools. When implemented in isolation, carbon taxes, ETSs, and energy taxes provide the same incentive for abatement in the near term on businesses. A business can decide whether to emit one additional tonne of CO_2eq or to reduce emissions by one tonne of CO_2eq. If the cost of abatement is lower than the carbon price, emissions will be reduced; if the cost of abatement is higher than the carbon price, one more tonne of CO_2eq will be emitted. From the perspective of the single agent subject to different overlapping pricing tools, the relevant carbon price is the sum of the prices imposed by the various tools.[190] Let's consider a business subject to an ETS price of 30 €/tonne of CO_2eq and subject to an additional carbon tax of 10 EUR/tonne of CO_2eq. If one additional tonne of CO_2eq is emitted, the business will have to surrender one allowance (for an opportunity cost equal to its price) and pay the carbon tax, for a total cost of 40 €/tonne of CO_2eq. Hence, emissions will be reduced if the abatement cost is lower than 40 €/tonne of CO_2eq. Otherwise, the business will opt to emit, acquire an allowance and pay the carbon tax for a total expenditure of 40€.

While ETS and energy or carbon taxes are additive from the perspective of the final user, this may not be case from a systemic perspective. Namely, the emissions reductions generated by each tool do not 'sum up' when the economy is already using all ETS allowances, i.e. it is 'working by the cap'.[191] In this case, the additional reduction triggered by an energy or carbon tax will result in a reduction of emissions by those operators facing low abatements costs; this means that some allowances will be available in the market. Therefore, operators with high abatement costs could buy the allowances, and emit more, thus reducing the positive impact of energy and carbon taxes.

This is not the case, however, if the economy does not 'work by the cap', i.e. if the allowances issued are higher than total emissions, as has been typically the case in the EU (see Table 6 below). In this case, allowances are not scarce, and operators can already buy as many as they want, based on their marginal cost of abatement. More in detail, the carbon tax is additive, in terms of emission reduction, as long as the additional carbon abatement that it generates is smaller than the difference between total emissions and allowances issued.

Table 6: EU ETS: Cap and Verified Emissions

Year	ETS Emissions	Cap	Difference	%
	MN tonne CO_2eq			
2013	1.975	2.084	109	5%

[188] David A. W., Carbon Taxation in the EU: Expanding the EU Carbon Price, Journal of Environmental Law, Vol. 24, Issue 2, July 2012, Pages 183–206.
[189] OECD TEU (2015).
[190] General Secretariat of the Council, ECOFIN 33 ENV 51 Report on the efficiency of economic instruments for energy and climate change, ECFIN/EPC(2007)REP/ 55386/final, Brussels, 30 January 2007.
[191] More in details, all allowances issued in a given year are surrendered by the economic agents; or, in other words, the total amount of emissions covered by the ETS is one year is equal to the maximum amount of emissions.

2014	1.878	2.048	170	8%
2015	1.864	2.012	148	7%
2016	1.808	1.977	170	9%
2017	1.809	1.943	134	7%
2018	1.736	1.909	174	9%

***Source**: European Environment Agency, Greenhouse gas - data viewer, available here*

Overlapping carbon or energy taxes increases the price of carbon emissions on businesses, and thus, by reducing emissions, reduces their demand for allowances[2], thus indirectly affecting the price of the ETS. This is the main justification why, in most systems, installations covered by the ETS are shielded, in full or in part, from carbon and energy taxes. In the EU, such overlaps exist, but are limited. As for energy taxes and the ETS, many of the sectors specifically covered by the EU ETS correspond to uses which are excluded from the ETD. This is not the case, however, for the pulp and paper industry[192], and part of the chemical industry. Furthermore, the two Directives overlap in other sectors (other than electricity production), such as the production of heat from installations with a capacity of more than 20 MW. This may include non-energy-intensive sectors, such as mechanical engineering, textile companies, and food processing; no quantitative estimate of such an overlap exists[193].

The effect of the introduction of national energy or carbon taxes in a supranational ETS system, such as in the EU, depends on the level of the tax and the country size. If either the tax or the country is small, no impact will be produced on the allowance price, and the marginal abatement cost for emitters located in the carbon taxing jurisdiction will increase. If the rate is high or the country is large, the price of the allowances will be reduced; the marginal abatement cost will be higher in the carbon taxing jurisdiction, even accounting for the reduced allowance price, and lower in the rest of the EU. Between national carbon taxes and the ETS, the overlap is marginal. Five Member States do not apply at all the former to emitters covered by the latter. However, this is not the case in Denmark, Finland, Slovenia, Sweden, and Ireland.[194] The share of emissions covered by a carbon tax and those covered by both the ETS and a carbon tax are reported in Table 7, and the overlap is described in Box 9 below. Assuming that the level of overlap in these five countries is in line with the available data, emissions in the EU covered by both the ETS and a carbon tax amounted to about 2% of total emissions in 2017[195].

Table 7: National Carbon Tax: % of Emissions Covered and % of Overlapping

Member States	Statutory Rate (US$/tonne CO2eq)	% emissions covered (over total emissions)	% overlapping with ETS (over emissions covered by carbon taxes)
DK	26 (fossil fuels) 23 (F-gases)	40%	Not available
EE	2	3%	Not available
ES	17	3%	No overlap
FI	70 (transport fuels) 60 (fuels)	36%	37%
FR	59	35%	No overlap
IE	22	49%	40%
LV	6	15%	No overlap
PL	<1	4%	No overlap
PT	14	29%	No overlap

192 At least, for the amount of heat and electricity not generated by co-generation plants, which can be excluded by both the ETS and ETD coverage.
193 Cf. ETD IA, SEC(2011) 409 final.
194 OECD TEU (2015).
195 If 100% of Danish, Estonian, Slovenian, and Swedish emissions covered by carbon tax were also covered by the ETS, the share would increase to 4%. However, as discussed in Box 8, the overlap in Denmark and Sweden is reportedly very limited.

SE	127	40%	Not available
SI	19	24%	Not available

***Source**: World Bank Carbon Pricing Dashboard, OECD, Taxing Energy Use, 2019*

Box 9 Summary of Information on Exemptions from the WB Carbon Price Dashboard

- **Finland**. The carbon tax does not apply to fuel for electricity production, commercial aviation and commercial yachting. Certain industries and fuel uses are (partially) exempt from the carbon tax, such as refineries and CHPs or the use of coal and natural gas as raw materials in industrial processes. In terms of energy products, the carbon tax also does not apply to peat, a national energy source extensively used in the Country, that is only taxed based on its energy content.
- **Denmark**. Operators covered by the EU ETS are exempt, but for district heating and waste incineration plants. Certain energy-intensive industries, as well as aviation, navigation and, export of fuels, together with railways and power and heat production are (partially) exempt.
- **Sweden.** Operators covered by the EU ETS are exempt, except for the fossil fuels used to generate heat for other purposes than manufacturing and the heat is not generated in a combined heat and power plant. Also, certain industries, export of the fuels, railways, navigation and aviation, electricity production, forestry and agriculture are (partially) exempt from the carbon tax.
- **Latvia.** Operators covered by the EU ETS are generally exempt from the carbon tax. The carbon tax however never applies to the use of peat in industrial activities.
- **Estonia.** Not available
- **Poland.** Operators covered by the EU ETS are exempt. Exemption also extends to cases where the annual tax amount due under the Environmental Protection Act is less than 800 złoty.
- **Slovenia.** The Slovenia carbon tax applies to heating for buildings and transport. Operators covered by the EU ETS if deemed exposed to carbon leakage and/or are energy-intensive industries are exempt. Also, certain (energy-intensive) industries, export of fuels aviation and power production are exempt from the carbon tax.
- **Portugal.** The Portugal carbon tax is tied to the average EU ETS allowance in the preceding year. It applies to the carbon tax rate for coal-fired electricity generation and co-generation facilities that also participate in the EU ETS until the full tax rate is faced in 2022. Certain industrial processes (notably non-combustion usage) and modes of transport and vulnerable consumers are (partly) exempt.
- **France**. Operators under the EU ETS are exempt. Also certain industrial processes (non-combustion usage), power production, navigation, aviation, public and freight transport are (partly) exempt.
- **Ireland.** Operators under the EU ETS are partly exempt up to the ETD minimum excise level. Certain processes, export of fuels, power production, navigation and aviation are also (partly) exempt.

C.6.2. The existing indicators on 'comprehensive' carbon price

At international level, two organisations are attempting to measure a comprehensive carbon price, i.e. also including implicit measures such as energy taxes:

- the OECD, measuring the Effective Carbon Rate (ECR); based on this indicator, it also assesses the share of emissions priced above a given level and the Carbon Pricing Gap (CPG) for about 40 jurisdictions;

- the IMF, measuring the Effective Carbon Price (ECP) and the impacts of various carbon price levels for 135 jurisdictions.

Furthermore, a third source is the repository of all explicit carbon pricing initiatives (carbon tax and tradable permits/allowances) across the globe, including at sub-national level for some federal jurisdictions, provided by the World Bank. While it is not an indicator *per se*, it includes many information which can be used to populate quantitative tools.

OECD Effective Carbon Rate.[196] The ECR is the total price that applies to carbon emissions from energy uses as a result of three market-based policy instruments: energy taxes, carbon taxes, and carbon emission permits/allowances; VAT is excluded. Data on energy and carbon taxes are retrieved from the TEU database, and thus the base of information is common with the ECR.[197] Different from the TEU Database (and the ECR built thereupon), the ECR also includes ETS prices and revenues but considers the ETS average auction price in a year; i.e. the indicator does not account for the share of EUAs provided freely. Roughly speaking, these market-based instruments are summed, even though their combination is more complex (as described in Box 10 below). The ECR is expressed in €/tonne CO_2eq and is calculated both with and without emission from biomass.[198] As for subsidies, the ECR accounts for those reflected in energy or carbon tax policies (e.g. energy tax reduced rates or exemptions). In the latest edition, the ECR is not presented as such, i.e. in terms of average carbon rate in EUR/tonne CO_2eq per country. Rather, for each country and sector (road transport, industry, electricity, residential and commercial, agriculture and fisheries, off-road transport), the share of emissions above a certain benchmark carbon rate is reported. Differently, in the previous edition, the average ECR for road and non-road uses was reported, together with the share of emission; as a result, a country average ECR could be calculated.

Box 10 The combination of energy taxes, carbon taxes, and ETS in the OECD ECR

Data on carbon and energy tax rate and coverage are taken from the OECD 'Taxing Energy Use' database. Energy taxes are converted into carbon equivalent based on their calorific values and emission factors. From carbon taxes, the amounts which are offset for sectors under ETS are also discounted. Combining ETS with tax data is more complex. Not so much for allowance prices, which are taken from auctions or secondary market, as for the system coverage. The amount of emissions covered is estimated based on verified emissions data, or from government reports. To match tax data, emissions must be allocated to one of the six sectors covered by the OECD ECR (road transport, off-road transport, industry, agriculture and fisheries, residential and commercial, and main electricity generation). This is possible, with some approximation, depending on the nature of information made available by each jurisdiction. However, ETS data also include (i) emission from electricity self-generation; (ii) process emissions; and (iii) emissions from non-CO_2 gases. Again, to ensure matching, self-generation is moved from the electricity sector (as in the taxing energy use database) to the industry, while process emissions and other GHG gases are removed from ETS data by means of UNFCCC estimates. Finally, ETS emissions must be 'allocated' to the underlying fuel, by assuming that the ETS proportionately apply to each fuel burn by emitters covered, and the interaction between ETS and taxes must be disentangled. The latter aspect is straightforward for five sectors, but not so much for the industry. The limited information on the overlap lead for some uncertainty in the identification of the ECR coverage, i.e. the amount of emissions covered by either ETS or taxes, which can vary by few percentage points for most countries.

Source*: OECD TEU (2015).*

OECD Share of emissions priced above a given threshold. Based on the data used to calculate the ECR, the OECD computes the share of carbon emissions priced above certain price levels: EUR 0, 5, 30, and 60 per tonne of CO_2eq. The EUR 0 threshold is used to estimate the share of emissions priced at all in a country or sector, while the EUR 5 threshold can be used to estimate the share of emissions with a non-negligible

[196] 105. OECD, Effective Carbon Rates, Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris, 2018; hereinafter "OECD Effective Carbon Rates (2018)"; and OECD, Effective Carbon Rates, Pricing CO_2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, 2016; hereinafter "OECD Effective Carbon Rates (2016)".

[197] OECD Effective Carbon Rate (2018). at p. 16.

[198] The OECD provides two versions of the indicator. Main results are provided including emissions from the combustion of the biomass in the emission base, i.e. emissions from biomass are treated as equivalent to carbon emissions from fossil fuels. An alternative approach would be to consider biomass as carbon neutral, since, from a lifecycle perspective, when burnt, plants emit the carbon that they have absorbed during their life. This approach is however challenged in the scientific literature.

price. EUR 30 is the low-end estimate for carbon costs in 2020; EUR 60 is the mid-point estimate for 2020 and the low-end for 2030, as per the existing literature estimates. The indicator is measured for 42 countries and six sectors; estimates per national sectors are available. This indicator can be thus used to monitor to what extent countries are correctly pricing carbon; however, being thresholds discrete, it cannot capture all policy changes. For instance, an increase in carbon tax rate which does not cross any threshold (e.g. from 6 to 29 EUR per tonne of CO_2eq) would not lead to an improvement of this indicator.

OECD Carbon Pricing Gap.[199] The Carbon Pricing Gap (CPG) measures the extent to which national policies price carbon below two external benchmarks, EUR 30 and EUR 60 per tonne of CO_2eq. The CPG is measured both at country and sectoral level, based on the ECR data. Compared with the ECR, the CPG is considered a better tool to monitor national climate change policies. The ECR measures the average tax rate on carbon imposed in a jurisdiction and is affected by very high values (e.g. the typically higher taxation of transport fuels). Differently, the CPG measures the 'distance to target' from climate change objectives and is not affected by those emissions facing a very high, carbon price.[200] Unlike the OECD's share of emissions priced above a given threshold, the indicator does not rely on discrete values; therefore, any policy change is reflected in the indicator

IMF Effective Carbon Price.[201] The IMF has developed a tool to help countries in evaluating their progress towards meeting the mitigation pledges undertaken in the framework of the Paris Agreement. A forward-looking model calculates the carbon price that a country should introduce to meet its pledges, and the distance with its current carbon price, termed 'Effective Carbon Price' (ECP). This indicator is defined as the "economy-wide carbon price that, if implemented, would yield the same abatements as the combined effect of the carbon taxes, trading systems, and fuel taxes existing in a country" and is expressed in US$/tonne of CO_2eq.[202] The indicator results from the combination of carbon taxation (including energy taxes with a non-GHG tax base), and ETS. Differently, the IMF's ECP is model-based with a lower reliance on observational data. In particular, the components are weighted by their relative effectiveness in reducing carbon emissions; this is, in turn, determined by their price responsiveness, as measured by carbon elasticities (i.e. the carbon reduction that can be achieved by the various policies). Furthermore, the IMF provides estimates of the impacts of various ECP levels on each country, in terms of both carbon emission reduction, as well as other economic impacts (e.g. tax revenues, GDP, distributional effects). However, the ECP, based on the estimates currently published, does not provide for sectoral data.

Critical assessment. Before discussing the methodologies and policy relevance of the various indicators, a consideration concerning feasibility needs to be made. ***Only institutions which have already built over the years a significant database on energy taxes and subsidies (including carbon taxes) have ventured into assessing carbon pricing.*** Both the IMF and the OECD publications rely on both the existing internal databases, and the expertise accumulated over the years in measuring the various price components. Carbon price cannot be measured without consolidated data for assessing the rates and coverage of energy taxes and subsidies, carbon taxes, and tradable permits/allowances. Further than this feasibility consideration, other aspects are worth discussing to assess the features of a policy-relevant and

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[201]Parry, I. et al., *Mitigation Policies for the Paris Agreement: An Assessment for G20 Countries by Ian Parry*, International Monetary Fund Working Paper N° 18/193, August 2018; IMF, Fiscal Policies for Paris Climate Strategies — From Principle to Practice, International Monetary Fund Fiscal Affairs Department, Policy Paper, May 2019, hereinafter "IMF Policy Paper (2019); IMF, *Fiscal Monitor, October 2019: How to Mitigate Climate Change*, International Monetary Fund Fiscal Affairs Department, 2019.
[202]IMF Policy Paper (2019), p. 33.

methodologically robust indicator on carbon pricing, based on the international experience.

- **Scope.** Both the OECD and the IMF include three market-based tools in their carbon pricing indicators: carbon taxes, energy taxes (converted into their GHG equivalent), and emission permits/allowances. That way, a comprehensive analysis is ensured by jointly considering the most relevant forms of market-based carbon pricing. As energy taxes remain the most widespread market-based tool for pricing carbon, any carp carbon pricing indicator not encompassing them would not cover most of the current policies. Both institutions sum the effects of the two tools when applied to the same energy use, fuel, or sector, in line with the economic rationale, at least from a short-term perspective. When it comes to tradable permits/allowances, the effort, as illustrated in Box 10 above, is to reconcile emissions with energy and fuel consumption data, and to allocate costs to the various categories of users; no attempt is made to consider tradable /allowances as a 'tax on production', with its implications on the calculation of total revenues.[203]

- **Backward and forward-looking approach.** The OECD ECR takes a snapshot of how the market-based carbon instruments have been applied so far in the jurisdictions covered, to estimate what the carbon rate is. This approach, built by analogy with the OECD ETR, does not provide indication on what the level of carbon price should be to achieve a any objective in emission reduction. The IMF adopts a different approach, trying to determine which is the future price of carbon in each country ceteris paribus and which is the rate needed to achieve any country's Paris pledges, also taking into consideration the effectiveness of other policies. Such an approach accounts for the wide differences that exist in carbon policies and economic structure at global level, a significantly minor concern should the indicator be applied to a group of more homogeneous countries such as the EU. However, this indicator, once properly tailored, could be used to measure, on a country basis, the distance between current carbon policies and EU or national climate change targets.

- **Methodology to calculate carbon price**. The IMF ECP and the OECD ECR rely on a different methodology for aggregating the various market-based instruments, and the fuels or sectors to which they apply. Both the ECP and the ECR first convert non-GHG measures, such as energy taxes, into an equivalent basis by dividing them by the relevant CO_2eq emission factor. Then, the IMF ECP weighs the various policies by their effectiveness in reducing carbon emissions; this is, in turn, determined by their price responsiveness, as measured by carbon elasticities (i.e. the carbon reduction that can be achieved by the various policies). Differently, the OECD ECR is based on detailed fuel tax and permit/allowance data. The aggregated value results from weighting fuel taxes by their emissions share, rather than their effectiveness in reducing national emissions. Though a detailed comparison is not possible for the countries covered by the OECD and the IMF,[204] the latter anecdotally reports that, for the United States, the OECD ECR in 2030 would be $22, while the IMF ECP would be $6.[205] Without an indication in literature about which weight – emissions covered or emissions share – is to be preferred, and what the policy implications are, the two methodologies are difficult to reconcile. This aspect will be investigated in a later stage when contacting the international institutions.

- **Carbon price (rate) vs. related indicators.** Both the IMF and the OECD accompany their carbon pricing estimates with other indicators assessing the

[203] Cf. Section 4 above.
[204] The OECD no longer publishes the ECR per country (as per the latest edition); the IMF has not yet published the underlying spreadsheet.
[205] IMF Policy Paper (2019), p. 34.

distance between carbon price levels, and those which would achieve certain results in terms of carbon emission reduction (i.e. the achievement of Paris pledges). As described above, the OECD publish both the share of emissions priced above a certain level and the CPG. The former provides an assessment of the share of carbon emissions above thresholds that are considered sufficient to limit impacts of climate change, the latter measures the difference between a country's carbon pricing policy and that needed to meet the necessary benchmark prices. While OECD benchmarks are exogenous, the IMF measures the distance against nationally (endogenously) determined targets.[206] The OECD considers these two indicators more policy relevant than the ECR because they directly answer the question "to what extent are fiscal and other policies correctly pricing carbon?".

- **Climate change and other policy objectives.** Some different opinions exist on whether a single indicator can encompass both explicit and implicit pricing tools. In particular, it is questioned whether energy taxes should be converted 'in full' into their carbon tax equivalent, considering that they (i) have been introduced for various aims, not all related to environmental objectives or the fight against climate change; (ii) they might compensate also for other externalities (e.g. air pollution, road use and congestion). Such a critique is partly justified, but it does not affect the validity of the existing indicators:
    - From an economic perspective, the aim of a tax (or a price) is irrelevant for the economic actor. Taxes on fuels increase the cost of carbon, and therefore reduce carbon emissions, regardless of whether the tax was introduced to e.g. fight climate change, reduce the use of private cars, increase public revenues.
    - In the short-term, the demand effect – i.e. the reduction of demand and consequently of carbon emissions due to an increase in the price of carbon – of energy and carbon taxes is equivalent. Therefore, they are both appropriately included in carbon pricing indicators.
    - However, such an equivalence is partly lost in the long-term. As a consequence, while carbon pricing indicator provides information on the short-term incentives to reduce emissions, they may not fully capture the incentives for long-term investments in low-carbon technologies. For instance, carbon capture technologies are hardly promoted by energy taxes, as the long-term price wedge is likely to be insufficient.
    - Also, from a policy perspective, explicit carbon prices signal a higher political commitment against climate change and this can create a ripple effects towards other jurisdictions.

All in all, on the one side the carbon price methodologies currently employed which aggregate explicit carbon tools and energy taxes are correct in terms of capturing the current price of carbon and thus the short-term effect on emissions. However, this does not imply that explicit carbon policies and energy taxes produce the same effects in terms of long-term emission reduction or have the same political value. Explicit carbon policies, such as ETS and carbon prices, are more effective in reducing carbon emissions in the long term and in signalling the political commitment in the context of the Paris Agreement. Finally, to better account for the various aims of the energy taxation and for the various externalities that should be compensated over and above carbon emissions, the corrective tax rates approach represents the only available reference framework. Such framework also puts into question the argument that energy taxation should be equalised in terms of energy

[206] It should also be considered that the IMF covers 135 global jurisdictions, and hence a wider and more diverse set of countries compared to the OECD study. The IMF's measure is not a gap measure, but a gap measure (e.g. distance between the current ECP and Paris pledges' level; share of emissions taxed above the Paris pledge level) could be calculated based on the available data.

or carbon content, as other externalities would become relevant in the determination of the optimal tax rate.

- **Time lag.** The time lag between the publication of the indicator and the reference year of the data is important if the indicator is to be used to monitor the Member State policy, rather than to assess medium- or long-term climate change policies at international level. To that end, the current time lag for the OECD indicator is most likely excessive, as emissions, energy use and tax data in the latest publication are 3-years old; together with the other infrequent publication schedule, this means that data may be up to 6 years old. The issue is of more limited relevance for the IMF estimates, which are model-based, and forward-looking. In this respect, the complementary work by the WB is very important, providing an up-to-date repository of explicit carbon pricing initiatives, i.e. carbon emission permits/allowances, and carbon taxes, as well as information on the related revenues, and the underlying legal mechanisms, with a 1-year time lag and even for future scheduled policy initiatives. The repository, however, does not cover other forms of carbon pricing – what is termed 'implicit' – and, in particular, fuel and energy taxes.

C.6.3. Conclusions

The policy salience of carbon pricing has constantly increased with the risks associated to climate change and with the policies for fighting it. In particular, it became more so after the Paris Agreement, through which most of countries pledged to reduce or contain their emission levels. Carbon pricing is both a policy tool (or set thereof) which can be deployed both national climate change policies and the respect of the Paris pledges, and a monitoring tool, a sort of common denominator, to monitor those policies.

The broader theme of carbon pricing goes beyond the fiscal area, covering not only energy and carbon taxation, but any policy which explicitly or implicitly, directly or indirectly, put a price of carbon. These include first and foremost ETS systems, as well as other tools, such as offset mechanisms, results-based climate finance, energy efficiency policies, or RES support.

The existing indicators for measuring carbon pricing focus on three market-based tools: ETS, carbon taxes, and energy taxes. These three tools put an explicit price on carbon (ETS, carbon taxes), or an implicit one (energy taxes), which can then be converted in per tonne of CO_2eq accounting for fossil fuel emission factors. Both the ETS and energy taxes are regulated at EU level, while carbon taxes are not, following a failed attempt to introduce a carbon component within the Energy Taxation Directive. Ten Member States and the UK have however introduced a carbon tax in their national system, or a carbon component within their energy taxation mechanisms.

Though energy and carbon taxes can be jointly considered in a single pricing indicator, their effect on consumers is not the same. Namely, their incentives for reducing consumption in the short-term are largely equivalent, but the incentives to switch to low-carbon technologies in the long-term are not. In particular, in the long-term, a carbon tax will provide incentives for adopting low-carbon technologies. Differently, an energy tax whose rate is not set based on the product carbon content will not, because its tax rate will result in higher or lower carbon costs, depending on the rate applied to each energy source. As for the interaction of ETS and energy or carbon tax, they are additive from the point of view of the single consumer, but may not be so, under certain circumstances, once the overall impacts on emission is considered.

Several indicators exist for measuring carbon prices and the elated policies:

- the OECD, measuring the Effective Carbon Rate, the share of emissions priced above a given threshold, and the Carbon Pricing Gap for about 40 jurisdictions;

- the IMF, measuring the Effective Carbon Price and the impacts of various carbon price levels for 135 jurisdictions.

These tools include carbon taxes, energy taxes, and emission permits/allowances, by summing their effect when applied to the same emission source. Their methodology, however, differs. First, the OECD Carbon Rate is the "current" price of carbon once accounting for existing energy or carbon taxes and ETS; differently, the IMF attempts to measure the future carbon price at constant policy, and the actual rate that would allow each country to meet its Paris pledges. Furthermore, the OECD Carbon Rate results from the aggregation of the various tools based on their emissions covered; the IMF Carbon Price aggregates the various tools based on their equivalent effectiveness. Carbon prices seem indeed to diverge for the same jurisdiction under the two tools, although at the moment only anecdotal evidence is available in this respect.

The OECD also publishes the share of emissions priced above given thresholds and the Carbon Pricing Gap, which can be used to monitor the distance between the current carbon price and what is deemed necessary to mitigate the harm from climate change. These indicators are considered by its creator more policy relevant than the carbon rate, because they directly answer the question "to what extent are fiscal and other policies correctly pricing carbon" and require no aggregation. Unfortunately, current estimates suffer from a time-lag of up to three years, which would need to be significantly narrowed if these are to become an indicator used to monitor fiscal policies.

C.7. CONSISTENCY WITH OTHER EU POLICY GOALS

Introduction. This section is devoted to reviewing existing indicators on the ***coherence of energy taxation policy with EU broader policy goals in the field of energy***, and namely: energy efficiency, energy availability and affordability, and air pollution reduction objectives. It is structured as follows: the next two paragraphs will put the subject into framework. First the drivers of the impact of energy taxation on the different energy policy areas and their interaction with the relevant current EU energy policy indicators is reviewed. Then the conceptual issue of what represents internal and external coherence of energy taxation with these goals is described in more detail. The remaining four paragraphs will briefly summarise the state of the art from the review of literature for each of these policy areas. A final paragraph will sum up the main findings so far on existing and possible coherence indicators.

C.7.1. Measuring Impacts of Energy Tax on Different Energy Policy Areas

Drivers of Impact. Energy taxation may have different impacts on different EU energy policy goals depending on tax design, tax rates and, eventually, related subsidies. ***The EU policy goals first considered here are those common to all the Member States***[207] ***as outlined in the Energy Union Communication (EUC)***[208], and namely

- Energy availability[209];
- Energy affordability;
- Energy efficiency;

[207] There is one more key dimension missing in this analytical framework. Most energy taxation subsidies are actually granted for competitiveness concerns, while related policy goals are not considered here as these are not EU common goals. Industrial policy falls largely under Member States responsibility and subsidies reflect the specificities of the different industrial systems, although they tend to concentrate in energy-intensive industries. Also agriculture can be considered in many respects as an energy intensive industry. Agriculture accounts for some 2.8% total EU energy consumption as compared to 1.1% of EU GDP. In the Netherlands the share of energy consumption attributable to agriculture exceeds 8% of the total

[208] See Communication from the Commission, A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM(2015)80, 25.2.2015.

[209] Also known as energy security.

- And reduction of air pollution[210].

To the extent these impacts can be quantified and turned into compliance with objectives, indicators could always be built of the underlying Baumol prices[211] required for their achievement and of the role played by taxation in it. ***Baumol prices have been extensively used only for GHG reduction*** as the level of carbon price needed to achieve certain emission reduction targets worldwide. No similar indicator in other policy areas could be identified. Indicators[212] for most of these broad EU policy goals have been detailed in the monitoring system for the Implementation of the EUC as reported in the relevant Commission Working Document[213] and energy taxation can variously interact with some of them.

Energy efficiency. EU energy efficiency policy goals are defined in terms of reduction of both energy consumption and energy intensity (i.e. energy consumption per unit of GDP). This is detailed on a sectoral basis in the list of Energy Union indicators below:

- both primary energy consumption and primary energy intensity (i.e. energy consumption per unit of GDP);
- final energy consumption, per country, as resulting from the final energy consumption of the main energy intensive economic sectors, and namely: manufacturing, transport, households and services;
- final energy intensity in manufacturing;
- final energy consumption per square meter in residential sector, climate corrected, as a driver of final energy consumption of households (per capita);
- final energy consumption in transport including share of collective transport in all passengers' transport and final consumption in transport vs. passengers and freight activity;
- final energy intensity in the services sector.

Energy taxation directly affects energy efficiency by increasing energy prices. However, this is hardly captured by any of the existing monitoring indicators, as there is no such thing as a general index of the level of energy prices to which a similar index of implicit energy tax rates could be linked. ***One synthetic indicator[214] has been proposed by the OECD about the correlation between energy intensity indicators for the economy as a whole and the corresponding effective tax rates at the Country level***, but this has not been expanded to other similar supply-side areas where it would have been conceptually possible (e.g. manufacturing and services). The OECD did these kinds of analyses in the past also in PPP terms and could consider resuming these PPP-based correlations.

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[210] EU policy objectives encompass both GHG emissions reductions, as well as SOX, NOX and PM reduction goals dealt with elsewhere in the EU acquis and whose taxes are not generally considered as energy taxes

[211] In Baumol prices charges/taxes are set at the level that is expected to be sufficient to achieve a given (typically environmental) objective.

[212] Some of them have been included in an online dashboard that also had the original intention of by-passing the timeliness issues created by the delayed publication of the Member States Energy Balance Sheets. See Trinomics, *Study with Evaluation Criteria on Early Estimates of Main Energy Balance Sheets Components in 2015 and for the Production and Visualisation of Indicators to Monitor Energy Union Implementation*.

[213] See Commission Staff Working Document, Second Report on the State of the Energy Union, Monitoring progress towards the Energy Union objectives – key indicators, SWD(2017)32, 1.2.2017.

[214] See Factsheet #22 in Annex E.

Energy availability. Energy availability represents the dependence of energy sources on imports. There are three basic mechanisms through which energy taxation can impact on energy availability: (i) taxes where energy imports represent the tax base (ii) subsidies to domestic fossil fuels granted as rebated tax rates; (iii) explicit incentives to domestic renewable sources. The Commission current indicator of energy availability is not expressed in monetary terms, but just through calorific energy units as net import dependency as shares of total energy units. ***No corresponding taxation indicator expressed per energy content exists, and no such thing as an effective tax rate on energy imports appears to be currently measured***.

Energy affordability is defined as a household's ability to pay for the necessary levels of energy use. The concept has entered the *EU acquis* with the liberalisation of the markets for electricity and natural gas, but it can be extended to all heating fuels. As taxes are a component of final prices, ***this is the only area in which EU indicators with an explicit taxation dimension have already been adopted***, and namely: a) trends in household electricity prices; and b) trends in household gas prices. However, these indicators do not capture the weight of upstream energy taxation on prices. ***Since no indicators on the total burden of energy taxation on disposable income or energy consumption is available it is not possible to create any correspondence with the remaining relevant indicators***. After some discussions[215] with the Member States energy affordability[216], in fact, is now considered as the share of energy expenditure on final consumption for the lowest quintile of disposable income. As this is an *ad hoc* indicator calculated on purpose from budget household surveys, energy affordability is also monitored through a combination of more easily available indicators, including:

1) weight of expenditures on electricity, gas and other fuels on total household expenditure as drawn from the HICP, an indicator used as a rough proxy for energy inflation;

2) social survey data on the inability of respondents to keep their home adequately warm (as a proxy of the share of the total population potentially at risk of energy poverty).

GHG Emission Reduction*.* Carbon taxes have been introduced to reduce GHG emissions and provides incentives to product substitution with low carbon sources or renewable energy sources. ***The OECD has been producing an indicator correlating carbon rates with carbon intensity, but there is little data breakdown to match with the GHG sectoral indicators.*** For the time being also the IMF carbon prices do not have a sectoral dimension to ***measure impacts at that level***. So, there are no EU indicators detailing carbon-dependent energy taxation revenues under the ETS or within the remit of the Effort Sharing Regulation (ESR). Some broad correlation can be made only with the OECD carbon rates. Also, data on charges for renewable energy sources are limited and mainly available for electricity. As mentioned before, data on taxation of environmentally-friendly products are not necessarily available in the other areas, including exhaustive information on exemptions. Even data on rates are scarce in niche

[215] Three indicators drawn from SILC survey, and namely: 1) the proportion of the population with arrears on energy bills; 2) the ability to keep the home adequately warm; and 3) population living in dwellings with leakages and damp walls were first proposed as reference indicators in 2015. Following feedback from Member States and other stakeholders, affordability indicator has been changed and a temporary 'energy affordability index' was proposed pending work to deliver a better, commonly agreed metric for monitoring energy poverty.

[216] The Commission 2018 Regulation on the Governance of the Energy Union and Climate Action states that Member States shall include in their plans, an assessment of the number of households in energy poverty, as defined from the energy needed to guarantee basic standards of living, and measured through EC indicative guidance on relevant indicators. These were initially selected only among SILC indicators, which proved extremely controversial as these are opinion-based.

areas (e.g. electricity for car transport). This hinders immediate comparability with most of the EU indicators proposed to monitor progress in that area, and namely:

GHG emissions reductions is monitored through:

1) share of GHG emission reductions under ETS and under ESR;

2) sectoral share of GHG emissions;

3) gap between GHG emissions projections and targets in effort sharing sectors;

4) gap between latest (proxy) inventory of effort sharing emissions and interim targets;

5) GHG intensity defined as a combination of indicators on GHG emissions per capita; GHG intensity of power and heat generation; average CO2 emissions from new cars;

6) renewable energy share: in terms of RES share transport; RES share electricity; RES share heating & cooling; fossil fuels avoidance by RES and GHG emissions avoided due to RES.

As mentioned before, attempts to combine RES charges with carbon taxation and ETS prices in the carbon price indicator have remained confined in the academic literature and never been followed up by indicator producers.

Air Pollution. ***No EU energy indicator has currently been proposed*** within the framework of the Energy Union Communication to monitor ***the relation between energy consumption and air pollution***, as the matter is not included in the Communication.

C.7.2. Defining Issues of Internal and External Coherence

Internal Coherence. Issues of internal coherence arise because of the possible overlapping of energy taxation with other policy actions aimed at achieving the same policy goal. These attribution issues are variously defined as problems with the possible "double counting" or "crowding out" of taxation effects. These consist in the possibility that ***energy taxation contributes to the same relevant goals as other policies so that its net impact becomes hardly distinguishable and the net combined impact is lower than the sum of each of them***. The problem of the share of total impact attributed to any single policy would require detailed case by case assessments of the costs of the promoted technology or product substitution and the underlying fiscal incentive. To simplify double counting issues, impacts are often conventionally attributed to either one instrument or another. ***Examples of possible double counting are well known in the field of energy efficiency policies*** and have been considered for the calculation of the achievement of the objectives of the related EU Directive[217].

Issues of double counting and overlapping in the achievement of the policy objectives have been extensively described in the field of GHG emissions reductions. For instance, ***national carbon taxes might have some degree of overlapping with the ETS***

[217] Taxation rates beyond the ETD minimum ones were listed among the tools to achieve the objectives of the Energy Efficiency Directive in the 2014-2020 period according to art. 7(b) provisions. This opportunity was actually exploited by seven Member States. Sweden, for instance to comply with mandatory energy saving targets under the Directive, used energy taxation as the sole proposed policy instrument and refrained from proposing other actions. Conversely, other Member States that have differentiated areas covered by taxation from those covered by other policy instruments for the same reason. As will be seen, similar simplifications are adopted for the definition of indicators of correcting tax rates for energy externalities.

which could cause emission reduction benefits to net off at the EU level when the ETS operates around the cap. This is because national carbon taxes cannot give rise to any additional carbon emission reduction, as these are at any rate capped under the ETS EU-wide. So additional savings at the national level would translate into more offer for allowances abroad.[218] Similar considerations apply to SO_X and NO_X emission taxes to the extent that GHG emissions correlate with them in the power industry under the ETS. In the presence of a cap-and-trade program, introducing any additional tax instrument on different sources of pollution might also yield no further reductions in overall GHG emissions, but simply translate into a reduced cost-effectiveness of the ETS itself.[219]

External Coherence. External coherence refers to a number of ***possible trade-offs between energy taxation policies aimed at reaching certain objectives in given areas and the other different energy policy goals***. As reported in Figure 3 below[220] energy taxation can have conflicting impacts on a number of different energy goals because these are not necessarily aligned[221]. For instance:

- ***Carbon taxation can reduce coal and peat consumption and improve GHG emission reduction to the detriment of energy availability*** as natural gas is usually imported. Conversely, the introduction of a national carbon tax with substantial exemptions granted, for instance, to domestic high-carbon fuels (e.g. peat) on energy availability grounds also provides conflicting incentives;

- ***Tax subsidies to biomasses for heating or biofuels do contribute to GHG emission reductions, but at the same time can negatively affect the attainment of air pollution targets*** and, in particular, PM emissions (e.g. wood derivatives);

- ***Gasoil subsidies*** can improve car transport energy efficiency at the expense of air pollution and carbon emission reduction objectives;

- ***Charges to finance RES and carbon taxes*** can reduce energy affordability, but improve energy efficiency and contribute to a GHG emissions reduction.

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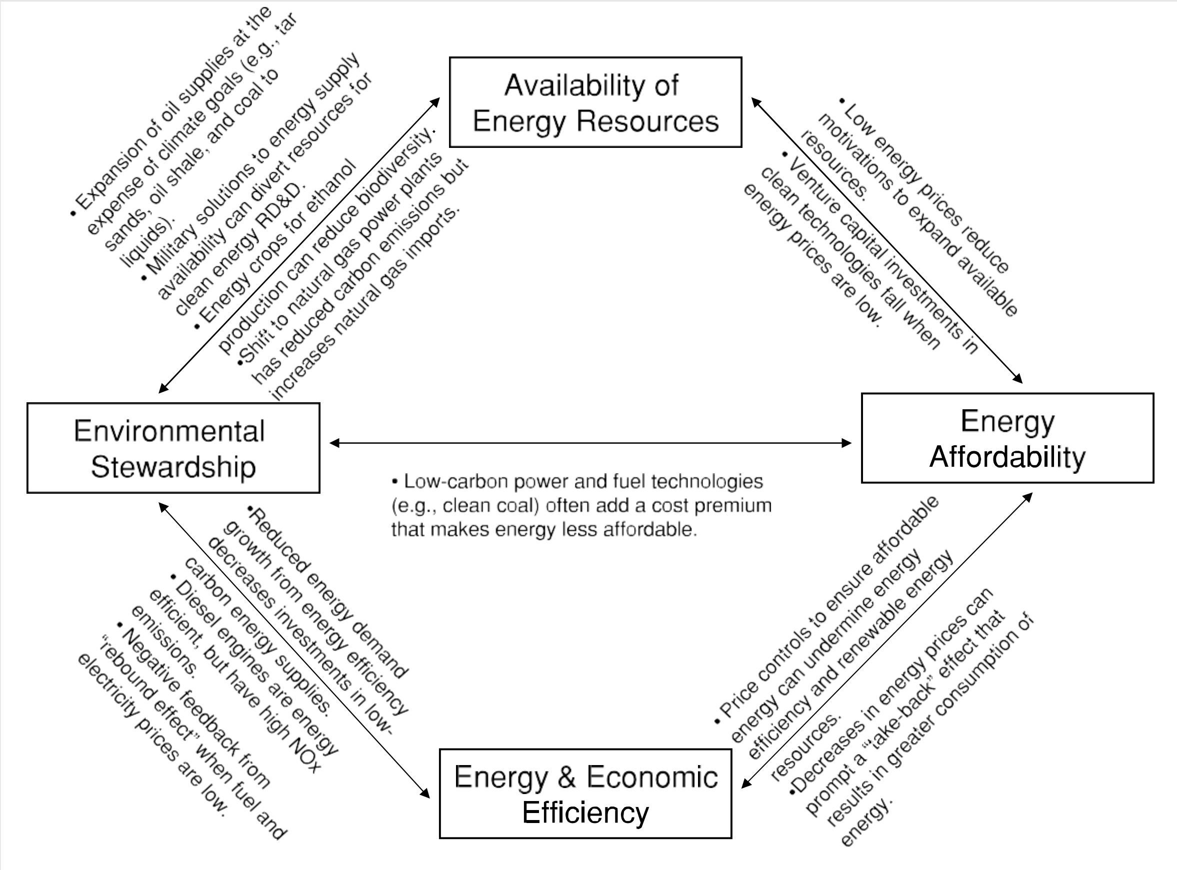
[218] This was noted by IPPC with reference to the UK. "*The issue applies to the United Kingdom's efforts to reduce emissions through a carbon tax on the power sector (electricity generators). The generators are required to pay the tax on every unit of carbon emission while also being subject to the EU ETS cap on over- all emissions. While the tax may lead to greater reduction in carbon emissions by the generators in the UK, the impact on overall emissions in the EU might be negligible, since overall European emissions are largely determined by the Europe-wide cap under the EU ETS*" See IPPC- WG3, AR5 *Climate Change 2014: Mitigation of Climate Change*. https://www.ipcc.ch/report/ar5/wg3/.

[219] Nevertheless, the IPCC considers the combination of GHG emissions pricing and some other emission taxation policy justified in terms of cost-effectiveness losses to the extent that the latter policy directly addresses a second market failure that GHG emissions pricing does not directly confront.

[220] The figure is drawn from Benjamin K. Sovacool1 and Marilyn A. Brown *Competing Dimensions of Energy Security: An International Perspective,* Annual Revies Environmental Resources, 2010

[221] Incentives to energy efficiency and reduction of carbon emissions are aligned when tax rates are epxressed in energy terms or quantities, no longer so with carbon taxes.

Figure 3: Competing Dimensions of Energy Taxation



Source: *Sovacool, B. K., and Brown, M. A., 'Competing Dimensions of Energy Security: An International Perspective', Annual Review of Environment and Resources, Vol. 35, 2010, p. 86.*

Problems with policy coherence of fiscal measures were also highlighted in the evaluation of the ETS mechanism as a contributing factor to the price collapse that occurred in the market for EUA in the 2012-2013 period.[222] The 2009 RES Directive[223], which set a national binding renewable target for 2020, resulted in an unexpectedly rapid uptake of renewable technologies also for energy companies under the ETS. ***The rapid adoption of subsidised renewable energy sources reduced demand for emission allowances and therefore impacted the price signal for carbon***. In fiscal terms the result was that the mechanism that led to an ***increase in the amount of revenue from renewable charges also contributed to a parallel decrease in the revenues from ETS***. In terms of related objectives, the carbon emission savings achieved under the Renewable Energy Directive partly compensated for the ETS programmed emission reductions and the impact of the two policies, at least in part, netted off as also noted by the IPPC.[224]

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[222] Environment Agency Austria Umweltbudesamt, *Evaluation of the ETS Directive*, 2015, http://publications.europa.eu/resource/cellar/0478baf0-d6d4-11e5-8fea-01aa75ed71a1.0001.01/DOC_1.

[223] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140, 5.6.2009.

[224] The IPCC explains this as follows "*a carbon tax can have an additive environmental effect to policies such as subsidies for the supply of RE. By contrast, if a cap-and-trade system has a binding cap (sufficiently stringent to affect emission-related decisions), then other policies such as RE subsidies have no further impact on reducing emissions within the time period that the cap applies* [*emphasis added*]." IPCC (2014). IPCC *Summary for Policymakers: Mitigation of Climate Change* 2014.

C.7.3. Energy Efficiency

Impact of Taxation. Energy taxation reduces energy consumption by increasing the price of energy products. The size of this effect is mediated by price elasticities that can (slightly) vary by type of consumer from product to product and from Member States to Member States. On top of this immediate basic effect, there can be longer term structural impacts. These, through the provision of tax-rate related incentive mechanisms, ***can exert a long-term influence on consumption and spur increased efficiency by technological means***. However, this long-term impact is partly compensated by the so-called ***rebound effect*** (or take-back effect) defined as the reduction in expected energy consumption savings from new technologies because of behavioural or other systemic feedback, such as more economic growth, on consumption behaviours. These rebound effects would tend to offset the benefits of the new technologies and the other measures taken[225].

Indicators Mentioned in the Literature. In the IEA and OECD sources, examples of impacts of taxation policy on long-term energy efficiency outcomes have been mainly described in the field of car transport (see IEA Energy Efficiency Report, 2016) with reference to vehicle fuel consumption per 100 km. According to IEA sources, there would be evidence that ***taxes have more impact on behaviour than underlying raw price changes***, owing to the greater salience of taxes to consumers' behaviours and the perception that they are likely to be persistent than equivalent increases in ex-tax prices[226]. So, they would tend to have a long-term structural impact. For instance, as a result of its long-term policy of heavily taxing fuels IEA has highlighted that Italy still has one of the highest relative propensities in the world to buy low fuel consumption vehicles.[227] The OECD has plans to analyse the existing set of IEA energy efficiency indicators from the point of view of energy taxation in the future, possibly by means of correlation indicators, but little such studies exist for the time being, not to speak of related indicators. These are generally missing from all available energy efficiency sources[228].

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[225] Len Brookes, for instance, extensively wrote about the fallacies of energy-efficiency as a solution to greenhouse gas emissions. His analysis showed that any economically justified improvements in energy efficiency would in fact stimulate economic growth and increase total energy use. For improvements in energy efficiency to contribute to a reduction in economy-wide energy consumption, the improvement must come at a greater economic cost. Brookes, L. *The greenhouse effect: the fallacies in the energy efficient solution*, Energy Policy, Vol. 18, N. 2, 1990, pp 199–201. This work provided a theoretical grounding for further empirical studies. It also reinforced a divide between energy economists on two opposed positions Even though several studies have been undertaken in this area, neither position has yet claimed a consensus view in the academic literature. Recent studies have demonstrated that direct rebound effects are significant (about 30% for energy), but that there is not enough information about indirect effects to know whether or how often back-fire occurs. Studies have also shown that the rebound effects for energy products is lower at high income levels, due to the lower price sensitivity in these quintiles. For instance, the elasticity of gas consumption in UK households was found two times larger for households in the lowest income decile when compared to the highest decile and much higher rebounds were observed in low-income houses for improvements in heating technology.

[226] Li, S., J. Linn and E. Muehlegger, *Gasoline taxes and consumer behaviour*, American Economic Journal: Economic Policy, Pittsburgh, Vol. 6, No. 4, 2014, pp. 302-342.

[227] Researchers from the Bank of Italy also noted that over the last 20 years freight transport vehicles have become more inefficient than the EU average, but failed to make a connection with the existing subsidy on diesel for freight transporters that has also been in place since a long time. I. Faiella, F. Cingano, *La tassazione verde in Italia: l'analisi di una carbon tax sui trasporti*, in Economia pubblica: mensile di studi e d'informazione del Ciriec October 2013.

[228] Dedicated datasets of efficiency decomposition indicators like the EU ODYSSEE-MURE do report these long-term structural effects on car energy efficiency. The impact of changes in the fuel mix from gasoline to diesel and from oil products to biofuel, both leading to an increase in the average heat content in TOE/litre has been accounted for among the "other factors" determining increased car energy efficiency. However, because of the attribution problem these are not separately calculated and hardly explicitly associated to the fiscal incentives provided by means of differential

Price Elasticities from Econometric Models. The opposite approach of attributing technological improvements mainly to taxation is found in price elasticities data, and in particular in the distinction between short-term and long-term elasticities where the latter incorporate also technological substitution and the residual issue conversely becomes the identification of natural "not price-driven" technological improvements. From an average of study results worldwide, ***the IMF in its conceptual models[229] on the possible impacts of carbon taxation assumes that price elasticity for both electricity and transport fuel demand is at about -0.5*** of which half composed of short run reduced consumption effects and half of technical improvements. This compounds with an annual rate of natural technological efficiency improvement estimated at around 1 percent a year. ***Coal price elasticity of -0.7[230] is assumed for all countries and the same elasticity is applied to other fossil power generation fuels***. These values are slightly higher than those collected for policy implementation purposes for assessing the impact of the Energy Efficiency Directive. Price elasticities there were separately provided for transport, service, industrial, agriculture and household use and for different fuels, as well as for electricity by Member States that had recourse to art.7 provisions. In half of cases both long run (LR) and short-run (SR) elasticities were estimated. The first are inclusive of energy efficiency effects through technological improvements.

As shown in the Table 8 overleaf, in the EU energy products would represent extremely price inelastic goods, even apparently close to total inelasticity as far as diesel (particularly for freight transport) or certain manufacturing applications are concerned. In other words, already low-price elasticities would be ***even lower when energy products are used as production factors rather than for consumption purposes***. Agriculture also appears particularly poorly responsive to prices, although relatively fewer data are available. Then, elasticities would tend to negatively correlate with levels of income, and this also confirms available evidence from the literature. Finally, contrary to IMF assumptions, in some cases ***long term elasticities would appear much higher than short-term ones***, although it is unclear how natural technological improvements have been accounted for and possible double counting with previous energy efficiency policies at the Member States level. Actually also because of methodological disagreements[231] on whether these long run elasticities could be considered compatible with the stated objectives of the Directive and their timeframe, including the rebound effect, some Member States preferred either providing short run elasticities only for target compliance calculation or at any rate accounted the benefits as one-year benefits applying to 2014 only. All these models assume that taxes have a direct pass-through on prices which determines consumption. However, as the Swedish gasoil price paradox demonstrates, carbon taxes can increase prices above all indirectly by incentivising product substitution with costlier often tax-exempted renewables.

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tax rates. The ODYSSEE-MURE energy saving dataset also includes cumulative data on energy savings achieved by Member States by means of taxation measures under art.7, this is because According to the Energy Saving Regulation energy savings from tax measures achieved by exceeding the minimum excise rates under the ETD and estimated by means of price elasticities shall be accounted separately. However this has not been reported neither in general nor separately for fiscal measures. It is possible that these datasets refrain from identifying energy taxation impacts because of internal coherence and double counting issues.

[229] IMF Policy Paper – *Fiscal Policies for Paris Climate Strategies – From Principle to Practice*, May 2019.

[230] Also the IPPC maintains that long term price elasticity of carbon-intensive sources can be higher in manufacturing and power generation.

[231] JRC, Energy Savings Calculation Methods under Art. 7 of the Energy Efficiency Dir., https://publications.jrc.ec.europa.eu/repository/bitstream/JRC99698/report%20on%20eed%20art%207%20-%20publishable.pdf.

Actually, most of the debate on carbon price levels is about the technologies that would become economical at certain levels of carbon taxation[232].

Table 8: Value for Price Elasticities Used in the Energy Saving Calculation

Sector	Fuel	EE	FI	DE	NL	ES	SE
Households	Oil						
	Gas	-0.26 ST		-0.05 to -0.20			
	Electricity	-0.18 ST		-0.05 to -0.20	-0.10 ST -0.20 LT	-0.18 ST -0.32 LT	-0.07 ST -0.50 LT
	District Heating	-0.20 ST			-0.15 ST -0.25 LT	-0.14 ST -0.40 LT	
Services	Oil			-0.025 to -0.20			
	Gas	-0.26 ST		-0.025 to -0.20	-0.10 ST -0.23 LT	-0.18 ST -0.32 LT	
	Electricity	-0.18 ST		-0.025 to -0.20	-0.10 ST -0.22 LT	-0.03 ST -0.2 LT	-0.07 ST -0.50 LT
	District Heating	-0.20 ST					
Road transport	Petrol	-0.26 ST	-0.49 ST	-0.25	-0.05 ST -0.40 LT		-0.40 ST -0.60 LT
	Diesel	-0.26 ST	-0.17 ST	-0.05	-0-05 ST -0.40 LT		-0.60 ST -0.00 LT
	All fuels						-0.19 ST -0.26 LT
Industrial	Electricity			-0.025	-0.05 ST -0.10 LT	-0.05 ST -0.3 LT	-0.00 to -1.24
	Gas			-0.10	-0.03 ST -0.15 LT	-0.18 ST -0.32 LT	-0.21 to -1.43
	Coal						
Agriculture and horticulture	Electricity				-0.05 ST -0.10 LT	-0.39	
	Natural gas						

Note: ST; Short-Term; LT: Long-Term.
Source: Ricardo Energy & Environment, *Study evaluating progress in the implementation of the Energy Efficiency Directive*, appendix 4, DG ENER, 2016, *available* here.

Taxation Impact Indicators. The OECD has empirically reported for conceptual purposes a synthetic statistical ***correlation indicator between the overall <u>effective energy tax rate</u> of a Country and its <u>energy intensity</u>*** considered as an indicator of energy efficiency on the supply side (see OECD, TEU 2019). The exercise was not replicated by typology of use, so no relationship with the EU sectoral energy intensity indicators was published, although this could change in the future. Data are available for the 22 Member States part to the OECD and show (see Table 9 below) that the estimated value is close to the real one for about half of the countries; this means that, for the rest of the sample, energy intensity is not drawn only, or mostly, by energy taxation. The OECD plans to continue this kind of analysis by means of correlation indicators in the future and to expand its scope. This could also include correlation with the energy intensity indicators in PPP terms proposed as explanatory factors by the ODYSSEE-MURE project.

[232] IMF Finance and Development, *The Economics of Climate*, December 2019, https://www.imf.org/external/pubs/ft/fandd/2019/12/pdf/fd1219.pdf.

Table 9: Comparison between Actual Energy Intensity and Predicted Energy Intensity based on Effective Energy Tax Rates (OECD, 2017)

	Average effective energy tax rate	Energy intensity	Predicted energy intensity	Difference between predicted and actual
NL	6.78	3.26	0.79	-2.47
DK	6.55	2.15	1.11	-1.04
LU	6.30	2.21	1.47	-0.74
IT	5.59	3.20	2.46	-0.73
HE	4.92	4.73	3.41	-1.32
IE	4.68	1.89	3.75	1.86
SI	4.36	6.33	4.20	-2.14
AT	4.32	3.22	4.26	1.03
FR	4.03	3.94	4.67	0.74
LU	3.87	5.12	4.90	-0.22
DE	3.79	3.51	5.01	1.50
FI	3.75	5.36	5.06	-0.30
PT	3.73	4.35	5.09	0.74
SE	3.55	3.90	5.35	1.45
ES	3.20	3.90	5.83	1.93
BE	3.07	4.19	6.02	1.82
LV	2.95	6.18	6.19	0.00
EE	2.58	9.86	6.71	-3.16
SK	2.26	7.03	7.17	0.14
PL	2.21	8.29	7.23	-1.07
HU	2.14	7.59	7.34	-0.25
CZ	2.00	8.62	7.53	-1.09

***Source**: OECD Taxing Energy Use database and authors elaborations.*

C.7.4. Energy Availability

The status of energy availability policies has been long and fiercely debated in the economic literature. In particular, diverging opinions have arisen on whether these policies are implemented in response to an externality and therefore related subsidies are justified in economic terms. The IMF has not included energy availability considerations in their calculation of corrective tax rates, and hence does not consider it an externality (see Box 11 below). To avoid price signal distortions and to be tax efficient, these subsidies should eventually be granted as feebates or reimbursements to users, rather than by means of rebates in tax rates.

IEA has defined as energy availability taxes all taxes and levies applied to energy products with the declared purpose of guaranteeing supply availability (e.g. stockpiling taxes) and separately accounts for them in its energy price and taxation datasets.

Box 11 Energy Availability as an Externality

It has been long debated whether energy availability can truly be assimilated to a price volatility-based externality and be attributed a cost to be covered by means of an environmental tax. Setting an equalisation tax on external energy equal to this price wedge and smoothing final consumer prices in the long run would therefore "internalise" this negative externality by means of an environmental tax.[233] Others[234] maintain the radically opposite position that there cannot be any such thing as an energy availability externality[235] at the global level and that this "externality" simply relates to welfare distributional effects between energy exporters and importers. Reducing imports would therefore do little to reduce price shocks in efficient energy

[233] This is clearly not the rationale behind those taxes on energy availability, taxes on stockpiling or energy reserves that some Member States have introduced to pay, among others, for their IEA energy availability obligations and are closer to charges in nature.
[234] For a critical review of the energy availability concept from the economic viewpoint, see Metcalf, G. E., *The Economics of Energy Security*, Working Paper 19729.
[235] "See Metcalf above quoting US National Research Council. 2009. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*. Washington, DC.

markets. From this it would descend that energy availability, from a purely economic viewpoint, would only depend on reducing energy consumption rather than imports.

Impact of Taxation. ***The possible impact of taxation on EU energy availability goals consists in creating price wedges between imported and domestic sources.*** So, in a nutshell, for Countries deprived of fossil fuels, a favourable tax regime for renewables or domestic biomasses, as well as nuclear energy sources can steer consumption away from imported fossil fuels. Any carbon tax would dampen coal and peat consumption substantially more than oil and natural gas thereby triggering product substitution. For Member States relying on domestic coal, peat or shale oil sources for their energy production, a carbon tax rate low enough to favour product substitution with natural gas rather than renewables, may simply translate into increased imports and a worsening of their energy availability indicator[236].

Indicators Mentioned in the Literature. IPPC maintains that energy availability represents indeed one of the several externalities behind taxation of fuel for transport, but then reports ***practical difficulties*** in calculating related costs on a separate base, which hinders the creation of any indicator that could serve as a basis to define a corrective tax rate. IEA has long reported that during periods of falling commodity prices, higher tax rates have a dampening effect on end-user price changes and discourage so-called consumption rebound effects from lower energy raw prices. This has usually been very roughly captured through proxy indicators on the share of taxes on total fuel prices (IEA, 2016). The higher taxes are. the lower this risk is.

Existing Taxation Impact Indicators. ***No energy taxation indicator expressively aimed at capturing the energy availability dimension has been identified*****.** Nobody, for instance, has ever published an implicit tax rate of imported sources of energy in a Country to compare it with that of domestic ones and assess the extent to which a switch to a domestic mix of energy sources is encouraged by means of fiscal incentives and by the structure of energy tax rates. Energy taxes with an undifferentiated import-related tax base are such a tiny sub-group in the current national tax lists to hardly justify their separate identification by means of an indicator. The only possible indicator could be based the IEA data on energy availability as a share of energy taxes or prices at the product level. These group taxes and levies related to strategic stockpiling and similar items.

While there is abundant literature on developing energy availability indicators and indexes that can take into consideration the various dimensions of energy availability, the impact of taxation has generally been considered from a dynamic perspective and included into the scope of scenario-based energy availability models[237] rather than

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[236] See on this point Ecofys, Analysis of impacts of climate change policies on energy availability, Final report for the DG Environment, published in 2009, cit. according to which a swift from high carbon to low carbon sources of energy is associated with a substantial worsening of the energy availability profile.

[237] A more sophisticated modelling approach would also allow an assessment of the impact on multiple policy drivers of implementing economic instruments such as fuel and carbon taxation or emissions trading scheme. IEA *Energy Security and Climate Change Policy Interactions, An Assessment Framework*, IEA Information Paper, 2004. It is also noted that the majority of approaches evaluating the impacts on energy systems and energy availability rely on model-based scenario analysis. Energy system models (e. g. the TIMES- MARKAL family of models or the European PRIMES model) are used to generate scenarios of how energy systems could develop. Energy availability parameters are either incorporated as a constraint the model has to satisfy; or some aspect of energy availability is analysed after the model has constructed a scenario. By using energy efficiency policy modelling results under a baseline scenario, i.e. without the effect of the energy efficiency policy (including taxation), and with a policy scenario, the difference between the evolution of the energy availability indicator in each case can be used to determine whether, and to what extent, the policy has increased or decreased the 'vulnerability' of the energy system (of a region, a EU Member State, or the EU as a whole) to the earlier identified energy availability risks. COMBI Project Various Authors, *Widening the Perspective: An*

monitored through indicators strictly speaking. These are not on the agenda of the main indicator producing organisations either.

C.7.5. Energy Affordability

Impact of Taxation. Energy taxation tools as ***concessional VAT rates on electricity and heating or other forms of tax reimbursements have been used as a substitute for regulated prices since the 2009 liberalisation of the electricity and natural gas markets*** with the aim of reducing the increase in the level of consumer prices. The reform has introduced in the EU acquis the concept of energy affordability, as a household's ability to pay for the necessary levels of energy use and then entirely left it to Member States subsidiarity intervention. This includes the definition of the criteria for identifying who is at risk of using inadequate levels of electricity and heating[238] with potential negative consequences on human dignity or health. The Energy Union Communication while insisting in avoiding regulated tariffs has aimed at harmonising the definition of statistical criteria to presume a need for these ex post tax subsidies for comparability purposes. So, while Member States have been building a number of energy affordability indicators[239] finetuned to their own domestic definition of energy poverty that sometimes go beyond the EU definition of vulnerable consumers in the two markets concerned, the search for a common ground at the EU level has led to the only instance of mixed recourse to evidence-based and opinion-based indicators in the field of energy. This was considered at any rate as a temporary solution.[240] All affordability income-based indicators based on Eurostat Household Budget Survey, including those proposed for the monitoring of the EU Energy Union Communication, share the common problem that ***expenditure data are burdensome to calculate and collected every five years***. Otherwise, it is necessary to work with national statistical institutes on an ad hoc basis. At any rate they cannot separate aggregate energy costs from their taxation component to assess its eventual impact.

Indicators Mentioned in the Literature. Since the subject of energy affordability is relatively new and there are still differences in agreeing a commonly accepted statistical definition for reference, comparative studies on the relationship between energy taxation and energy affordability are relatively few. This is compounded by the practical difficulties in analysing budget household surveys microdata that are often available at

Approach to Evaluating the Multiple Benefits of the 2030 EU energy efficiency potential, 2016 International Energy Policies & Programmes Evaluation Conference, Amsterdam.

[238] One can notice that while the EU Directives narrow the scope of energy affordability down to the residential use of energy, when the European Economic and Social Committee released their 2013 opinion *For coordinated European measures to prevent and combat energy poverty*, they mentioned "other essential energy services" which may include mobility aspects. Since then, CEER has been regularly reviewing how Member States have implemented these social protection provisions in its reports on the EU Electricity and Gas Markets.

[239] For a review of these indicators and related policies see E-Insight, *Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures*, Policy Report, May 2015; and Trinomics, *Selected Indicators to Measure Energy Poverty*, Final Report for DG ENER, European Commission, published in 2016.
https://ec.europa.eu/energy/sites/ener/files/documents/Selecting%20Indicators%20to%20Measure%20Energy%20Poverty.pdf.

[240] The European Energy Poverty Observatory has in the meantime proposed an articulated set of indicators for which data, however, are often still missing. These include two SILC indicators: 1) arrears on utility bills and 2) inability to keep home adequately warm and two indicators drawn from the Household Budget Survey data, and namely: 3) low absolute energy expenditure defined as the share of households whose absolute energy expenditure is below the national median and 4) high share of energy expenditure on income, as the proportion of households whose share of energy expenditure on income is more than twice the national median. Complementary indicators include data over and above household electricity and gas prices including fuel oil prices, coal prices, district heating prices and biomass prices as drawn from the DG ENER EU Buildings Database. Most of these additional price data are currently missing.

the national level only[241] or with substantial delay. In 2017 an OECD Working Paper found that ***higher GDP per capita was clearly correlated to a lower share of households facing energy affordability challenges***, by all the possible indicators[242] they selected as a basis for measurement. At the Country level, they also found no strong association between the share of households facing challenges to afford energy, and the level of taxes on heating fuels and on natural gas as measured in the relevant Eurostat and DG ENER indicators that have currently been proposed for that purpose in the monitoring framework of the EU Energy Union Communication. Correlation in the market for electricity depends on how the very special Dutch case where tax refunds are provided[243], is dealt with, but at any rate was not strong. A number of possible explanations were proposed: 1) Countries expecting that taxes on energy use would particularly harm poor households may opt for low taxes on energy;[244] 2) high energy taxes might not increase the share of households with high energy spending because they would reduce energy use by an equal factor or greater so to keep total expenditure fixed; 3) higher energy prices may trigger compensative wage increases over time. Energy prices and taxes also appeared to be unrelated to living in a cool climate.

It was tentatively concluded that ***higher energy prices reduce energy demand by almost enough to keep energy expenditure constant over the long run***. These findings are broadly compatible with what highlighted in historical reviews of energy prices and income elasticities.[245] The OECD Working Paper concluded that the very high share of households with high domestic energy expenditure observed for many Central and Eastern European countries and related energy affordability problems depend on the fact that many of these buildings do not allow for individual heat metering, which creates an inefficient combination of (forced) high temperatures and billing by size

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[241] Flues, F. and K. van Dender, "*The impact of energy taxes on the affordability of domestic energy*", 2017, OECD Taxation Working Papers, No. 30, http://dx.doi.org/10.1787/08705547-en

[242] The three proposed indicators fulfilled the position invariant burdening and impoverishment criteria. The TPR measures energy affordability through the share of households spending more than 10% of disposable income on domestic energy. It can also more simply be regarded as an indicator that shows how many people have relatively high domestic energy costs. The LIHCS defines a household to face energy affordability risk when it spends more than 10% of disposable income on domestic energy and also falls below the relative poverty line, set at 60% of median income, after expenditure on energy. The RPL indicates that households face challenges to afford energy if they fall below the relative poverty line of 60% of the median income after expenditures on domestic energy. All these three indicators positively correlate with the subjective statements of the SILC survey, which suggests that the three indicators reflect spending constraints rather than preference-driven choices to keep energy expenditures low. See Flues and van Dender above.

[243] A tax credit applies to each electricity connection. This is because up to a certain amount, energy use is regarded as a basic need. No energy tax is paid on this basic amount. This is reimbursed even if the annual energy tax is less than the tax credit, which is usually the case for electricity. No exemption from or refunds of energy tax is granted to people with high heating bills.

[244] This explanation, however, was tentatively ruled out by the authors due to the lack of any negative correlation between high ex-tax prices and low post-tax ones that was considered as a proxy of tax compensation intentions.

[245] As early as in the late 19th century it was noted that the share of the household budget spent on fuel and light was virtually constant (at around 6%) at different levels of income, and it was even proposed to have a sort of Engel's Third Law: "the percentage of outlay . . . for fuel and light is invariably the same, whatever the income". More recently studies have converged on the finding that residential sector income elasticity appeared to be constant at about 0.5 until per capita income reached a given threshold, and then it also dropped toward zero or even became negative. Income elasticity of energy demand in the transport sector also appeared to fall as income levels increased, but only slightly. This would happen because of the saturation effect, according to which, beyond a certain level of consumption, as incomes rise, a declining share of the budget is allocated to energy products—and thus income elasticities for those energy products fall. This is in line with the finding that per capita income levels negatively correlate with the available metrics of energy affordability risks in horizontal comparisons. R. Fouquet, *Long-Run Demand for Energy Services: Income and Price Elasticities over Two Hundred Years* Review of Environmental Economics and Policy · July 2014.

totally unrelated to energy taxation. In summing up the available evidence, ***it was concluded that Countries with higher taxes on heating fuels and electricity do not have higher share of households subject to energy affordability risks***. These tentative findings do not imply that energy taxes and prices can be increased without affecting households at all. Short and medium-term impacts matter, and adjustment costs can be large. Then energy affordability indicators do not provide any comprehensive measurements of the impact of energy prices on household welfare or well-being. If price increases are less than fully compensated by adaptive reductions in demand, so that total expenditures rise, then expenditure cuts would need to be made elsewhere. This would make the case for means-tested income compensation.

Taxation Impact Indicators. To carry out their analysis the authors of the OECD Working Paper recurred to the ***same energy taxation indicators as proposed by the Commission for the monitoring of the Energy Union Communication***, plus one drawn from the Oil Price Bulletin. No attempt was made to calculate final impact in affordability terms, as this would have required detailed information on price and income elasticities at the Country level. These indicators include:

- The share of taxes in retail electricity prices for households defined as ***the share of taxes and levies in the electricity price paid by household consumers in consumption band DC (2 500 kWh- 5000 kWh)*** in the second half of the year as drawn from the Eurostat series. This indicator was used by the Commission to comment on increasing trends over time and to highlight Member States where the share of taxes exceeded 50 % of the total consumer price. Data breakdown was used to highlight that VAT remained the main tax component in retail electricity prices, and that the trend in other taxes and levies was decreasing, while the share of levies imposed to support renewable energy sources increasing.

- The share of taxes in retail gas prices for households defined as ***the share of taxes and levies in the gas price paid by household consumers in consumption band D2 (20GJ - 200GJ)*** in the second half of the year as reported by Eurostat. Also, in this case the indicator was used to highlight the Member States in which the share increased 50% and the related size of the increase. No comment was deemed relevant on tax breakdown.

- Share of taxes in retail heating oil prices defined as ***the share of taxes (VAT, excise duty and other indirect taxes) from the consumer price of heating oil*** (heating gas oil) as from the Weekly Oil Price Bulletin. Since no detailed breakdown of data by tax component is available, but just VAT rates and other indirect taxes including excises, comments were referred to the nominal excise duty rates and the VAT rates including concessional ones contributing to the total share of taxes and levies in the final consumer price overall. A huge dispersion in the excise duty rates for heating oil and the weight of indirect taxes was noted. The number of Member States where the share of taxes increased was also recorded.

These price indicators do not represent the net final cost of energy taxation for consumers, because they do not net off parallel off-tax subsidies. Also the weight of RES charges on electricity prices can be misrepresented in certain Member States.

C.7.6 GHG Reduction

Impact of Energy Taxation. Carbon taxes exert a direct influence on energy prices. unless compensated by parallel reductions in other energy taxes to keep revenue-neutrality. In that case, the incentive to energy efficiency disappears in the short term, while the primary objective of promoting carbon emission reductions remains. Their ***ultimate impact depends on the cost incentive provided to switch, in the long-term, between high-carbon and low-carbon sources or renewables***. There are various retrospective studies on the impact of the carbon taxes in curbing carbon emissions in the different national circumstances and with conflicting results also based on the different methodologies used, the level of taxation in place, and the consideration given to exemptions and parallel compensatory subsidies. It has been empirically noted that the impact of the different carbon taxes on the overall level of GHG emissions varies with the ***scope of the emissions covered and with the type and size of exemptions***.[246] This can be the case for Member States that exempt from the carbon tax their national peat sources like Finland (as peat has a CO_2 content higher than coal and after some initial uncertainty has not been considered by UNFCC as a carbon-neutral biomass for emission accounting purposes). Also, exemptions granted to large energy consumers outside the ETS reduces the likely impact of the tax. The ETS is a quantity-based mechanism, so reduction in GHG emissions is certain.

Existing Indicators. The subject of carbon pricing and related gap indicators has been extensively reviewed before. Correlation with the GHG reduction indicators under the Energy Union Communication have been partly elaborated by the OECD as correlations between carbon rates and carbon intensities. ***No specific dataset have been found yet on the contribution given by carbon taxation in particular, or energy taxation in general, to the achievement of the ESR objectives*** expressed as binding GHG reduction targets to be met through mitigation actions in the sectors outside the ETS (transport, buildings, small businesses and services, agriculture and waste), although indirect considerations can be made starting from the OECD carbon rates. The IMF Carbon Price is not available yet with a sectoral dimension.

Because of subsidiarity considerations, Member States can adapt policies to achieve these targets to their national circumstances, including through recourse to carbon or to GHG emission taxation[247] and a mechanism of allowances (EUA) that can be exchanged between Member States has been created. Member States greatly vary in the extent to which they have put an explicit carbon price outside the ETS. Germany has just introduced a mixed carbon-tax- emission trading mechanism covering two sectors under the ESR (transport and heating) that will be enacted starting from 2021. National carbon taxes greatly vary in terms of their implementation mechanisms and in the share and type of emissions potentially targeted, including possible issues of overlapping with the ETS. In a few cases, Member States have put a special tax directly on coal. The purpose was to put coal at a cost disadvantage with natural gas while achieving GHG emission goals. There can be other residual cases in which Member States can create fiscal incentives for low-carbon sources without a formal carbon tax. Low excise taxation of LPG and methane as a transport fuel is a case in point.

Taxation Impact Indicators. Only a few Member States are in a position to provide a breakdown of their carbon tax revenues by sector and compare them with the related share of emissions also to steer the contribution of carbon taxation to their ESR efforts. For instance, Sweden can, although with apparently substantial delay, provide a sectoral breakdown of gross revenues from carbon tax by NACE sector and compare them with the underlying attributable share of carbon emissions, i.e. exclusively those originated from energy consumption and industrial processes.

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[246] The Earth Institute – Columbia University, *Carbon Pricing as a Policy Instrument to Decarbonize Economies* 2019.

[247] Starting from 2021 the ESR targets will become increasingly stringent, and this is expected also to have an impact on the price of ESR allowances that is therefore forecast to rise .According to the Oeko-Institut's calculations, Germany may already have to spend around 600 million euros on purchasing emission certificates for around 120 million tonnes of excess greenhouse gases to 2020. For 2021-2030, according to these – optimistic – projections, Germany will have a greenhouse gas emissions gap of around 300 million tonnes of CO² that could come at a cost of between 5 and 30 billion euros. Oko-Institut *Entwicklung der Effort Sharing Emissionen nach Sektoren in Deutschland*. Working Paper 5/2018. https://www.oeko.de/fileadmin/oekodoc/WP-ESD-Trends.pdf.

C.7.6. Air Pollution

Impact of Taxation. Taxation of air pollutants is technically complex and costly to manage because, as the products of combustion cannot be easily standardized, it requires monitoring at the plant level of a number of different processes and matrixes. The debate that at the EU level accompanied the costs of managing the ETS, which is a much simpler process and the importance of estimating the costs of managing the scheme give an idea of the importance of the issues at stake. ***Despite these technical difficulties a number of Member States have introduced taxation of NO_X and SO_X emissions*** that is typically aimed at power generation plants. Because of the technical difficulties above, it does not seem that any Member State has introduced a ***tax on PM emissions***[248] as such, as these are usually managed by means of technical standards. Because of the variability of the underlying matrixes and related difficulties in quantifying emissions over time, these taxes often apply to fossil fuels only and biomass-based plants are generally exempted.

These taxes are so environmental in nature that at times they are designed as feebates to ***raise no net revenue at all***. In Sweden total revenues from the NO_X tax are redistributed to the group of taxed plants to reduce any potentially negative impact on competitiveness and raises no net revenue for the Government[249]. The reimbursement mechanism is based on how energy efficient the plants are. This is tantamount to an incentive scheme financed by participants themselves. Similar reimbursement mechanisms are in place also elsewhere. There is evidence that in Sweden the SO_X tax has massively favoured substitution from oil to other energy sources – mainly electricity – thereby also cutting GHG emissions and this is also demonstrated by the sharp drop in related tax revenues over time, as the sulphur content of emissions has decreased among tax paying entities. The sulphur tax has also induced technological progress on both the demand and supply side, and also caused a small substitution effect between heavy and light fuel oil. These secondary substitution effects between products can also be expected by those Member States that have differentiated their excise rates based on the sulphur content of oil, particularly fuel oil.

Existing Indicators. Taxes on air pollutants resulting from energy processes are ***not considered as energy taxes***. They are grouped together with other taxes on water emissions, fertilizers, pesticides, waste, etc, under the common label of taxes on pollution and classified as such in the existing statistical datasets. The OECD has been working on a more granular classification of these taxes and has created the sub-category of "pollutant emissions to air" as recently reported also in their 2019 Revenue Statistics.[250] For the time being, this classification difficulty has hindered the development of taxation indicators on the subject, not to speak of indicators linking results from taxation with the attainment of air pollution objectives.

Corrective Tax Rates. While the field of ordinary energy-related air pollution taxation indicators is rather underdeveloped, emissions and in particular NO_X, SO_X and PM emissions have been ***extensively considered in the calculation of the cost of energy-related externalities and related corrective tax rates***. This is because most of these costs are health-related and somehow connected to the value of a statistical life (VSL), and related estimation methodologies are relatively advanced and can benefit from progresses in health policy cost benefit assessment interventions. The

[248] Taxation of PM particles so far has been implemented only within the framework of transport taxation on vehicles.

[249] According to the OECD: "this means that firms emitting low volumes of NOx per unit of energy produced are net beneficiaries of the scheme – only firms with large NOx emissions per energy unit are net tax payers". OECD (2013) *The Swedish Tax on Nitrogen Oxide Emissions. Lessons in Environmental Policy Reform*. OECD Environment Policy Paper, December 2013 no. 2. OECD. http://www.oecd-ilibrary.org/environment-and-sustainable- development/the-swedish-tax-on-nitrogen-oxide-emissions_5k3tpspfqgzt-en.

[250] OECD, Revenue Statistics 2019: Annex 2.A. List of environmentally related tax bases, *OECD Publishing*, Paris, 2019, p. 54.

calculation of the costs of these externalities and therefore of the ideal Pigouvian tax that should pay for them, does not, however, necessarily means that taxation represents the most efficient policy instrument in a given circumstance and should be preferred to other means such as standards, or that related externalities should be covered by a tax base rather than another. At any rate, to represent an incentive to change polluter behaviour the ideal tax base should be represented by emissions themselves.

The IMF has started publishing on an experimental basis the corrective tax rates in US$ for air pollutant emissions, including CO_2, SO_2 and $PM_{2.5}$ and the most important fuels worldwide, including in almost all Member States by means of a common costing methodology. Emission-related externalities are calculated following a health-based rationale by estimating excess mortality in different Countries due to different sources of emissions, and in particular to coal, natural gas and vehicle and heating exhaustions at ground level. Different scenarios of recourse to best practices in emission controls are assumed. The accuracy of these estimates depends on the granular availability of emission data and the robustness of these estimates crucially depends on the VSL[251]. The IMF is considering an update and expansion of the scope of these calculations, depending on the sufficient availability of emissions data on these plants.

Based on its own VSL values, the IMF found that taxes on coal would compensate on average for some half of its externalities worldwide and road fuels would be under-priced by 20%. It is worth reminding that the IMF does not include the non-deductible VAT surcharge on these estimates, so any apparent under-pricing in the EU could be compensated by this component, as far as private road fuel propellants are concerned. It would be confirmed, for freight transport fuels. Corrective tax rates particularly affected by VSL estimates are those for coal, natural gas for power generation and gasoil while estimates for gasoline and natural gas for heating would not change substantially. Conversely, IMF estimates envisage a cost of carbon at US$ 35/tonne as a reference price for climate change damage as against a short run € 100/tonne value assumed by the EU in its assessment of transport-related externalities.

For transport fuels (see Table 11 overleaf) the IMF decided to include a broader set of externalities was considered over and above air pollution. These include congestion, accidents and infrastructure costs. There are diverging opinions on whether and the extent to which these externalities comply with commensurability principles and can be expected to be directly impacted by energy taxation. The environmental cost of diesel reflects its greater air pollution. The authors themselves warn against considering some of these externalities as entirely suitable to taxation by means of fuel taxes (e.g. congestion) and no cross-check was carried out of whether these externalities were already by other taxes or charges (typically vehicle or congestion taxes, motorway fees but also pollution taxes). A study recently commissioned[252] by DG MOVE that also considered other externalities (noise, well-to-tank emissions, habitat damage) as however demonstrated that less than half of transport related externalities, as a whole, are covered by taxes or charges if fuel taxes are assumed to pay for all of them. So far

[251] The IMF follows an OECD estimate of US$ 4.7 mn per VSL that is then adjusted to the different income level of the different Countries in a proportional way by assuming a 1.0 income elasticity. The US$ 4.7 mn benchmark is more than double the value recommended by the Commission in the past for its own cost-benefit analysis purposes that was in the range of € 1-2 mn per VSL and is also higher than the € 3.6 mn currently adopted in the EU Handbook on the External Costs of Transport that is also based on the very same source, but indexed based on different assumptions. Estimates on the cost of emission externalities actually widely differ between these two sources, See footnote DG MOVE, Study Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities, Publications Office of the European Union, Luxembourg, June 2019; and *Handbook on the External Costs of Transport*. Versions 2019 – 1.1, that also includes an extensive review of the values proposed by different sources, available on https://ec.europa.eu/transport/themes/sustainable/internalisation-transport-external-costs_en.

[252] DG MOVE, Transport taxes and charges in Europe. An overview study of economic internalisation measures applied in Europe, European Commission Directorate-General for Mobility and Transport, Publications Office of the European Union, Luxembourg, 2019.

most of the research effort on corrective tax rates for energy-related air pollution has focused on fossil fuels. There seems to be a gap on the estimate of these values for biofuels and biomasses that are well-known sources of PM and SO_X emissions.

Table 10: IMF Corrective Tax Rates for Pollutant Emissions (US$ per tonne)

	CO_2	SO_2			NO_X			$PM_{2.5}$		
		coal	natural gas	transport heating	Coal	natural gas	transport heating	Coal	natural gas	transport heating
AT	35	41,004	41,889	12,951	31,812	31,666	2,664	51,736	53,150	350,052
BE	35	53,017	51,863	10,883	34,613	34,243	2,201	64,698	63,189	276,234
BG	35	23,980	#N/A	7,536	19,472	#N/A	1,545	28,991	#N/A	201,479
HR	35	35,046	35,676	10,533	28,197	27,410	2,179	44,610	45,720	290,953
CY	35	#N/A	#N/A	2,232	#N/A	#N/A	458	#N/A	#N/A	59,950
CZ	35	56,034	55,308	9,670	40,836	41,184	1,982	69,818	68,676	258,025
DK	35	26,136	26,025	6,276	20,048	19,993	1,277	34,589	34,627	162,816
EE	35	#N/A	28.605	8.435	#N/A	22.914	1.733	#N/A	34.958	226.999
FI	35	14,814	16,035	10,786	12,152	12,711	2,198	17,739	19,320	281,719
FR	35	33,555	37,779	15,908	24,511	27,670	3,239	41,725	46,003	414,075
DE	35	53,192	56,125	20,082	35,624	36,603	4,115	65,936	69,514	535,454
EL	35	20,699	20,734	8,028	16,843	16,213	1,657	25,562	25,570	219,970
HU	35	41,057	40,925	11,070	30,712	30,608	2,275	51,744	51,840	298,250
IE	35	12,897	18,828	4,991	10,468	14,585	1,030	16,217	22,833	136,535
IT	35	26,627	31,596	13,346	20,905	22,958	2,744	33,654	40,278	360,129
LT	35	#N/A	34.985	13.522	#N/A	27.769	2.782	#N/A	44.700	365.862
LU	35	#N/A	86,775	#N/A	#N/A	65,283	#N/A	#N/A	105,443	#N/A
LV	35	23.252	28.935	10.572	19.784	23.459	2.174	29.743	36.413	285.607
MT	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NL	35	53,065	50,535	13,357	35,421	34,581	2,723	65,304	62,168	349,477
PL	35	38,887	35,828	9,468	28,429	27,749	1,955	49,082	45,043	259,582
PT	35	12,221	12,533	6,383	9,265	9,355	1,318	14,755	15,177	175,156
RO	35	26,813	27,895	7,995	21,377	21,041	1,659	33,293	34,439	223,169
SK	35	42,444	46,050	7,275	32,616	33,770	1,508	53,469	58,463	202,158
SI	35	52,466	52,388	10,936	39,744	39,419	2,273	67,044	66,807	307,217
ES	35	16,871	19,270	19,055	13,364	14,498	3,897	20,852	23,980	504,326
SE	35	17,058	19,702	16,370	13,005	15,757	3,333	21,281	25,956	426,238

Source: IMF *Survey : Fiscal Policy to Address Energy's Environmental Impacts*, 2014 Data are available by downloading the excel file from the *"Pricing database tool" link.*

Table 11: IMF Corrective Tax Rates for Fuel Use and Road Fuels (US$ per GJ)

	Coal					NG in power generation				NG for heating			Gasoline					Diesel					
	CO_2	Pollution			Tot.	CO_2	pollution		Tot.	CO_2	air	Tot.	CO_2	air	cong.	acc.	Tot	CO_2	air	cong.	acc.	road	Tot
AT	3	46	3.1	3.1	6	2	1.3	1.0	2.9	2	0.2	2.1	0.08	0.01	0.35	0.13	0.56	0.09	0.15	0.36	0.11	0.03	0.75
BE	3	62	17.1	17.1	20	2	1.1	1.0	3.0	2	0.1	2.1	0.08	0.01	0.55	0.16	0.80	0.09	0.12	0.52	0.11	0.06	0.90
BG	3	170	6.3	54	57	2				2	0.1	2.0	0.08	0.01	0.09	0.33	0.51	0.09	0.20	0.09	0.22	0.00	0.61
HR	3	66	7.8	33	36	2	2.7	2.7	4.6	2	0.1	2.1	0.08	0.01	0.12	0.25	0.46	0.09	0.25	0.11	0.17	0.03	0.66
CY						2				2	0.0	2.0	0.08	0.00	0.23	0.11	0.42	0.09	0.04	0.21	0.08	0.02	0.45
CZ	3	126	15.1	15	19	2	4.8	1.3	3.2	2	0.1	2.1	0.08	0.01	0.25	0.20	0.53	0.09	0.18	0.23	0.13	0.05	0.69
DK	3	23	1.7	2	5	2	3.5	0.8	2.7	2	0.1	2.0	0.08	0.00	1.09	0.10	1.28	0.09	0.07	1.15	0.09	0.05	1.44
EE	0,7	2,7	2	0,1	2,0	0,08	0,028	0,005	0,129	0,24	0,09	0,195	0,004	0,065	0,014	0,37	0,7	2,7	2	0,1	2,0	0,08	0,028
FI	3	15	2.3	3	6	2	2.0	0.8	2.7	2	0.1	2.1	0.08	0.01	0.45	0.09	0.63	0.09	0.17	0.47	0.08	0.04	0.86
FR	3	41	7.8	8	11	2	1.8	1.0	3.0	2	0.2	2.2	0.09	0.01	0.48	0.15	0.73	0.10	0.17	0.51	0.13	0.05	0.95
DE	3	86	5.7	6	9	2	2.6	1.1	3.1	2	0.1	2.1	0.08	0.01	0.37	0.11	0.58	0.09	0.20	0.39	0.10	0.03	0.82
HE	4	58	8.9	15	19	2	0.5	0.5	2.4	2	0.1	2.0	0.08	0.01	0.30	0.20	0.59	0.09	0.11	0.32	0.18	0.03	0.74
HU	3	269	12	22	26	2	2.8	1.8	3.7	2	0.2	2.1	0.08	0.01	0.16	0.21	0.46	0.09	0.16	0.15	0.14	0.00	0.54
IE	3	18	1.7	3	7	2	0.4	0.3	2.3	2	0.1	2.0	0.08	0.00	0.43	0.09	0.61	0.09	0.07	0.45	0.08	0.02	0.72
IT	3	30	2.5	3	6	2	0.8	0.7	2.6	2	0.2	2.1	0.08	0.01	0.27	0.17	0.53	0.09	0.19	0.28	0.15	0.03	0.75
LT	3					2	3,6	0,9	2,8	2	0,2	2,1	0,08	0,047	0,072	0,431	0,63	0,09	0,401	0,062	0,219	0,041	0,82
LU						2	2.3	1.7	3.7	2			0.08		0.74	0.04	0.86	0.09		0.77	0.04	0.00	0.91
LV	3	52	7,0	10	14	2	2,4	1,7	3,6	2	0,1	2,1	0,08	0,031	0,087	0,240	0,44	0,09	0,340	0,074	0,122	0,079	0,71
MT						2				2			0.08	#N/A	0.28	0.11	0.47	0.09		0.29	0.10	0.09	0.58
NL	3	47	3.4	3	7	2	1.9	1.1	3.0	2	0.2	2.1	0.08	0.01	0.51	0.10	0.70	0.09	0.16	0.53	0.09	0.01	0.89
PL	3	82	9.2	12	16	2	2.6	1.4	3.3	2	0.1	2.1	0.08	0.01	0.15	0.31	0.55	0.09	0.13	0.14	0.21	0.02	0.59
PT	3	13	2	4	7	2	0.3	0.3	2.3	2	0.1	2.0	0.08	0.01	0.24	0.19	0.52	0.09	0.09	0.25	0.18	0.03	0.64
RO	3	172	9.3	36	39	2	2.7	2.0	3.9	2	0.1	2.0	0.08	0.01	0.08	0.42	0.59	0.09	0.13	0.07	0.29	0.05	0.63
SK	3	123	8.3	9	12	2	4.0	1.1	3.0	2	0.1	2.0	0.08	0.01	0.18	0.20	0.47	0.09	0.12	0.17	0.14	0.02	0.54
SI	3	249	12	14	18	2	7.8	1.8	3.7	2	0.1	2.1	0.08	0.01	0.16	0.12	0.37	0.09	0.09	0.15	0.08	0.03	0.45
ES	3	45	4.5	8	11	2	1.1	0.5	2.4	2	0.2	2.2	0.08	0.02	0.42	0.12	0.65	0.09	0.21	0.45	0.11	0.04	0.90
SE	3	21	1.7	2	5	2	1.7	0.5	2.4	2	0.2	2.1	0.08	0.01	0.49	0.05	0.63	0.09	0.16	0.52	0.04	0.04	0.85

Source: IMF: Fiscal Policy to Address Energy's Environmental ImpactsData are available by downloading the excel file from the "*Pricing database tool*" *link.*

C.7.7. Assessing Coherence of Energy Taxation with Energy Efficiency, Energy Availability and Emission Reduction Objectives

Coherence Issues. There can be several examples of ***mutually conflicting objectives*** impacting on coherence, just to mention some of them:

- an ***increase in the level of energy taxes*** always has a positive impact on energy efficiency and reduces energy consumption. For fossil fuels this can be translated in lower target carbon emissions. Increases in the prices of electricity or heating, however, negatively affect energy ***affordability***;

- carbon-tax reforms can increase the level of prices and therefore contribute to energy efficiency objectives, but they can also favour product substitution, so that the impact on energy efficiency is indeterminate;

- support to ***renewables decreases GHG emissions*** and can be financed also to improve energy availability and reduce dependence on imports. Related price increase can contribute to energy efficiency if paid through charges. In that case, if related costs are borne by households this may also worsen energy affordability problems. If support to renewables is paid, instead, by means of general taxation sources, the energy efficiency incentive disappears together with energy affordability problems;

- the structure of the energy tax / excise rates can be geared to favour energy efficiency by modulating tax rates. This can go to the detriment of air pollution and GHG emission reduction if the fuel receiving indirect incentives is relatively higher in carbon content or has worse air pollution impact like ***gas oil compared to gasoline*** for cars. The same can be said of tax rate modulation to favour national fossil sources for energy availability purposes (e.g. coal, peat);

- ***national carbon or coal taxes*** applied on companies ***under the ETS*** do contribute to local air pollution reduction and increase the level of national prices thereby providing incentives for carbon efficiency. They might reduce the total national carbon emissions at the national level and at the EU level only under certain conditions, otherwise the ***EU impact nets off***;

- in the past support to renewables partly had this crowding out effect and contributed to decrease the effectiveness of the ETS in curbing carbon emissions by decreasing demand for ETS allowances and related carbon price.

- ***concessional VAT rates***, excise rebates and other forms of price subsidies can be provided to smooth energy affordability risks to the detriment of providing incentives for ***energy efficiency***;

- although addressed to other environmental externalities, taxes on emissions of air pollutants have the potential ***of crowding out the GHG reduction effort*** under the ETS and reduce the carbon price;

- ***biomasses and biofuels*** can contribute to GHG emission reduction but at the same time ***worsen air pollution locally*** in terms of NO_X, SO_X and PM emissions. This is particularly so in urban and congested areas.

This complex set of interactions can be preliminarily summarised in the matrix reported in Table 12 below.

Table 12: Coherence Aspects of Various National Taxation Policies under an EU ETS Mechanism with the Overarching EU Energy Policy Objectives

	Savings in Energy Consumption	Energy Efficiency	Energy Availability (as share of imports)	Energy Affordability	Emission Reduction
Increase in energy taxes	+/+	+/+	=/=	=/- (if electricity or heating)	+/=
Carbon and coal taxes under ESR revenue neutral (modulated not to increase the level of prices)	=/=	=/=	=/- (if domestic sources are also targeted)	-/= (if heating is covered)	+/+
Carbon and coal taxes under ESR additional revenues	+/+	+/+	=/- (if domestic sources are also targeted)	=/- (if heating is covered)	+/+
RES charges	+/+	+/+	+/+	-/- (not if paid by businesses only as this impacts competitiveness)	=/+ (no additional effect when under ETS)
RES covered by general taxation	=/=	=/=	+/+	+/+	=/+ (no additional effect when under ETS)
Carbon and coal taxes under the ETS	+/+	+/+	=/-	-/-	=/= (if ETS is around the cap)
ETS Proceeds	+/+	+/+	+/=	-/-	+/+
Taxes on NO_X and SO_X emissions	+/+	+/+	=/-	=/+	=/+
Support to biofuels and biomasses	=/=	=/+	+/=	=/=	-/+ Improves GHG but worsens air pollution
Modulation in tax rates to promote energy efficiency (e.g. gasoil)	+/+	+/+	=/=	-/-	-/-
Modulation in tax rates to promote energy availability (methane for cars)	-/-	=/=	+/+	-/-	-/-
Modulation in tax rates to promote competitiveness	-/-	-/-	=/=	=/=	-/-
Modulation in tax rates to favour energy affordability	-/-	-/-	=/=	+/+	-/-
Modulation in tax rates to favour pollution reduction	=/+	=/-	-/-	-/-	+/+

(SO_X content rates)					
Total allocation of fiscal resources to pursue the various objectives					
Revenue recycling under certain conditions				++	

Existing and Possible Coherence Indicators. There have been attempts in the literature[253] to measure the internal coherence of policies in the environmental domain by ***assessing adoption patterns of policy instruments*** that collectively support a given aim, for instance, decarbonisation. Due to data availability restrictions, to assess trends in policy instrument adoption, preferences, and coherence across environmental domains, the OECD database of Policy Instruments for the Environment (PINE) was used as a source, as this allowed to identify tools related to climate change, as compared with others aimed at energy efficiency or other aims. A matrix identifying environmental policy domains and cross sectoral policy outputs was developed for each country and the ***number of different instruments adopted since 1950*** was counted as a proxy of their policy importance. All policies that have stated environmental objectives related to climate change were counted including ETS, fees, taxes, deposit refund systems, subsidies, and voluntary approaches and compared to those enacted for other purposes.

So, a very rough indicator was created with the share of these targeted instruments on the total number of those identified. The same exercise can be repeated starting from other databases (e.g. the OECD fossil fuel subsidies database) or by type of tax instruments and the related tax base (e.g. subsidies as compared to revenues from taxation). It is worth noting that the authors gave up any attempt at quantifying these aspects in monetary terms because they found that available datasets just on revenues from carbon taxes were not comparable enough to justify drawing conclusions from the available data.[254]. Therefore, they were reluctant to draw any conclusions from this metric or any derivative such as the standard deviation or other statistical measures. Finally, they also found a total lack of datasets on the use of proceeds (earmarked or for general purpose) for revenue recycling, a piece of information deemed key for assessing the effectiveness of carbon pricing policies, particularly in coping with energy affordability aspects, and due to unclear/insufficient information, this issue was therefore not analysed as it should have been.

Notwithstanding these feasibility issues, it can be observed that if data had been available and taxes and related subsidies could have been easily classified on the basis of their main purposes, nothing would have impeded to weight the qualitative criteria of the Table 12 above with data on taxation revenues or, in the case of subsidies, foregone revenues as calculated and reported by the Governments themselves to the NTL, PINE or Fossil Fuels Subsidies databases. To be able to do that a number of information data gaps should have been filled in in the way information is made available, and in particular:

[253] The Earth Institute – Columbia University, *Carbon Pricing as a Policy Instrument to Decarbonize Economies*, July 2019.

[254] Moreover, because of the way ETS are accounted for, there were a number of countries implementing the ETS with unreliable figures on ETS proceeds as a share of government revenues, which is fully understandable once the methodological problems created by their recording for national accounting purposes are known.

- revenues from national carbon taxes (i.e. with carbon as the tax base and the reduction of carbon as an incentive) should be clearly identified and split between taxes operating under the ESR and ETS schemes;

- costs of RES should be clearly distinguished between those covered by charges and those covered by general taxation or borne only by businesses;

- subsidies should be classified according to their main purposes: whether to increase energy efficiency, availability, affordability or pollution reduction and subtracted or added to the various policy objectives;

- as an increase in the carbon tax is likely to result in a serious deficit on energy affordability parallel data should be collected on revenue recycling to assess how the latter can compensate for the other;

- taxes on emissions of pollutants can have different impacts depending on the existence of reimbursement mechanisms;

- real revenues from ETS should be known.

The resulting matrix would allow to calculate both ***the share of fiscal resources devoted to the different policy objectives*** and the amount of resources on the total simultaneously pursuing conflicting objectives. This could allow to have a broad overview of the degree of coherence of the different national taxation policies with the different objectives of the EU Energy policy, as well as identify areas for possible trade-offs. The matrix could be further simplified by indicating the primary incentives provided by the different tax rates. So taxes on energy could be accounted for energy consumption savings and energy efficiency purposes, but not for pollution reduction, and the reverse could be done with carbon taxes.

Also the alternative corrective tax rate reference framework to measure subsidies could represent a reference framework to assess coherence aspects. The main limitations are represented by the fact that affordability aspects are captured only as concessional VAT rates and these are measured on industrial rather than consumer prices. Moreover, the methodology does not allow to consider energy availability aspects, as these have not been considered as an externality. GHG and air pollution aspects can conversely be analysed more in detail.

C.8. ENERGY TAX DATASETS

This section reviews the datasets available to produce energy taxation indicators. Since indicators depend on availability of data on taxation revenues, prices and tax rates and related subsidies, this section is structured into three parts. First, ***available energy taxation datasets*** are reviewed and compared in their salient features and main differences. Then sources of ***information on prices and tax rates*** are described. Finally ***available sources on energy subsidies*** are also reviewed in more detail and their main differences highlighted. As shown in previous sections, a clear difficulty with energy taxation data is represented by the level of detail and data breakdown available in existing sources. This hinders the subsequent construction of indicators or requires recourse to heterogeneous sources of information.

C.8.1 Energy Taxation Datasets

NTL-based Energy Taxation Dataset. The European Environmental Taxation dataset is a subset of the National Tax List for general ESA purposes. Energy taxes are simply identified based on a letter code as a subgroup of environmental taxes. Once compliance with national accounts is ensured, there is no binding criterion Member States must follow for tax reporting. This gives rise to ***a number of heterogenous reporting***

practices that hinder subsequent data comparability. For instance, there are countries:

- separately reporting excise duties by type of fuels and keeping track of the related carbon tax component even if the tax is formally the same (e.g. DK);
- bundling together in the same amount revenues from all fuel excises together with the carbon tax component (e.g. SE)
- bundling together all energy excises including electricity together with the carbon tax (e.g. PT)
- separately reporting system charges or public service obligations as a tax
- separately reporting RES charges as a tax (e.g. BE)
- bundling together electricity excises with RES charges (e.g. IT, HR)

It is therefore impossible to draw from the NTL dataset a piece of information as simple as the share of energy taxation revenues from fuel excises, electricity excises, or carbon taxes. Only revenues from ETS, whatever their practical significance might be, should be recorded separately because of the different nature of the underlying tax, although in practice this not always happens. This lack of data breakdown is because the ***European Environmental Taxation dataset was simply superimposed on the existing NTL one to reduce reporting burden on Member States****, so only data* ***classification based on the original NTL coding*** (production, consumption, wealth tax, etc.) is possible. These traditional tax classification categories, however, are of very ***limited significance in the field of energy*** and have never been used for reports or quoted as relevant in the literature.

OECD Energy Taxation Revenues. The OECD has developed in parallel their own datasets on environmental taxes, the ***Environmental Taxation Revenue Dataset*** and the ***Policy Instruments for the Environment (PINE) database***[255] whose data have been recently reconciled. PINE was originally developed in co-operation with the European Environment Agency (EEA) and then run as an entirely in-house exercise. Since data are also sourced from the NTL, the dataset covers all the EU Member States and follows the SEEA traditional classification in energy, transport, resources and pollution taxes, but also includes an additional one for ***transversal policy domains*** to better respond to new information needs. One of them – still under development at the moment - is specifically devoted to climate change and overcomes the traditional division between energy, transport and resource taxes, by grouping together carbon taxes, ETS, energy taxes, with taxes on road use, forestry taxes, etc. In some one third of Member States, including most of the large ones - the estimate of climate change-related taxation is still on a provisional basis. No indicator has been published from reclassified climate change taxation revenues yet. The PINE database also has a separate section for earmarked taxes.

While drawn from the same original source, OECD and Eurostat data differ in some respects. The OECD follows its own Revenue Statistics format where revenues from states/regions and local government are reported only in an aggregate form. So, ***OECD data do not include subnational energy taxes***, but where revenues from energy taxation amount to more than 20% of a country's total[256]. As long as the proposed Catalonian carbon tax remains on constitutional hold, the issue of subnational energy taxes appears as hardly relevant in the EU at the moment. The share of energy taxes on total Government revenues, in certain OECD Countries would therefore be two incommensurable figures. Until 2018 data the OECD dataset has not reported from the

[255] As the name goes, the PINE database is larger in scope than collecting data on taxes and related revenues and includes also information – not necessarily updated - on fees and charges, tradable permits, deposit-refund systems, environmentally motivated subsidies and other voluntary approaches used for environmental policy.

[256] To achieve that aim and overcome the limitations of Revenue Statistics the Secretariat relies on the expert judgement of the delegates to the OECD Joint Meeting of Tax and Environment Experts.

ETS. Moreover the OECD its own Revenue Statistics methodology that had more stringent requirements in terms of compliance with the proportionality principle. So, the total amount of revenues from energy taxation was generally lower in the OECD data than in the Eurostat ones and could reach as high as 30% of the total[257]. A detailed comparison of the two datasets is reported in the appendix to this section. The OECD datasets should increasingly be converging because ***ETS data will also be reported by the OECD*** and dialogue with Eurostat and national data providers on tax classification should be improved.

Moreover, the OECD has recently embarked into a ***pilot exercise*** aimed at increasing the level of data disaggregation available on environmental taxation, thereby redressing some of the more significant analytical data gaps that have increasingly appeared evident over time. The Table 13 below summarises the proposed OECD analytical reclassification scheme[258]. As can be seen, this envisages: 1) the separate identification of transport fuel taxes; 2) a clearer distinction between carbon taxes and ETS proceeds from energy-related emissions from those that are non-energy related that are now classified under pollution taxers; 3) the separate identification of taxation of air pollutants (including NOx and Cox emissions) and ozone depleting substances (that would no longer be considered as carbon taxes) among pollution taxes. Finally, among the memo items included – i.e. items that remain officially considered outside the scope of environmental taxation – but are reported for comparison and completeness purposes the OECD has envisaged 4) the separate indication of taxes on oil and gas extraction, as well as of 5) revenues classified as resource rent taxes including mining.

Table 13: OECD Proposed Analytical Reclassification of Environmental Taxes

Category	Details	Environmentally-related tax bases (consumption, production and trade)
ENERGY *including fuel for transport*	*Energy products for transport purposes*	Unleaded petrol, leaded petrol, diesel, other energy products for transport purposes.
	Energy products for stationary purposes	Light fuel oil, heavy fuel oil, natural gas, coal, coke, biofuels, electricity, district heating, other energy products for stationary use.
	Energy-related GHG emissions	Energy related carbon content, energy related emissions of CO_2 and other GHGs (including proceeds from permit schemes).
TRANSPORT *excluding fuel for transport*		Motor vehicles: production, trade or sale, registration or use, vehicle insurance, road: use, congestion, other means of transport: railways, water, air.
	Non-energy related GHG emissions	Non-energy related carbon content, emissions of CO_2 and other GHG not related to energy
	Pollutants emissions to air	NOx emissions, SOx emissions, other air pollutants (excluding GHGs)

[257] Significant differences in this respect can be noted for BG, SK, and LV and are mainly due to omission of RES revenues. SI apparently does not report to the NTL as energy taxes revenues from electricity excises and the carbon tax. FR includes miscellaneous taxes that are not always considered as energy taxes by OECD.

[258] See OECD, Revenue Statistics 2019: Annex 2.A. List of environmentally related tax bases, OECD Publishing, Paris, 2019, p. 54.

POLLUTION	*Ozone depleting substances*	Ozone depleting substances
	Effluents to water	Effluents of oxidable matter (BOD, COD), other effluents to water, effluent collection and treatment.
	Non-point sources of water pollution	Pesticides, artificial fertilisers, manure
	Waste management	Waste collection, treatment of disposal, individual products, packaging
	Noise	Noise
	Radiation	Radiation, radioactive substances
RESOURCES	*Resource extraction, abstraction, harvesting*	Fresh-water abstraction, harvesting of biological resources, extraction of raw materials, landscape changes
MEMO ITEM 1	*Land taxes*	Land by type of land use
MEMO ITEM 2	*Taxes on Oil and Gas Extraction*	Extraction of oil and natural gas
MEMO ITEM 3	*Resource rent taxes*	Resource rents e.g. from mining, fisheries)

Source: OECD, Revenue Statistics 2019: Annex 2.A. List of environmentally related tax bases, OECD Publishing, Paris, 2019, p. 54.

Excise Duty Tables. A database exists on the taxation of the various energy products, that is the Excise Duty Tables (EDT) by DG TAXUD. The EDT dataset gathers information on the rates of and the revenues from "taxes on consumption (excise duties and similar charges) other than VAT on energy products and electricity". Rebates are notified when relevant for revenue raising purposes and expressed in tax rates, but are not necessarily exhaustive of all *niche* or off-tax reimbursements. The definition also includes carbon taxes, as long as they are incorporated in the excise mechanism and collected together (as is usually the case). ***The EDT are populated with revenue information supplied by the Member States, which do not necessarily have to conform to the ESA 2010 methodology, and the Commission does not guarantee its accuracy*.** Excise revenue data on energy products are split into eight different categories; rates are provided following the same classification, further broken down according to sector and uses. The product categories are as follows:

1. Leaded petrol
2. Unleaded petrol
3. Diesel
4. LPG and methane
5. Heavy fuel oil
6. Natural Gas
7. Coal and Coke
8. Electricity

Data are provided also for 'revenues from mineral oils', including the most commonly used transport fuels and covering items 1 to 5, and for 'total revenues', incorporating all items and other unclassified revenues. ***Most Member States, but not all, provide data for each category***. In particular, a number of countries do not provide disaggregated data for mineral oils, namely Germany, Croatia, Italy, Latvia, and Austria.

Germany and Austria also do not provide disaggregated data for coal and coke, and Austria also for natural gas and electricity. Other countries feature specific data gaps (e.g. in Poland petrol and diesel revenues are not distinguished) or use a different product categorisation. For instance, in Spain and Ireland, revenues from diesel also include gasoil for heating and industrial purposes. The situation is summarised in Table 14 below.

Table 14: Excise Duty Tables: Missing data

Product	Missing data and other issues
Leaded petrol	7 (DE, HR, IT, LV, AT, PT, SK)
Unleaded petrol	7 (DE, HR, IT, LV, AT, PL, SI includes biofuels and biogas)
Diesel	10 (DE, HR, IT, LV, AT, PL, ES and IE includes gasoil for industrial and heating purposes, LT includes gasoil for heating and kerosene, SI includes biofuels and biogas)
LPG and methane	4 (DE, LV, HR, AT)
Heavy fuel oil	6 (DE, HR, IT, LV, AT, PL includes gasoil for heating)
Total mineral oils	**No missing data**
Natural Gas	1 (AT includes coal and electricity)
Coal and Coke	4 (DE, LV, AT, SE)
Electricity	2 (AT, UK)
Total excises from electricity and energy products	**No missing data**

Source: *Excise Duty Tables, Tax receipts – Energy products and Electricity (DG TAXUD), July 2019.*

To calculate as simple a distinction as between transport fuel and non-transport fuel-related energy taxation revenues, DG TAXUD cannot rely on NTL sources and must have recourse to the Excise Duty Tables that alone can provide a proxy of the necessary level of detail. At present, extrapolations with different levels of approximation can be used to come to this estimate. This process is variously supported by additional data made available by the Member States themselves.[259] Estimates criteria may have changed over time, as new information was made available, although this did not trigger a recalculation of vintage data for all Member States. Aware of the margin of error in these data and the ***limitations in their comparability***, the Commission never publishes

[259] There can be Countries (e.g. PL or DK) that already provide a breakdown of transport and other fuel excises in their National Tax List, so that no further calculations are necessary. For other Member States, total revenues attributed to transport fuel taxes can be directly provided by the respective Ministries of Finance in a separate document either as total amounts or as the share of the total mineral oil tax revenues attributable to transport. It usually happens that data are provided on a cash basis and have to be transformed on an accrual basis to be compatible with ESA principles, although the difference can be very small. For the remaining half of Member States, [COM add reference: It's less than half of the Member states] estimates are made by combining and extrapolating data from different sources with increasing degrees of approximation. First of all, Eurostat energy balances provide a ratio between transport and non-transport uses in final energy consumption for all mineral oil products. Then, the following algorithm applies to allocate NTL reported values: if the Member State provides in their National Tax List separate data referred to revenues from mineral oil taxes, than the share stemming from the energy balances of estimated transport fuel taxes on total revenues from all mineral oils as reported in the Excise Duty Rates is applied to the data reported in the National Tax List to calculate the amount of revenues from transport fuel only. If no such mineral oil tax data are reported in the NTL then as a second-best solution the share of total revenues from all energy products and electricity calculated from the Excise Duty Rates is applied to NTL energy taxes as a whole. In other cases, an intermediate solution requires the split between transport fuel tax revenues and other tax revenues as provided by the Member States — mostly in cash data — is applied to the respective category when several relevant ones are provided in the NTL. See DG TAXUD, Taxation Trends Report 2019 Edition. Annex B: Methodology and explanatory notes, Publications Office of the European Union, Luxembourg, 2019.

these data as absolute values, but only in the format of share of energy taxation revenues on a given total.

Revenues from excise duties on energy products and electricity, as reported in the Excise Duty Tables, represent the vast majority of taxes accounted for under the NTL database. As shown in Table 15 below, at EU level, five euros of energy taxes out of six come from excise duties. This is not the case for about one third of Member States, in which excises represent nevertheless always more than 60%, but less than 80% of total taxes. ***Those significant discrepancies are usually due to the way in which Member States provide energy tax data to Eurostat and compliance with the provision not to include renewables charges***. So, for example, Eurostat sources include revenues from green certificates in Belgium (-29%), and renewables fees in Italy (-30%). In other cases the differences behind are more difficult to explain.

Table 15: Energy Taxes and Excise Duties on Energy Products and Electricity (in 2018)

MS	Excise Duties on Energy Products and Electricity (mn EUR))	Energy taxes (mn EUR)	Ratio	MS	Excise Duties on Energy Products and Electricity (mn EUR)	Energy taxes (mn EUR)	Ratio
AT	5,431	5,457	100%	LV	567	836	68%
BE	6,217	8,808	71%	LT	806	809	100%
BG	1,202	1,442	83%	LU	932	952	98%
HR	1,163	1,427	81%	MT	153	162	95%
CY	401	463	87%	NL	14,352	14,486	99%
CZ	3,625	4,220	86%	PL	8,714	11,789	74%
DK	4,675	5,885	79%	PT	2,405	3,800	63%
EE	580	624	93%	RO*	3,096	3,407	91%
FI	4,657	4,565	102%	SK	1,302	1,972	66%
FR	43,263	46,708	93%	SI	1,098	1,355	81%
DE	47,740	49,479	96%	ES	15,344	18,252	84%
EL	4,257	5,350	80%	SE	7,115	7,509	95%
HU	2,268	2,370	96%	UK	30,963	42,276	73%
IE	2,597	3,138	83%	**EU28**	**244,132**	**290,436**	**84%**
IT	32,309	46,303	70%				

***Source**: Eurostat database and DG TAXUD, Excise Duty Tables. **Note**: Data refers to 2018.*

Eurostat Energy Taxation NACE 64 Breakdown. This is possibly the most underexploited of existing datasets, as no indicators have been drawn from it yet, but descriptive statistics only. According to their statistical Regulation, energy taxes and ETS revenues have to be allocated <u>also</u> to ***the level of NACE 64 industries, households and non-residents***. This has caused some estimation and reconciliation difficulties. Eurostat has long been working on collecting complementary data from the perspective of the paying entity by means of a voluntary survey. There still remain some unallocated amounts and differences with the NTL totals. As a result of this process, the share of energy taxes has also been published for seven NACE aggregated sectors[260], defined as paying entities[261], and by 64 NACE sectors ('energy taxes by type of activity'). This particular series was proposed among the Eurostat Resource Efficiency indicators ***for European Semester purposes***. However, NACE-64 criteria have some possible limitations for use. Moreover, their level of disaggregation might not be granular enough to capture energy intensive industries.

The first difficulty in using NACE breakdown data depends on compliance with the territoriality principle and therefore should also include ***revenues paid by non-residents***. Results without a separate indication of non-residents can be ambiguous. It is up to the Member States to provide separate data for non-residents, as this might

[260] This classification was made possible by regrouping the original NACE criteria.
[261] Namely: 1) households, 2) industry, 3) construction, 4) wholesale and retail trade and repair of motor vehicles, 5) transportation and storage, 6) services, and 7) agriculture, forestry and fishing.

represent an additional burden for them[262]. When they decide not to related amounts can end distorting data on the likely sectors they have been allocated to (e.g. fuel retailers in LV or other transportation services in HR) thereby creating comparability issues for possible downstream indicators, as nothing is known about their relative size. The typical case in point is represented by the so-called "fuel tourism" [263]. Eurostat currently estimates energy tax revenues from non-residents at around some 2.5% of the total for the EU 27 overall. Nevertheless, in small countries (Luxembourg and Malta are the typical example) this share is much more significant and can reach as high as 50%-60%. Taxes paid by non-residents can be a significant amount of the total also in certain transit countries (e.g. 13% in Austria).

Secondly, another difficulty preventing the use of sectoral tax data is that the main energy balance databases adopt a ***different classification, which is not enough detailed and does not make an explicit reference to NACE***. This is, for instance, the case for the Eurostat Energy Balance, which cannot be immediately compared to NACE-2 taxation level but for very restricted cases. A simulation is reported in the Box 12 below together with some preliminary considerations that could be drawn from these analyses. In fact, ***the database on energy taxes paid by economic activity could be useful to estimate the impact of energy excises across the various industries***. Importantly, one day this could represent a useful input to the revision of the Energy Tax Directive.[264] As shown above, when confronting EDT revenues and Eurostat data, energy excises represent 84% of total energy taxes. This means, on the one side, that EDT data could be used as a proxy for total energy taxes, and, on the other side, that available data on energy taxes are a good proxy for the excise burden per sector. The main caveat is that the distribution of the remaining 16% is unclear, e.g. between households and industrial users, or among industries. However, there is no evidence that energy taxes other than excises weigh disproportionately on industrial users (with the exception of the ETS, which however accounted for only 3% of total taxation in 2018).

Box 12 A simulation of ITR indicators from NACE 64 Data

A simplistic assumption which would allow carrying out such analysis could be made at present only for manufacturing industries. For these users, the share of fuels used 'in support of their primary activities' is likely to be so preponderant compared to transport fuels that the latter consumption could be disregarded. As a result, when data from the Energy Tax database and the Energy Balance refer to similar sectoral aggregation, an ITR could be calculated. The table 4 below provides a correspondence Table, showing the sectors for which, this is possible and what re-aggregation needs to be done. This strategy, however, would need to be refined, e.g. by consulting specialised industry sources analysing and estimating sectoral energy balances. An attempt could also be made considering PEFA data per NACE sector, rather than Eurostat Energy Balance data, although this appears to have methodological limitations on the reliability of energy consumption data.

Table 16: Correspondence between Energy Balance and Energy Taxes Sectoral Data

[262] In some countries, direct estimates of taxes paid by non-residents may be available from tax authorities. Otherwise national statistical offices can have recourse to triangulation of different sources to make their estimates

[263] This piece of information has been actively sought after in evaluations of EU policies. However, due to availability of data on non-residents, proxies had to be used instead including the per capita releases for consumption of petrol and gas oil in each Member State, although these figures do not necessarily fit with those of the Countries that have the estimate of revenues from non- residents available. See Commission Staff Working Document, Evaluation of the Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, SWD(2019) 329 final, Brussels, 11.9.2019.

[264] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003.

Energy Balance		Correspondence with energy taxes by economic activity	Consumption (KTOE)	Energy tax revenues (MN EUR)	ITR (EUR/TOE)
Name	Definition				
Iron & steel	24,1/2/3/51/52	24 Manufacture of basic metals	38,147	2,696	71
Non-ferrous metals	24,4/53/54				
Chemical & petrochemical	20, 21	20 Manufacture of chemicals and chemical products 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	52,718	5,610	106
Non-metallic minerals	23	23 Manufacture of other non-metallic mineral products	34,754	2,270	65
Transport equipment	29, 30	29 Manufacture of motor vehicles, trailers and semi-trailers 30 Manufacture of other transport equipment	8,587	1,891	220
Machinery	25,26, 27, 28	25 Manufacture of fabricated metal products, except machinery and equipment 26 Manufacture of computer, electronic and optical products 27 Manufacture of electrical equipment 28 Manufacture of machinery and equipment not elsewhere classified	19,436	4,015	207
Mining & quarrying	02.07/08 + 09.9	*No matching possible*	-	-	-
Food, beverages & tobacco	10, 11, 12	10-12 Manufacture of food products; beverages and tobacco products	29,996	3,581	119
Paper, pulp & printing	17, 18	17 Manufacture of paper and paper products 18 Printing and reproduction of recorded media	34,043	1,441	42
Wood & wood products	16	16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	8,772	753	86
Construction	41, 42, 43	*Matching possible, but use of transport fuel likely to be significant, hence estimate is unreliable.*	-	-	-
Textile & leather	13,14, 15	13-15 Manufacture of textiles, wearing apparel, leather and related products	4,261	742	174

Source: Eurostat: i) Energy balance: final energy consumption (new methodology of energy) in EU 27 and UK, available here; and ii) Environmental taxes by economic activity (NACE Rev. 2) (env_ac_taxind2).

As the Table shows, the sectoral ITR varies widely, from 42 EUR/TOE for the paper industry to more than 200 EUR/TOE for the production of transport equipment and machinery. Other industries with a relatively low ITR are the basic metal industry, including both the production of ferrous metals (steel) and non-ferrous metals (aluminium, copper, etc.), and the manufacture of non-metallic minerals (glass and ceramics). A low ITR in these sectors is in line with the structure of the Directive.[265] For the pulp and paper industry, the relatively lower tax burden may be explained by the widespread use of co-generation, which can be exempted ex Article 15 of the Directive. Obviously, the analysis is only preliminary and the reasons underlying the estimated tax burden should be assessed more in detail. Anyhow, the exercise provides a glimpse about

[265] As established in Article 2.

how existing data could be used to estimate the sectoral ITR and the relation between the ITR and the Energy Taxation Directive.

The World Bank Carbon Pricing Dashboard. The WB Carbon Pricing Dashboard is an interactive online platform providing updated ***information on existing and emerging carbon taxes and ETS initiatives around the world***. It complements and builds on the data and analyses of the annual ***World Bank State and Trends of Carbon Pricing*** reports. The dashboard provides information on tax rates, share of emissions covered, and is one of the few available sources on possible overlapping with ETS scheme, GHG conversion mechanisms[266] and revenues from taxation for both the latest available fiscal year and estimates of likely revenues for the current year. A Country factsheet provides some limited details on rebates and exemptions at the national level. The ETS scheme is reported at the EU level only without national details[267].

Taxes in Europe (TEDB) database. The Taxes in Europe (TEDB) database is on-line information tool made available by the European Commission. The system contains information provided by the Ministries of Finance of the EU Member States on around 650 taxes. Database is divided by eleven categories, including one on ***energy products and electricity*** and other taxes). For each tax, the database provides historical information across various sections including: legal basis, taxpayers, assessment base, exemptions, rate structure, tax due date, economic and statistical classification, and total revenue generated. ***The level of detail provides in the general comments greatly varies***, Finland, for instance, attaches to its tax on energy products a detailed table[268] while France comments that its tax on energy products has rates that often include a CO_2 component[269], without providing further details. The total revenue generated is provided in millions of EUR or national currencies, as percentage of gross domestic products and as percentage of total tax revenue. As reported in the appendix to this section, not all taxes included in the NTL are described in the TEDB[270]. This is probably because they do not pass the 0.1% GDP threshold. When they are the revenue reported generally always coincide, but with some possible exceptions (e.g.IT and SE).

C.8.2 Energy Prices and Rates Datasets

OECD Taxing Energy Use Database. Given existing limitations in the availability of analytical data on energy taxation revenues and the increasing interest in highlighting subsidies and uneven taxation of fossil fuels, the OECD has developed the ***Taxing Energy Use database*** classifying by product and by sector all the relevant ***tax rates of energy taxes, defined as fuel taxes, carbon taxes and electricity taxes only***. The OECD, in fact, has chosen to make the analysis of tax rates rather than that of tax revenues the focus of its energy taxation reviews. This dataset is structurally comparable to the tax-rate part of the EU Excise Duty Table and actually extensively draws from it as far as EU Member States and excises are concerned to the point of being practically undistinguishable. The OECD has added rates on carbon taxes.

[266] For instance, since 2019, Finland has changed the methodology to calculate the CO_2eq emissions for heating fuels and fuels for work machines covered under its carbon tax, and full lifecycle emissions of the fuels are now used instead of only combustion emissions. To reduce the tax burden this was accompanied by a reduction in the tax rates.

[267] Other datasets specifically on ETS usually report spot or auction prices only. See for instance the ICAP https://icapcarbonaction.com/en/ets-prices

[268] For further details see https://ec.europa.eu/taxation_customs/tedb/taxDetails.html?id=4077/1577833200#general_commentsTitle1.

[269] For further details see https://ec.europa.eu/taxation_customs/tedb/taxDetails.html?id=4080/1577833200#Tax_object_and_basis_of_assessmentTitle1.

[270] TEDB covers: 1) all main taxes in revenue terms. These include notably personal income taxes, corporate income taxes, value added taxes, EU harmonised excise duties; 2) the main social security contributions; 3) other important taxes yielding at least 0.1% of GDP

Electricity taxes include only "compulsory, unrequited payments", in compliance with the OECD definition of the proportionality principle to define a tax. Therefore, the TEU database so far has not included rates specifically related to the financing of renewables.

Oil Price Bulletin. The EU has two dedicated datasets specifically created to keep track of the prices of energy products that can also be used for the estimation of the total tax burden. The first is the ***DG ENER Oil Price*** **Bulletin** covering mineral oil products and LPG[271]. The dataset includes separate information on retail prices with and without taxes. The level of detail available on taxation covers VAT and other indirect taxes[272]. There is no separate indication of the excises or the carbon component. As always happens with market-based surveys the key data quality points are represented by the representativeness of the sample and the criteria used to weigh prices and types of similar products[273]. Data are available for energy products with a truly European market dimension and do not include markets with a mere national significance (e.g. methane for cars in Italy, kerosene for heating in Ireland). Since only aggregate data by product are published it is not always possible to fully appreciate the importance of rebates or exemptions linked to given product environmental features (e.g. blending with biofuels).

Eurostat Energy Prices Statistics. The second dataset is represented by ***Eurostat statistics on the prices of natural gas and electricity for households and industrial users***. Data are published by consumption band[274] and also include a breakdown by type of broadly intended "tax", i.e. irrespective of whether it complies with the proportionality principle or not. These are grouped into five main categories: 1) VAT; 2) taxes, fees, levies or charges relating to the promotion of renewable energy sources, energy efficiency and CHP generation, i.e. incentives to ***promote technological innovation***; 3) taxes, fees, levies or charges relating to strategic stockpiles, capacity payments and energy security; taxes on natural gas distribution; stranded costs and levies on financing energy regulatory authorities or market and system operators, in other words the costs of mechanisms to ensure a ***smooth energy market functioning***; 4) ***environmental***[275] ***taxes strictly speaking*** narrowly defined as those taxes, fees, levies or charges relating to air quality and for other environmental purposes; taxes on emissions of CO2 or other greenhouse gases; and 5) a ***residual final category*** encompassing all other taxes, fees, levies or charges not covered by any of the previous four categories: support for district heating; local or regional fiscal charges; island compensation; concession fees relating to licenses and fees for the occupation of land and public or private property by networks or other devices. As can be seen no specific category was envisaged for electricity excises.

IEA Energy Prices Statistics. Starting with the 2020 edition of its Energy Prices database, ***IEA has also started publishing information on the tax rate components of energy prices*** for a number of energy products and namely: coal, LPG, regular, mid-grade and high-grade gasoline, kerosene (excluding for air transport),

[271] Since 1994 DG ENER has been publishing the *Oil Price Bulletin* weekly consumer prices for petroleum products in EU countries. It includes retail prices of main fuels for transport: gasoline, diesel, LPG, as well as heating fuels with an EU market (e.g. gasoil but not kerosene), as well as fuel oils for industrial uses with and without sulphur.

[272] A Table summarising changes in taxation to monitor trends over time is provided for excises only.

[273] In 2011 a number of comparability and data quality issues on the Oil Price Bulletin dataset have been tackled by means of a Commission Recommendation taking stock of the results of a survey carried out in 2008. Improvements, among others, referred to price weighting methodologies, the way price discounts are dealt with and incentives on biofuels are accounted for. Following Member States requests data on LPG were also included.

[274] The annual consumption volumes for each consumption band shall be transmitted once per year, together with the price data for the second semester.

[275] Tax items are negative in the Netherlands because of the way the energy tax refund works. Also the way excises on electricity are accounted for is not immediately apparent, as there are Member States reporting no environmental taxes, as well as no other taxes.

automotive diesel, fuel oil, natural gas and other products eventually relevant at the Country level. These are available for commercial, electricity generation, industry, residential and transport uses. Data breakdown on energy taxation envisages the separate indication of: 1) VAT; 2) environmental taxes; 3) renewable support taxes, 4) energy security taxes 5) social taxes and 6) other taxes. These are, however, defined slightly at a variance with the usually available statistical definitions of energy taxation as reported in Box 13 below.

Box 13 IEA Definition of Energy Taxation Categories

VAT. Information on VAT rates include applicability of specific rates per energy product and per consumer sector. So, VAT is typically considered nil for industry and electricity production but fully applicable to transport. Outside the EU Goods and Service Taxes are assimilated to VAT.

Environmental Taxes. These include the separate identification of carbon taxes and include soil remediation taxes, sulphur taxes, and NOx taxes on air pollutants.

Renewable Support Taxes. Renewable support taxes comprise all taxes and levies specifically raised with the aim of supporting investments in renewable energy technologies (and therefore not the provision of the service). For the time being, these taxes are reported for Hungary (on electricity), Luxembourg (on electricity) and Slovenia (on all energy products).

Energy Security Taxes. These taxes comprise all taxies and levies applied to energy products with the purpose of guaranteeing supply security (e.g. stockpiling taxes).

Social Taxes. These taxes are defined on earmarking principles and comprise all energy taxes and levies whose revenue is used to support social policies, including the implementation of social tariffs, financing the educational system, etc.

Other Taxes. Other taxes are a default category for all excise taxes not categorised above, i.e. by far most of them and other residual taxes that cannot be considered in any of these categories.

CEER RES Dataset. The biennial CEER Status Review of Renewable Support Schemes represents one of the main sources of information on the costs of renewables and ***depends on data provided by the Member States themselves*** that can have recourse to ***heterogenous underlying methodologies for their estimates***. The dataset provides information on total financial support by type of renewable technology for 23 Member States out of 27.[276] Separate qualitative indication is given of the Countries relying on general budgetary and extra-budgetary sources of RES financing[277]. No breakdown of financing sources, even as a share of the total, is provided when Member States report both support from general taxation and recourse to dedicated levies (e.g. LU, DK) An indicator of total renewable energy support per unit of total

[276] Data are missing for Belgium where renewables are managed at the regional level and the Federal Government provides data for federal schemes only (but the regional ones could be retrieved from the NTL), Bulgaria where these are considered private company obligations, Slovenia that entirely manages renewables through a State-owned company and Slovakia where system operators stopped in 2013 accepting requests for connecting renewables above 10 kilowatts to the distribution grid because of concerns over grid stability and security of supply. Surplus solar electricity from domestic producers is supplied free of charge into the distribution network. Wind installations are not supported.

[277] In fact, Member States that do finance RES in full or in part through general taxation (FR, FI, DK, MT, LU) are usually Member States that have either introduced a carbon tax or extensively rely on energy taxes paid by non-residents. There can also be a parallel formal earmarking process. For instance, since January 2016, renewables support in France has fallen under the general State budget, through a dedicated purpose fund the financing of which is decided each year by the Parliament through the Finance Law. This is currently funded by internal taxes on fossil fuels. In other cases, the purpose of support is not so explicit. In the Czech Republic State budget funds are used to generically cover "operating support" for electricity, although a renewable energy source levy also exists.[277] Germany is reported to have extensively used energy taxation revenues to finance renewables, although a levy also exists.

electricity produced [€/MWh] is published. A comparison on 2016 estimates with data published by other sources has revealed some discrepancies in data classification,[278] which highlights a possible need for data reconciliation.

C.8.3 Energy Subsidies Datasets

Definition of Energy Subsidies. There is no commonly accepted definition of subsidy and how to measure it. Since the early 2000's, international organisations' – and in particular OECD, IMF, IEA, and the World Bank – attention has empirically focused on '*environmental harmful subsidies*'; among those, subsidies to fossil fuels soon came at the centre stage.[279] The pressure to reduce and remove fossil fuel subsidies ramped up from 2015 onwards, following the conclusion of the Paris Agreement, and was fostered by the G20 commitment on this respect.[280] There are two main rationales for introducing fossil fuel subsidies: (i) ensuring affordable access to basic energy consumption for the disadvantaged; and (ii) ensuring competitive access to energy for energy-intensive manufacturing industries. While a debate exists on whether these objectives are actually fulfilled by the existing subsidies and how net revenue raising is affected if offsetting is considered, they ***certainly run contrary to the objectives of climate change policies, as they make fossil fuel price lower, thus providing an incentive for its consumption.*** To reduce and remove energy subsidies, they had first to be identified (and possibly quantified), and this led to the production of various publications and databases on this subject. There are three main approaches to identifying and quantifying energy subsidies:[281]

1) ***bottom-up, or measure-based***. Subsidies are measured by compiling a list of existing policy measures that confer a benefit on the consumption or production of energy products. Those mainly consist of (i) direct budgetary transfers, i.e. sum of money which is transferred from the government to energy producers or consumers; or (ii) tax expenditures, that are reductions of exemptions from energy taxes for certain uses or productions. The magnitude of the various subsidies is quantified by relying on national budgets, for direct transfers, or, for tax expenditures, based on a benchmark, which defines the 'standard' tax rate and thus allows calculating the resulting fiscal advantage This is the OECD approach also used by other publications that expand its database.[282]

2) ***top-down, or price-gap***. Subsidies are measured by quantifying the gap between local prices, tax inclusive, and international price benchmarks. The international price is a proxy for the cost of imports, for energy-importing countries, as well of the opportunity costs for energy-producing countries. This is the approach used by the IEA[283] and by the IMF (to calculate pre-tax subsidies).

[278] Reported values were broadly compatible with DG ENER data for most Member States considered and major differences can be noticed only for Spain (€ 8 bn vs. € 5.3 bn). Four Member States state that are reported by the DG ENER study as not requiring end user taxes and fees (NL, SE, RO, CY) are indicated by CEER as relying on separate charges and levies, while data on consumer subsidies are provided on Countries reported by CEER as relying on general taxation (CZ). There are no elements to conclude whether different estimates for LU and DK depend on the separate identification of budget from off-budget support. See Trinomics (2018), for DG ENER.
[279] Cf. OECD, Companion to the Inventory of Support Measures for Fossil Fuels 2015, OECD Publishing, Paris, 2015.
[280] Cf. OECD, Companion to the Inventory of Support Measures for Fossil Fuels 2018, OECD Publishing, Paris, 2018, hereinafter "OECD Inventory (2018)".
[281] Cf. i.a. Bárány, A. and Grigonytė, D. economic brief Measuring Fossil Fuel Subsidies, ECOFIN Economic Brief, Issue 40 | March 2015.
[282] E.g. ODI, Phase-out 2020, Monitoring Europe's fossil fuel subsidies, Overseas Development Institute and CAN Europe, 2017, Trinomics (2018), for DG ENER.
[283] The IEA publication is not covered in the following review, as it only reviews non-EU countries. IEA, World Energy Outlook 2019, OECD Publishing, Paris, 2019.

3) ***externality-based approach***. Subsidies are measured as the difference between a theoretical price including all external costs generated by the consumption of an energy product, and the local price, tax inclusive. This is the approach used by the IMF to calculate post-tax subsidies.

Below, the main aspects of relevant repositories and studies on energy subsidies are discussed. The various approaches are then critically assessed at the end of this sub-section.

OECD Inventory of fossil fuel subsidies.[284] The report and the database provide a list of 1200+ policies "conferring a benefit for the use or production of fossil fuels" across 44 OECD and G20 countries. Data are therefore not available for all Member States. ***The definition of support is intendedly broader than 'subsidies' and include both direct budgetary transfers, as well as tax expenditures*** that in any way provide "a preferential treatment for fossil-fuel production or consumption relative to alternatives". Tax expenditures include rebates, exemptions and reimbursements or reductions on VAT and excise (on the consumption side), and on producers' taxes, such as corporate tax and royalties, on the production side. They are measured against a benchmark, which is however not defined in the inventory. Rather, the database relies on nationally-established benchmarks, which vary from country to country. The fuels covered include both primary fossil fuels (e.g. oil, coal, natural gas), as well as secondary products (e.g. gasoline, diesel).

IMF Fuel subsidies[285]. The database provides an estimate of per-country (185 jurisdictions including all Member States) and per-fuel subsidies granted to fossil fuels (petroleum, coal, natural gas, and electricity), ***based on a top-down approach***. First, the economic efficient price of fuels is defined as the sum of (i) the economic (or opportunity) cost of supplying the fuel, as measured by the international price; (ii) the external environmental costs associated with fuel consumption, namely local pollution, climate change, and, for transport fuels only, congestion, road accidents, and road damage; and (iii) a uniform VAT rate (i.e. standard) for revenue-raising considerations. Based on this approach, the indicator estimates total subsidies as the sum of: (i) the pre-tax subsidies, which measure, via a price-gap approach, the difference between local market prices tax inclusive, and an international reference price; and (ii) post-tax subsidies, that is the difference between the local market price and a price which reflected eternal cost and revenue requirements. Producer subsidies are included in pre-tax subsidies, and are relatively small.

DG ENER. Energy Prices, Costs, and Subsidies.[286] The report provides an inventory of all forms of financial support to any energy-related purpose, covering the industrial, residential, transport, energy, and agricultural sectors. Subsidies are defined in line with the OECD methodology as any direct or indirect financial support to energy consumption and production, including tax expenditures. The coverage does not include sub-national interventions, investment of development banks, and the diesel-gasoline gap. The list of subsidies was collated based on existing databases, in particular the OECD intervention, and original in-country research. ***Tax expenditures are measured as the difference to a 'benchmark tax' set by each***. The list of subsidies is not limited to fossil fuels, but cover any form of energy, including RES. The analysis is carried out per country, and within each country per sector and energy product; the list of subsidies and their magnitude is not published as an Annex to the report.

[284] OECD Inventory (2018).
[285] IMF working Papers, Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates, 2019.
[286] The title varies across the various editions.

DG ENV Support and tax expenditures for fossil fuels.[287] The report and the database identify and quantify EU28 government support to fossil fuels. Support measures include both budgetary support and tax expenditures, accruing to consumers and producers. Production supports encompass: (i) direct support to primary producers, (ii) support for restructuring; (iii) R&D subsidies; (iv) public investment in energy infrastructure – an item not covered in most of similar inventories; (v) fiscal incentives for oil and gas exploration; (vi) tax expenditures (exemptions, reductions, rebates). Consumer support mainly consists of tax expenditures for specific sectors/households, or fuels, including the petrol-diesel gap. **Tax expenditures are measured against an external benchmark: for excises, the minimum tax rates** included in the 2011 Commission Proposal for revising the Energy Taxation Directive; for VAT, the standard VAT rate applicable in each Member State.

Overseas Development Institute and Climate Action Network Europe. Europe's fossil fuel subsidies.[288] The report provides a list of subsidies to fossil fuels, for 11 European countries, defined as "any financial contribution by a government, or agent of a government, that is recipient-specific and confers a benefit on its recipients in comparison to other market participants", ***in line with WTO practice***. The definition includes (i) direct transfers of funds, (ii) foregone revenues; (iii) provision of goods and services other than general infrastructure below market value; and (iv) income or price support. The report covers any of these subsidies provided by (i) government and public agencies; (ii) national, EU and international financial institutions; and (iii) investments by state-owned enterprises. Foregone revenues are measured against nationally-established benchmarks, which vary from country to country. The report covers energy production (coal, oil and gas, electricity) and consumption (transport, household, commerce and industry, agriculture); it is accompanied by country policy briefs in which national subsidies are listed and their magnitude quantified.

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[287] Enhancing comparability of data on estimated budgetary support and tax expenditures for fossil fuels, Final report for the European Commission.

[288] ODI, Phase-out 2020, Monitoring Europe's fossil fuel subsidies, Overseas Development Institute and CAN Europe, 2017.

Appendix – Comparison between Total Tax Revenues Reported in the NTL and OECD Databases

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
Austria	Tax on energy	899	926	943	Energy tax	899	926	944	Y	D214A (C06)
	Tax on mineral oils	4,338	4,551	4,363	Tax on mineral oils	4,313	4,551	4,363	Y	D214A (C09)
	Special tax on mineral oils	0	0	0	Special tax on mineral oils					D214A (C13)
	Emission trading allowances	47	63	151						D29F (C01)
	Total	**5,284**	**5,540**	**5,457**		**5,477**	**5,307**	**5,149**		
Belgium	Contribution for the surveillance on domestic fuel oil	33	32	31	Excise duties on fuels and electricity	5,217	5,441		Y	D214A+D2122C (C13)
	Contribution on energy	340	340	337					Y	D214A+D2122C (C15)
	Excise duties on liquefied natural gas and liquefied hydrocarbon and benzol	0	0	0						D2122C (C02)
	Excise duties on mineral oil	4,845	5,078	5,415					Y	D214A+D2122C (C01)
	Contribution for FAPETRO	5	4	4	FAPETRO contribution	5	4	4		D214A (C28)
	Contribution for APETRA	109	109	118	APETRA contribution	109	109	118		D214A (C29)
	Contribution on oil product for heating	6	4	4	Contribution on heating fuels	6	4	4		D2122C (C14)
	Federal contribution on electricity and natural gas / Contribution to the Energy Fund (FR)	518	812	490	Federal contribution on electricity and natural gas	518	812	490		D214A (C16)
	BCR - green certificates delivery	36	36	41						D214A (C35)
	FC - green certificates delivery	751	654	710						D214A (C31)
	FC - surtax on distribution prices to finance green certificates	636	625	569						D214A (C32)
	FED - surtax on transmission price for offshore wind energy	257	286	337						D214A (C30)
	WR - green certificates delivery	366	383	383						D214A (C33)
	WR - surtax on transmission prices to finance green certificates	152	204	176						D214A (C34)
	Emission permits	135	112	193						D29F (C04)
	Total	**8,186**	**8,678**	**8,808**		**5,854**	**6,370**	**..**		
Bulgaria	Fuel	2,167	2,305	2,185	Fuel excise tax	2,167	2,305	2,185	Y	D214A+D2122C (C02)
	Electric power	36	38	35	Tax on electricity	36	38	35	Y	D214A (C06)
	Natural gas	35			Tax on natural gas	35	0	0	Y	D214A (C09)
	Coal and coke	2	-4	-2	Tax on coal and coke	2	-4	-2	Y	D214A (C07)
	The revenue of emission trading permits	167	249	603						D29F (C07)
	Greenhouse gas emissions license fees	0	0							D29F (C06)
	Total	**2,407**	**2,588**	**2,820**		**2,339**	**2,217**	**2,261**		
Croatia	Excise taxes on mineral oils	8,143	8,360	8,547	Excise tax on oil derivatives	8,143	8,359	8,547	Y	D214A (C02)
	Excise taxes on electricity - from 01.07.2013.	38	40	41	Excise tax on electricity	38	40	41	Y	D214A (C12)
	Fee for Incentivising Electricity Production from Renewable Energy Sources and Cogeneration	530	1,033	1,692	Fee for Incentivising Electricity Production from Renewable Energy Sources and Cogeneration	530	1,033	1,692		D214A (C15)
	Excise taxes on natural gas - from 01.07.2013.	30	31	32	Excise tax on natural gas	30	31	32	Y	D214A (C13)
	Excise taxes on solid fuels - from 01.07.2013.	0	0	1	Excise tax on solid fuels	0	0	1	Y	D214A (C14)
	Levy for CO_2 emissions into the environment	7	8	4	Tax on CO_2 emissions	7	8	4		D29F (C03)
	Fuel price fee									D214A (C10)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Emission permits	491	169	272						D29F (C08)
	Total	**9,239**	**9,641**	**10,589**		**9,471**	**10,316**	**10,316**		
Cyprus	Excise - Hydrocarbon Oils	393	410	407	Fuel excise tax	393	410	407	Y	D214A (C07)
	Stock Holding Company Fees	20	19	20	Stock Holding Company Fees	20	19	20		D214L (C04)
	Tax on Energy Conservation (Funds)	1	6	10	Tax on Energy Conservation (Funds)	0	6	10		D214A (C01)
	ETS Permits	0	7	26						D29F (C01)
	Total	**414**	**441**	**463**		**434**	**437**	**437**		
Czech	Excise duty on hydrocarbon fuels and lubricants	87,556	88,878	89,990	Fuel excise duty	87,557	88,878	89,990	Y	D214A+D2122C (C01)
	Energy tax on electricity	1,478	1,537	1,562	Electricity tax	1,478	1,537	1,562	Y	D2122C (C06)
	Energy tax on natural gas	1,191	1,301	1,346	Natural gas tax	1,191	1,301	1,346	Y	D214A+D2122C (C07)
	Energy tax on solid fuels	426	452	401	Solid fuels tax	426	452	401	Y	D214A+D2122C (C08)
	Tax on Emission Allowances	2,946	5,220	14,935						D29F (C06)
	Total	**93,597**	**97,388**	**108,234**		**90,652**	**92,168**	**93,298**		
Denmark	Duty on electricity	11,657	12,164	12,119	Duty on electricity	11,657	12,164	12,119	Y	D214A (C11)
	Duty on petrol	7,496	7,499	7,521	Duty on petrol	7,496	7,499	7,521	Y	D214A (C01)
	Duty on natural gas	3,213	3,002	3,325	Duty on natural gas	3,213	3,002	3,325	Y	D214A (C22)
	Duty on certain oil products	9,705	9,804	10,012	Duty on certain mineral oil products	9,705	9,804	10,012	Y	D214A (C12)
	Duty on coal, etc.	2,064	1,916	1,852	Duty on coal	2,064	1,916	1,852	Y	D214A (C17)
	Duty on carbon dioxide (CO_2)	3,577	3,632	3,627	Duty on CO_2	3,577	3,632	3,627	Y	D214A (C19)
	Duty on PSO (Public Service Obligations)	7,553	5,078	3,996	Duty on Public Service Obligations	7,553	5,078	3,996		D214A (C25)
	Carbon dioxide emission tax	408	405	1,415						D29F (C02)
	Duty on gas									D214A (C31)
	Total	**45,673**	**43,499**	**43,866**		**45,265**	**43,095**	**42,451**		
Estonia	Fuel excise	506	535	543	Fuel excise tax	506	535	543	Y	D2122C (C03)
	Electricity excise	35	36	37	Electricity excise tax	35	36	37	Y	D2122C (C07)
	Liquid fuel stockpiling fee	4	5	4	Liquid fuel stockpiling fee	4	5	4		D2122C (C08)
	Revenue from the sale of emission permits	21	24	39	Tax on the sale of emission permits	21				D29F (C02)
	Total	**567**	**599**	**624**		**567**	**576**	**584**		
Finland	Excise duty on liquid fuels	4,407	4,324	4,395	Excise on fuels and electricity	4,407	4,324	4,395	Y	D214A (C04)
	Stock-building levies on liquid fuels	44	43	45	Strategic stockpile fee (Security of supply fee)	44	43	45	Y	D214A (C14)
	Nuclear energy research levy	11	12	12	Nuclear energy research levy	11	12	12		D29H (C01)
	Income from auction of emission allowances	90	75	113						D29F (C02)
	Total	**4,552**	**4,454**	**4,565**		**4,462**	**4,379**	**4,452**		
France	Domestic duty on energy products	27,926	29,587	31,824	Mineral oils tax (taxe intérieure de consommation sur les produits énergétiques TICPE)	27,925	29,594	31,824	Y	D214A (C06)
	Contribution to the public service of electricity (CSPE)	7,267	7,863	7,710	Contribution to electricity generators for public services they provide	7,267	7,883	7,710		D214A (C07)
	Tax on electric energy	2,083	2,130	2,126	Domestic tax on electricity final consumption (TICFE and TCFE)	2,083	2,100	2,126		D214H (C05)
	Contribution of low voltage electric energy suppliers	377	378	377	Contribution of low-voltage electrical energy distributors (contribution des distributeurs d'énergie électrique basse tension)	377	378	377		D214L (C02)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Tax on electric pylons	241	251	256	Tax on electricity pylons (imposition forfaitaire sur les pylônes électriques)	241	249	256		D29A (C15)
	Other domestic duties	901	1,319		Domestic tax on natural gas (Taxe intérieure sur le gaz naturel TICGN)				Y	D214A (C02)
	Flat-rate tax on network corporations	1,324	1,329	1,346						D29A (C10)
	Tax on the sales of oil products for strategic storage	364	377	386						D214A (C11)
	Other taxes on energy	547	554	1,803					Y	D214A (C04)
					Special fuel tax in communities overseas (taxe spéciale sur les carburants dans les DOM)	533	536			
	Emission permits (EU ETS)	312	235	314						D29F (C02)
	Total	**41,342**	**44,023**	**46,142**		**38,426**	**40,740**	**42,293**		
Germany	Energy tax	40,135	40,998	40,834	Duty on mineral oils	40,135	40,998	40,834	Y	D214A (C02)
	Electricity tax	6,507	7,003	6,848	Duty on electricity	6,507	7,003	6,848	Y	D214A (C01)
	*Nuclear fuel taxes**	422	-2	0	Nuclear fuel tax	422	-6,284	0		
	*Contributions to the German National Petroleum Stockpiling**	280	288	292	Contributions to the German National Petroleum Stockpiling Agency	280	284	284		
	not defined	1,062	895	1,505						
	Total	**48,406**	**49,182**	**49,479**		**47,344**	**42,001**	**47,966**		
Greece	*not defined*	3,888	4,085	4,052	Mineral oil tax	3,888	4,085	4,052		
	New tax on electricity	175	148	157	Tax on electricity	175	148	157	Y	D214A (C02+C07)
	Other taxes related to pollution received by LAGIE	1,015	1,337	904	Special Levy for GHG reduction (ETMEAP)	1,015	1,337	904		D29F (C02)
	Taxes on pollution	188	152	237						D29F (C01)
	Total	**5,266**	**5,722**	**5,350**		**5,078**	**5,570**	**5,113**		
Hungary	Energy tax	18,499	18,843	20,175	Energy tax	18,499	18,843	20,175	Y	D214A (C09)
					Budget excises: diesel	402,943	411,037	437,831	Y	D214A (C05)
	Special split fuels	622,580	640,575	673,722	Budget excises: petrol	216,079	221,662	2,583		
					Budget excises: other oil	3,623	3,873	228,296		
	Nuclear contribution	21,294	22,798	22,798	Nuclear contribution	21,294	22,798	22,798		D214L (C05)
	Hydrocarbons stockholding fee	22,736	30,962	32,846	Hydrocarbons stockholding fee	22,736	30,962	32,846		D214I (C08)
	Environment petrol tax					70,894	77,792	79,106		
	Sale of emission allowances	25,754	19,830	26,411						D29F (C02)
	Total	**710,863**	**733,008**	**755,777**		**786,967**	**790,789**	**790,789**		
Ireland	Carbon Tax	434	435	430	Mineral oil tax - carbon component	350	346		Y	D214L (C02)
	Electricity tax	5	4	3	Electricity tax	5	4	3	Y	D214A (C03)
	National Oil Reserves Agency levy	132	130	134	National Oil Reserves Agency levy	132	130	134		D214L (C01)
	Public Service Obligation Levy	342	412	406	Public Service Obligation Levy	342	392	406		D29H (C05)
	Duty on imported hydrocarbon oil products	1,713	1,756	1,693	Mineral oil tax - non carbon component				Y	D2122C (C02)
	Duty on domestic hydrocarbon oil products	466	477	461		2,169	2,061	2,163	Y	D214A (C02)
					Solid fuel carbon tax	24	19	50		
					Natural gas carbon tax	56	54	25		
	Carbon Credits	15	11	11						D29F (C03)
	Total	**3,107**	**3,226**	**3,138**		**3,077**	**3,007**	**3,137**		
Italy	Excise duty on mineral oils	25,740	26,160	25,964	Excise duty on energy products				Y	D214A (C01)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Excise duty on refinery gas	608	644	622				26,600	Y	D214A (C02)
	In-bond surcharge on mineral oils	10	12	14		26,359	26,817		Y	D2122C (C01)
	In-bond surcharge on refinery gas	1	1	0					Y	D2122C (C03)
	Excise duty on electricity and fees to cover general system costs for renewable energies (A3 component)	17,008	14,709	14,201	Tax on electricity	17,008	14,709	14,201	Y	D214A (C05)
	Excise duty on methane	3,799	3,863	3,961	Regional tax on natural gas consumption	3,799	3,863	3,961	Y	D214A (C03)
	Levy on revenues of operators in the energy sector for the electricity and gas authority	54	61	61	Levy on revenues of operators in the energy sector for the electricity and gas authority	54	61	61		D29H (C07)
	Revenues of the Italian Central Stockholding Entity	16	20	26	Italian Central Stockholding Entity	16	20	26		D214A (C11)
	Local surcharge on electricity duty	0	0	0	Additional tax on electricity - towns / provinces					D214A (C06)
	Emission permits	411	549	1,454						D29F (C03)
	Total	**47,647**	**46,019**	**46,303**		**47,236**	**45,470**	**44,849**		
Latvia	Excise tax on oil products	467	484	536	Excise duty on oil products	467	484	536	Y	D214A (C02)
	Energy tax	1	5	5	Tax on electricity	1	5	5	Y	D214A (C07)
	Excise tax on natural gas	22	19	23	Excise duty on natural gas	22	19	23	Y	D214A (C06)
	Subsidised electricity tax	29	31	0	Subsidised electricity tax	29	31	0		
	State duty for keeping oil products` security reserves	13	12	16	State duty for keeping security reserves of oil products	13	12	16		D214L (C01)
	Mandatory procurement public service obligation fee	237	245	249						D214I (C01)
	Tax on coal, coke and lignite					1	6			
	Revenue from state-owned European Trading System permits auction	5	5	7						D29F (C02)
	Total	**773**	**802**	**836**		**533**	**558**	**580**		
Lithuania	Oil and other oil products	674	730	807	Tax on oil and other oil products	674	730	807	Y	D214A+D2122C (C05+C03)
	Electricity	3	2	2	Electricity tax	3	2	2	Y	D214A+D2122C (C06+C04)
	Air pollution charge for mobile sources/fuels					5	5			
	Deductions from Ignalina nuclear power plant income generated by sales of electricity									D214I (C04)
	Total	**677**	**732**	**809**		**682**	**737**	**809**		
Luxembourg	Excise duties on mineral oils	481	497	532	Excise duty on mineral oils	481	497	532	Y	D2122C (C03)
	Autonomous excise duties on mineral oils	179	185	197	Autonomous excise duty on mineral oils	179	185	197	Y	D2122C (C02)
	Supplementary tax on fuels	115	119	128	Product of social contribution levied on fuels	115	119	128	Y	D2122C (C04)
	Tax on control of domestic fuel	2	2	2	Inspection fee on domestic fuel	2	2	2	Y	D2122C (C05)
	Tax on production of electricity	6	0	4	Tax on electricity production	6	0	4		D214L (C03)
	Tax on distribution of electricity	1	1	1	Tax on electricity distribution	1	1	1		D214L (C02)
	Supplementary tax on electricity	2	2	2	Supplementary tax on electricity	2	2	2		D214L (C01)
	Tax on natural gas consumption	5	4	5	Tax on natural gas	5	4	5		D214L (C04)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Excise duty on Kyoto	56	58	62	"Kyoto" excise duties	56	58	62		D2122C (C15)
	Excise duty on benzol	1	1	1	Excise duty on benzol	1	1	1	Y	D2122C (C07)
	Excise duty on liquefied petroleum	0	0			0	0		Y	D2122C (C06)
	Emission permits	5	7	18						D29F (C01)
	Total	**853**	**876**	**952**		**848**	**869**	**934**		
Malta	Excise Levies – Petroleum	136	145	148	Petroleum excise tax	136	145	148	Y	D214A (C04)
	Excise Levies – Electricity	3	3	3	Electricity excise tax	3	4	3	Y	D214A (C08)
	Bunkering Tax	1	2	2	Bunkering fuel tax	1	2	2	Y	D214H (C05)
	Emission Trading Permits	4	4	9						D29F (C02)
	Total	**145**	**154**	**162**		**141**	**151**	**153**		
Netherlands	Taxes on energy	4,967	5,213	5,723	Energy tax	4,967	5,213	5,723	Y	D214A+D2122C (C06)
	Excise duties on gasoline	4,226	4,293	4,472	Excise duty on petrol	4,226	4,293	4,472	Y	D214A+D2122C (C01)
	Excise duties on other mineral oils	3,862	3,875	3,919	Excise duty on mineral oil (other than petrol)	3,862	3,875	3,919	Y	D214A+D2122C (C02)
	Levies on petroleum product stocks	108	110	111	Tax in connection with mineral oil stocks	108	110	111	Y	D2122C (C08)
	Surcharge on energy to promote sustainable energy					421				
	Fuel tax (tax on coal)					3				
	Emission permits	199	200	261						D29F (C05)
	Total	**13,362**	**13,691**	**14,486**		**13,746**	**13,491**	**14,225**		
Poland	Excise duty on petrol and other motor fuels	29,886	31,715	33,310	Excise tax on motor fuels				Y	D214A+D2122C (C01)
	fuel fee	7,671	7,307	8,283		38,495	40,084	42,667	Y	D214A+D2122C (C15+C16)
	Excise duty on liquid petroleum gas (LPG)	938	1,062	1,074					Y	D214A+D2122C (C09)
	Excise duty on fuel oils	229	203	177	Excise duty on fuel oils	229	203	177	Y	D214A+D2122C (C08)
	Excise duty on gas products excluding gas for combustion engines	133	154	148	Excise duty on gas products (excluding LPG)	133	154	148	Y	D214A+D2122C (C14+C15)
	Excise duty on electricity	2,349	2,152	2,378	Excise duty on electricity	2,349	2,152	2,378	Y	D214A+D2122C (C06)
	Excise duty on lubricants	202	204	191	Excise duty on lubricants	202	204	191		D2122C (C12)
	Excise duty on coal products	60	70	73	Excise duty on coal products	60	70		Y	D214A+D2122C (C12+C13)
	Payments to Power Industry Supervising Office for granting licences on energy production and distribution	143	116	88	Licences on energy production and distribution	143	116	751		D29E (C02)
	Temporary payment	1,456	2,784	2,392					Y	D214A (C16)
	Emission allowances	548	588	2,124						D29F (C02)
	Total	**43,615**	**46,355**	**50,238**		**41,611**	**42,983**	**46,312**		
Portugal	Tax on oil and energy products	3,410	3,495	3,546	Tax on petroleum and energy products	3,410	3,497	3,549	Y	D214A (C08)
	Fee for the obligatory establishment and maintenance of reserves of petroleum products	24	24	24	Tax for reserves of petroleum products	24	24	24		D29H (C20)
	Fee on electric installations	19	18	12	Tax on electric installations	19	18	12		D214H (C01)
	Fee on low energetic efficient light bulbs	0	0	0	Tax on low energy efficiency light bulbs	0	0	0		D214L (C05)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Fee of the management system of intensive energy consumptions	0	0							D29B (C05)
	Carbon trading rights	79	103	218						D29F (C03)
	Total	**3,532**	**3,640**	**3,800**		**3,453**	**3,539**	**3,585**		
Romania	Excises from energetical products sales	14,094	13,549	15,049	Excise tax on energy products	14,094	13,549	15,049	Y	D214A (C03)
	Customs Excise collected from imports of energy products	1,102	692	883	Tax on imports of energy products	1,102	692	883	Y	D2122C (C01)
	Excises from sale of electric energy	128	135	138	Excise tax on electricity	128	135	138	Y	D214A (C08)
	Development tax included in price of electricity and heat-Overdue previous years.	0	0	-1						D214A (C02)
	Quota over the trade price, excluding excises, of fuels and vehicles provided domestically by the producers and over the custom value of imported fuels	0	0	0						D214L (C04)
	Special purpose revenue from flat on auto fuel delivered domestically by producers, as well as auto fuels consumed by them and also on imported auto fuel (Overdue previous years)	0	0	0						D2122C (C09)
	Revenues from the sale of emission permits	1,333	1,190	2,311						D29F (C02)
	Total	**16,658**	**15,565**	**18,381**		**15,325**	**14,375**	**16,071**		
Slovakia	On mineral oils	1,194	1,230	1,267	Excises on mineral oils	1,194	1,230	1,267	Y	D214A+D2122C (C01)
	On energy - natural gas	25	26	24	Excise duty on natural gas	25	26	24	Y	D214A (C08)
	Tax on gas and liquid storage	1	1	1	Tax on gas and liquid storage	1	1			D29E (C03)
	On energy – electricity	499	579	612	Excise duty on electricity	12	11	11	Y	D214A (C06)
	On energy – coal	0	0	0	Excise duty on coal	0	0	0	Y	D214A (C07)
	Tax on installing nuclear equipment	4	4	4						D29E (C01)
	Emission Permits	65	57	63						D29F (C04)
	Total	**1,787**	**1,897**	**1,972**		**1,231**	**1,266**	**1,302**		
Slovenia	Mineral oil and gas	1,086	1,099	1,066	Fuel excise tax	1,086	1,099	1,066	Y	D214A (C02)
	Electric power and coal	34	32	32	Electric power and coal	34	32	32	Y	D214A (C06)
	Contribution of Nuclear power plant to finance its decomposition	8	9	8						D29F (C04)
	Indemnity for restricted use of area on the territory of Nuclear power plant	12	12	12						D29F (C05)
	Environmental tax due to the use of fluorinated greenhouse gases	1	0	0						D29F (C07)
	Taxes on air pollution	122	126	126						D214L (C01)
	Tax on air pollution - caused by gas and hard fuels	13	15	15						D29F (C03)
	Central stocktaking agency	32	32	30						D214H (C03)
	Energy efficiency tax					44	41			
	CO_2 tax					135	142	141		
	Electricity and energy surcharge (contribution for production of electricity from RES and CHP)					174	179			
	Emission permits	20	34	67						D29F (C06)
	Total	**1,326**	**1,359**	**1,355**		**1,472**	**1,493**	**1,239**		
Spain	Tax on Hydrocarbons	12,996	13,116	13,408	Tax on Hydrocarbons	12,994	13,156	13,447	Y	D214A (C01)

Country	Tax name NTL	2016	2017	2018	Tax name OECD	2016	2017	2018	TEDB	ESA2010 code (ref. to NTL and TEDB)
	Tax on production value of electricity	1,321	1,513	1,585	Tax on the electric energy production	1,287	1,511	1,588		D214A (C14)
	Tax on electricity bills	1,346	1,393	1,438	Special tax on electricity	1,343	1,387	1,429	Y	D214A (C02)
	Tax on Petroleum derived fuels	308	331	331	Tax on oil derived fuels	308	332	330		D214A (C07)
	Tax on Carbon	229	312	271	Tax on coal	243	315	276		D214A (C13)
	Contribution to the National Energy Efficiency Fund	207	206	208	Contribution to the National Energy Efficiency Fund	207	207	207		D214A (C12)
	Resource CORES	160	147	153	Tax on the oil stockholding agency	160	147	153		D214L (C06)
	Levy on petrol	24	25	25	Petrol tax	24	25	20		D214A (C15)
	Fee for the use of continental waters for the production of the electrical power	202	197	110						D214A (C17)
	Fees from the National Energy Commission	0	0	0						D214A (C11)
	Tax on Retail sales of certain hydrocarbons	13	1	0						D214A (C08)
	Tax on retail sales of certain mineral oils					1	1	0		
	Allowances of greenhouse gases	396	452	723						D29F (C06)
	Total	**17,202**	**17,693**	**18,252**		**16,567**	**17,081**	**17,450**		
Sweden	Other taxes on fuel	47,698	47,194	48,253	Energy tax on fuels	23,559	23,664		Y	D214A (C02)
					Tax on CO2	24,139	23,530			
	Taxes on electrical power	24,717	25,967	28,302	Tax on electricity	21,059	22,959		Y	D214A (C03)
	Special tax on nuclear power stations	4,254	2,564		Tax on nuclear power	4,254	2,564			D29B (C02)
	Tax on sulphur	11	10	13		11	10	13		D214A (C01)
	Tax for reduction and storage of nuclear waste					3,736	3,796			
	Emission trade permits	336	281	466						D29F (C04)
	Total	**77,016**	**76,016**	**77,034**		**76,758**	**76,523**	**13**		

***Source**: i) Eurostat's website and DG TAXUD's website provide data on revenue from energy taxes as in the national tax lists (last updated on 29 October 2019); ii) OECD PINE Database provide data on Revenues generated by environmentally related taxes; and iii) Taxes in Europe database for each Member State provides data on tax revenue energy products and electricity as a whole and indicates ESA codes included.*

ANNEX D – LIST OF REFERENCES

D.1 LEGISLATION AND POLICY DOCUMENTS

1. Commission Communication, A sustainable Europe for a better world: A European strategy for Sustainable Development, COM(2001) 264 final, 2001.

2. Commission Staff Working Document, Evaluation of the Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, SWD(2019) 329 final, Brussels, 11.9.2019.

3. Commission Staff Working Paper, Impact Assessment accompanying document to the Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, SEC(2011) 409 final, Brussels, 13.4.2011.

4. Commission Staff Working Document, Tax Policies in the European Union: 2020 Survey, SWD(2020) 14 final, Brussels, 3 February 2020.

5. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of The Regions and the European Investment Bank a Framework Strategy for a Resilient Energy Union, with a Forward-Looking Climate Change Policy, COM(2015) 80 final, Brussels, 25.2.2015.

6. Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, Annual Sustainable Growth Strategy 2020, COM(2019) 650 final, Brussels, 17.12.2019.

7. Communication from The Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, the European Green Deal, COM(2019) 640 final, Brussels, 11.12.2019.

8. Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003.

9. Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, OJ L 140, 5.6.2009.

10. Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, OJ L 275, 25.10.2003, p. 32–46.

11. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140, 5.6.2009.

12. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, OJ L 315, 14.11.2012.

13. Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, COM(2011) 169 final, Brussels, 13.4.2011.

14. Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics, OJ L 304, 14.11.2008.

15. Regulation (EU) 2016/1952 of the European Parliament and of the Council of 26 October 2016 on European statistics on natural gas and electricity prices and repealing Directive 2008/92/EC, OJ L 311, 17.11.2016.

16. Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council, PE/55/2018/REV/1, OJ L 328, 21.12.2018.

17. Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013, PE/3/2018/REV/2, OJ L 156, 19.6.2018.

18. Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts, OJ L 192, 22.7.2011.

19. Second Report on the State of the Energy Union, Commission Staff Working Document, Monitoring progress towards the Energy Union objectives – key indicators, SWD(2017) 32 final, Brussels, 1.2.2017.

20. Report from the Commission to the European Parliament and the Council, 2018 assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive as required by Article 24(3) of the Energy Efficiency Directive 2012/27/EU, COM(2019) 224 final, Brussels, 9.4.2019.

D.2 OTHER REFERENCES

1. Andersen, M. S., 'Europe's experience with carbon-energy taxation', *Sapiens*, Vol. 3, No. 2, 2010.

2. Autorità per l'energia elettrica e il gas, *Indagine conoscitiva sulle determinanti della dinamica del sistema dei prezzi e delle tariffe, sull'attività dei pubblici poteri e sulle ricadute sui cittadini consumatori,* Memoria per l'audizione presso la Commissione straordinaria, per la verifica dell'andamento generale dei prezzi al consumo e per il controllo della trasparenza dei mercati, del Senato della Repubblica, April 2009.

3. Bachus, K., 'How to tell green from grey? Towards a methodological framework for evaluating the greening of national tax systems', *Ecological Indicators*, Elsevier, Vol. 71, December 2016, pp. 229-238.

4. Bárány, A. and Grigonytė, D., 'Measuring fossil fuel subsidies', *ECOFIN Economic Brief*, Issue 40, March 2015.

5. BIO, IEEP, IVM and Vito, *Enhancing comparability of data on estimated budgetary support and tax expenditures for fossil fuels,* Final Report for DG ENV European Commission, published in 2014.

6. Blyth N., Lefevre N., 'Energy security and climate change policy interactions. An assessment framework', *International Environmental Agency*, Paris, Information Paper, 2004.

7. Bose, S., Bridges, A. L. and DeFrancia, K., 'Carbon pricing as a policy instrument to decarbonize economies', *The Earth Institute. Columbia University*, July 2019.

8. Brookes, L., 'The greenhouse effect: the fallacies in the energy efficient solution', *Energy Policy*, Vol. 18, N. 2, 1990, pp-199–201.

9. Bruvoll, A., 'On the measurement of environmental taxes', *Statistics Norway Research Departement,* Discussion Papers No. 599, 2009

10. Canadian Ammonia Producers, *Benchmarking Energy Efficiency and Carbon Dioxide Emissions,* Canadian Industry Program for Energy Conservation, Canada, 2008.

11. CEER, *Status review of renewable support schemes in Europe for 2016 and 2017*, Council of European Energy Regulators asbl, Brussels, Ref: C18-SD-63-03, 14 December 2018.

12. CEER, *Status review of renewable support schemes in Europe*, Council of European Energy Regulators asbl, Brussels, Ref. C16-SDE-56-03, 11 April 2017.

13. CEPS, *Composition and drivers of energy prices and costs: case studies in selected energy intensive industries*, European Commission, 2014.

14. CEPS, Ecofys and Economisti Associati, *Composition and drivers of energy prices and costs: case studies in selected energy intensive industries*, European Commission, 2016.

15. CEPS Task Force Benchmarking, "Benchmarking in the Cement Industry", presented by Claude Loréa, Technical Director of CEMBUREAU, at the 2nd meeting of the CEPS Task Force, Brussels, 8 July 2009.

16. Clean Energy Wire, *German government decides tax changes for climate plan, CO2 price details*, October 2019.

17. Congressional Research Service, *The value of energy tax incentives for different types of energy resources,* prepared for Members and Committees of Congress, March 2019.

18. Copenhagen Consensus Center, *Energy security: an impact assessment of the EU climate and energy package*, Department of Economics, University of Oldenburg, 2011.

19. Copenhagen Economics, *Carbon leakage from Danish energy taxation. The challenges of domestic climate policy*, for the Confederation of Danish Industry, January 2011.

20. Copenhagen Economics, *Innovation of energy technologies: the role of taxes*, Final report for DG TAXUD European Commission, published in 2010.

21. Costantini V. and M. Mazzanti. On the green and innovative side of trade competitiveness? The impact of environmental policies and innovation on EU exports, *Research Policy*, Volume 41, Issue 1, 2012.

22. CPLC, *Report of the high-level Commission on carbon prices*, Carbon Pricing Leadership Coalition, May 2017.

23. De Bruin, K. C. and Yakut, A. M., 'The economic and environmental impacts of increasing the Irish carbon tax', *Economic & Social Research & Institute*, Research Series No. 79, October 2018.

24. Deloitte, Technical and legal aspects of Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, Final Report for the European Commission, Publications Office of the European Union, Luxembourg, 2019.

25. DG CLIMA, *Guidance Document n°8 on the harmonised free allocation methodology for the EU ETS post 2020*, European Commission Directorate-General for Climate Action, Final version of 14 February 2019.

26. DG CLIMA, *EU ETS handbook*, European Commission Directorate-General for Climate Action, European Union, 2015.

27. DG MOVE, Study Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities, Publications Office of the European Union, Luxembourg, June 2019.

28. DG MOVE, *Handbook on the external costs of transport. Version 2019 - 1.1,* European Commission Directorate-General for Mobility and Transport, Publications Office of the European Union, Luxembourg 2019.

29. DG MOVE, Transport taxes and charges in Europe. An overview study of economic internalisation measures applied in Europe, European Commission Directorate-General for Mobility and Transport, Publications Office of the European Union, Luxembourg, 2019.

30. DG TAXUD, *Taxation Trends Report 2019 Edition*, European Commission Directorate-General for Taxation and Customs Union, Publications Office of the European Union, Luxembourg, 2019.

31. DG TAXUD, *Taxation Trends Report 2019 Edition. Annex B: Methodology and explanatory notes*, European Commission Directorate-General for Taxation and Customs Union, Publications Office of the European Union, Luxembourg, 2019.

32. DG TAXUD, *Taxation Trends Report*, European Commission Directorate-General for Taxation and Customs Union, Publications Office of the European Union, Luxembourg, 2009.

33. DG TAXUD, VAT rates applied in the member states of the European Union, Taxud.c.1(2019) – EN, European Commission Directorate-General for Taxation and Customs Union, Situation at 1st July 2019 (incl. also other dates).

34. Drummond, P., 'Understanding the Impacts & limitations of the current EU climate policy instrument mix', *CECILIA2050* WP2 Deliverable 2.10, London: University College London, 2014.

35. Ecofys *et al*., *Financing renewable energy in the European energy market study,* for DG ENER European Commission, published in 2011.

36. Ecofys, *Analysis of impacts of climate change policies on energy security,* Final report for the DG Environment European Commission, published in 2009.

37. Ecofys, Fraunhofer Institute for Systems and Innovation Research and Öko-Institut, *Methodology for the free allocation of emission allowances in the EU ETS post 2012 - Sector report for the glass industry,* Report for the European Commission, November 2009.

38. EEA, *Environmental taxation and EU environmental policies*, European Environmental Agency Report No.17, Luxembourg, 2016.

39. EEA, *EMEP/EEA air pollutant emission inventory guidebook*, sectoral guidance chapters - 2.A.2 Lime production, 2009.

40. EEA, *Market-based instruments for environmental policy in Europe*, European Environmental Agency, Copenhagen, 2005, p. 158.

41. EEA, *Air quality in Europe – 2019 report,* European Environmental Agency Report No.10, 2019.

42. EEA, *EMEP/EEA air pollutant emission inventory guidebook 2019,* European Environmental Agency Report No.13, 2019.

43. Environment Agency Austria Umweltbudesamt, Evaluation of the ETS Directive. *Carried out within the project "Support for the Review of the EU Emissions Trading System*, for the DG CLIMA, European Commission, Publications Office of the European Union, Luxemburg, 2016.

44. European Commission, *European semester: thematic factsheet - Resource efficiency*, November 2016.

45. European Commission, *State aid: Commission clears Czech support scheme for renewable energy*, EU Press release, Brussels, November 2016.

46. Eurostat, *Compilers guide on European statistics on natural gas and electricity prices*, Manual and guidelines, Publications Office of the European Union, Luxembourg, 2017.

47. Eurostat, *Energy balance guide. Methodology guide for the construction of energy balances & operational guide for the energy balance builder tool*, European Commission, 31st January 2019.

48. Eurostat, Environmental taxes. A statistical guide. 2013 Edition, Eurostat manuals and guidelines, Publications Office of the European Union, Luxembourg, 2013.

49. Eurostat, Environmental taxes statistics. Statistics Explained, Data extracted in January 2020, Planned article update: February 2021 (accessible here).

50. Eurostat, Physical energy flow accounts (PEFA). Manual 2014, draft version 15 May 2014.

51. Eurostat, *Towards a harmonised methodology for statistical indicators. Part 1: Indicator typologies and terminologies 2014 Edition*, Publications Office of the European Union, Luxembourg, 2014.

52. Eurostat, Towards a harmonized methodology for statistical indicators -Part 3 — Relevance of Indicators for Policymaking *2017 Edition*, Publications Office of the European Union, Luxembourg, 2017.

53. Faiella, I. and Cingano, F., 'La tassazione verde in Italia: l'analisi di una carbon tax sui trasporti', *Questioni di Economia e Finanza Banca d'Italia,* No. 206, October 2013.

54. Flues, F. and Van Dender K., 'The impact of energy taxes on the affordability of domestic energy', 2017, *OECD Publishing*, Paris, OECD Taxation Working Papers, No. 30: http://dx.doi.org/10.1787/08705547-en.

55. Fouquet, R., 'Long-run demand for energy services: income and price elasticities over two hundred years, *Review of Environmental Economics and Policy*, Vol. 8, Issue 2, July 2014, pp. 186-207.

56. General Secretariat of the Council, Report on the efficiency of economic instruments for energy and climate change - ECOFIN 33 ENV 51, ECFIN/EPC(2007)REP/ 55386/final, Brussels, 30 January 2007.

57. Gesetzentwurf der Bundesregierung, Entwurf eines Gesetzes über einen nationalen Zertifikatehandel für Brennstoffemissionen (Brennstoffemissionshandelsgesetz – BEHG), 4 November 2011.

58. Gores, S. and Moosmann, L., 'Entwicklung der Effort Sharing Emissionen nach Sektoren in Deutschland', *Ӧko-Institut e.V. Institute for Applied Ecology*, Working Paper No. 5, 2018.

59. Görlach, B., 'What constitutes an optimal climate policy mix? Defining the concept of optimality, including political and legal framework conditions', CECILIA2050 WP1 Deliverable 1.1. Berlin: Ecologic Institute, 2013.

60. High-Level Commission on Carbon Prices, Report of the High-Level Commission on Carbon Prices, World Bank, Washington, D.C., 2017.

61. High-level Group on Energy-intensive Industries, Masterplan for a competitive transformation of EU energy-intensive industries enabling a climate-neutral enabling circular economy by 2050, Report for DG GROW European Commission, November 2019.

62. Hood. C., 'Managing interactions between carbon pricing and existing energy policies. Guidance for Policymakers', *The International Energy Agency*, Insight series, 2013.

63. Horowitz, J., Cronin, J.A., Hawkins, H., Konda, L. Yuskavage, A., 'Methodology for analyzing a carbon tax', *US Department of the Treasury, Office of Tax Analysis,* Working Paper No. 115, January 2017.

64. House of Commons Library, *Carbon price floor (CPF) and the price support mechanism*, UK Parliament, Briefing Paper No. 05927, January 2018.

65. IEA, *Energy Prices and Taxes for OECD Countries*, International Energy Agency Statistics. Most recent version 1st Quarter 2020.

66. IEA, *Energy prices and taxes for OECD countries*, International Energy Agency Statistics, 2019

67. IEA, OECD and Eurostat, *Energy Statistics Manual*, OECD Publishing, Paris, 2004.

68. IEA, *World energy balance 2019 edition. database documentation*, International Energy Agency, 2019;

69. IEA, *World energy balances 2018*, International Environmental Agency, OECD Publishing, Paris, 2018.

70. IEA, *World energy balances 2019*, International Environmental Agency, OECD Publishing, Paris, 2019.

71. IEA, *World energy outlook 2019*, International Environmental Agency, OECD Publishing, Paris, 2019.

72. IMF by Coady, D., Parry, I., Le, N., Shang, B., 'Global fossil fuel subsidies remain large: an update based on country-level estimates', *International Monetary Fund*, IMF Working Papers No. 19/89, May 2019.

73. IMF Finance and Development, *The Economics of climate*, International Monetary Fund, December 2019.

74. IMF, *Fiscal monitor, October 2019: How to mitigate climate change*, International Monetary Fund Fiscal Affairs Department, Fiscal Monitor, 2019.

75. IMF, *Fiscal Policies for Paris Climate Strategies — From Principle to Practice*, International Monetary Fund Fiscal Affairs Department, Policy Paper, May 2019;

76. Insight_E, *Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures*, Policy Report, May 2015.

77. IPCC, *The AR5 climate change 2014: mitigation of climate change*, Intergovernmental Panel on Climate Change, 2014.

78. Johannesson Linden, Kalantzis, F., Maincent, E., Pienkowski, J., 'Electricity tariff deficit: temporary or permanent problem in the EU?' *Economic and Financial Affairs European Economy*. Economic Papers, Brussels, No. 534, October 2014.

79. JRC, *Energy savings calculation methods under article 7 of the energy efficiency Directive*, Report for DG ENER European Commission, Joint Research Team, January 2016.

80. Kanchanaa, K. and Unesakiab, H., 'ASEAN energy security: an indicator-based assessment', *Energy Procedia*, Vol.56, 2014, pp. 163-171.

81. Kosonen, K. and Nicodème, G., 'Taxation paper: the role of fiscal instruments in environmental policy', European Commission's Directorate-General for Taxation and Customs Union, Office for Official Publications of the European Communities, Luxemburg, Working paper No. 19, 2009.

82. Li, S., Linn, J. and Muehlegger, E., 'Gasoline taxes and consumer behavior', *American Economic Journal: Economic Policy*, American Economic Association, Pittsburgh, Vol. 6, No. 4, 2014, pp. 302-342.

83. Marcantonini, C. and Ellerman, D.A., 'The implicit carbon price of renewable energy incentives in Germany', *The Energy Journal*, Vol. 36, No. 4, October 2015, pp. 205-239.

84. Marten, M. and K. van Dender, 'The use of revenues from carbon pricing', *OECD Publishing*, OECD Taxation Working Papers, No. 43, Paris, 2019: https://doi.org/10.1787/3cb265e4-en.

85. Mazzanti, M., Antonioli, D., 'Inducing greenhouse gases abatement through policy packages. Ex post assessments from EU sectors', *CECILIA2050* WP2 Deliverable 2.7. Ferrara, University of Ferrara, 2013.

86. Metcalf above quoting US National Research Council. 2009. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. Washington, DC.

87. Metcalf, G. E., 'The Economics of Energy Security', *Annual Review of Resource Economics*, Annual Reviews, Working Paper 19729, Vol. 6, No. 1, 2013, pp. 155-174.

88. Munaretto, S., Walz, H., 'Political feasibility of climate policy instruments in the EU, *CECILIA2050* WP4 Deliverable 4.5, Amsterdam: Institute for Environmental Studies, VU University Amsterdam, 2015.

89. National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, The National Academies Press, Washington, D.C., 2010.

90. NERA, *Update on energy taxation and subsidies in Europe: an analysis of government revenues from and support measures for fossil fuels and renewables in the EU and Norway*, Report for the International Association of Oil and Gas Producers, May 2018.

91. Newbery, 'Reforming UK energy policy to live within its means'*, Cambridge Working Papers in Economics*, September 14, 2015.

92. ODI, *Phase-out 2020, Monitoring Europe's fossil fuel subsidies*, Overseas Development Institute and CAN Europe, 2017.

93. OECD, *Companion to the inventory of support measures for fossil fuels 2015*, OECD Publishing, Paris, 2015: https://doi.org/10.1787/9789264239616-en.

94. OECD, *Companion to the inventory of support measures for fossil fuels 2018*, OECD Publishing, Paris, 2018: https://doi.org/10.1787/9789264286061-en.

95. OECD, *Effective carbon prices*, OECD Publishing, Paris, 2013: https://doi.org/10.1787/9789264196964-en.

96. OECD, *Revenue Statistics 1965-2017, Interpretative Guide,* OECD Publishing, Paris, 2018.

97. OECD, *Effective carbon rates 2018: pricing carbon emissions through taxes and emissions trading*, OECD Publishing, Paris, 2018: https://doi.org/10.1787/9789264305304-en.

98. OECD, *Effective Carbon Rates, Pricing Carbon Emissions Through Taxes and Emissions Trading*, OECD Publishing, Paris, 2018.

99. OECD, *Effective Carbon Rates, Pricing CO2 through Taxes and Emissions Trading Systems*, OECD Publishing, Paris, 2016.

100. OECD, *Effective carbon rates: pricing CO2 through taxes and emissions trading systems*, OECD Publishing, Paris, 2016: https://doi.org/10.1787/9789264260115-en.

101. OECD, *Environmentally Related Taxes in OECD Countries*. *Issues and Strategies*, OECD Publishing, Paris, 2001.

102. OECD, *Indicators to measure decoupling of environmental pressure from economic growth*, Sustainable development SG/SD(2002)1/FINAL, May 2002.

103. OECD, *Revenue Statistics 2012*, OECD Publishing, Paris, 2012;

104. OECD, *Revenue Statistics 2019*, OECD Publishing, Paris, 2019;

105. OECD, *Taxation, innovation and the environment*, OECD Publishing, Paris, October 2010.

106. OECD, *Taxing energy use 2015: OECD and selected partner economies*, OECD Publishing, Paris, 2015: https://doi.org/10.1787/9789264232334-en.

107. OECD, *Taxing Energy Use 2018: companion to the taxing energy use database*, OECD Publishing, Paris, 2018: https://doi.org/10.1787/9789264289635-en.

108. OECD, *Taxing energy use 2019: using taxes for climate action*, OECD Publishing, Paris, 2019: https://doi.org/10.1787/058ca239-en.

109. OECD, *Taxing energy use: a graphical analysis*, OECD Publishing, Paris, 2013: https://doi.org/10.1787/9789264183933-en.

110. OECD, *The Swedish Tax on Nitrogen Oxide Emissions. Lessons in Environmental Policy Reform*, OECD Publishing, OECD Environment Policy Paper, No. 2, December 2013.

111. OECD, *Towards green growth: monitoring progress*, OECD Publishing, Paris, 2011: https://doi.org/10.1787/9789264111356-en.

112. OPEC, OECD and World Bank, *Analysis of the Scope of Energy Subsidies and Suggestions for the G20 Initiative,* Joint Report prepared for submission to the G-20 Summit Meeting Toronto (Canada) 26-27 June 2010.

113. Palm, V., Calculating greenhouse gas transfers: transfers that reduce the cost of emitting GHG, Statistics Sweden, 2020.-

114. Parry, I., Mylonas, V., and Vernon, N., 'Mitigation Policies for the Paris Agreement: An Assessment for G20 Countries', *International Monetary Fund,* IMF Working Paper No. 18/193, August 2018.

115. Parry, I., et al., 'Getting Energy Prices Right: From Principle to Practice', International Monetary Fund, Washington, 2014. An excel file is accessible and downloaded from the "Pricing database tool".

116. PV Magazine, *Bundeskabinett verabschiedet CO2-Emissionshandel für Verkehr und Wärmeversorgung*, October 2019.

117. Rey, L., Gonzalez-Eguino, M., Markandya, A., 'Pathways for the evolution of climate policy instruments', *CECILIA2050* WP4 Deliverable 4.1, Bilbao: BC3 Basque Centre for Climate. Change, 2014

118. Rey, L., Markandya, A. Gonzáles-Egiuno, M.; Drummond, P., 'Assessing Interaction between instruments and the 'optimality' of the current instrument mix', *CECILIA2050* WP1 Deliverable 1.3, Bilbao: Basque Centre for Climate Change (BC3), London: University College London (UCL), 2013.

119. Ricardo Energy & Environment, *Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive*, for DG ENER European Commission, 2016.

120. Robinson, D., 'Fiscal policy for decarbonisation of energy in Europe', *The Oxford Institute for Energy Studies*, (with annexes by Keay, M. and Hammes, K.), Paper No. 22, September 2017.

121. Smart Energy for Europe Platform, *Conceptualising energy security in the European context,* SEFEP working paper 2012-2014, June 2014.

122. Sovacool, B. K, 'The methodological challenges of creating a comprehensive energy security index', *Energy Policy,* Vol. 48, 2012, pp. 835-840.

123. Sovacool, B. K. and Brown, M. A., 'Competing dimensions of energy security: an international perspective', *Annual Reviews Environmental Resources*, Vol. 35, 2010, pp. 77-108.

124. Sovacool, B. K. and Mukherjee, I., 'Conceptualizing and measuring energy security: A synthesized approach', *Energy*, Vol. 36, 2011, pp- 5343-5355.

125. Speck, S. , Environmental tax reform and the potential implications of tax base erosions in the context of emission reduction targets and demographic change, *Economia Politica: Journal of Analytical and Institutional Economics*, Vol. 34, No. 3, pp. 407-423, 2017.

126. Tax Foundation, Carbon tax and revenue recycling: revenue, economic, and distributional implications, Fiscal Fact, No. 674, November 2019.

127. Tax Foundation, Carbon tax in Europe, November 2019.

128. The EU Sustainable Development Strategy dating back from the early 2000.

129. Thema, J. *et al*., 'Widening the Perspective: An Approach to Evaluating the Multiple Benefits of the 2030 EU energy efficiency potential', *COMBI Project*, International Energy Policies & Programmes Evaluation Conference, Amsterdam, 2016.

130. Trinomics, *Selected indicators to measure energy poverty*, Final report for DG ENER, European Commission, published in 2016.

131. Trinomics, *Study on energy prices, costs and subsidies and their impact on industry and households*, Final Report, for the DG ENER, European Commission, published in 2018.

132. Trinomics, Study with evaluation criteria on early estimates of main energy balance sheets components in 2015 and for the production and visualisation of indicators to monitor energy union implementation, Final Report Task 1 and 2, for DG ENER, European Commission, published in 2016.

133. Übertragungsnetzbetreiber (ÜNB), *Prognose der EEG-Umlage 2016 nach AusglMechV*, Prognosekonzept und Berechnung der ÜNB, 15 October 2015.

134. UNEP and IISD, *Measuring fossil fuel subsidies in the context of the sustainable development goals*, United Nations Environment Programme, 2019.

135. UNSD et al., System of environmental economic accounting 2012: central framework, United Nations, New York, 2014.

136. Weisbach, D. A., Carbon taxation in the EU: expanding the EU carbon price, *Journal of Environmental Law*, Vol. 24, Issue 2, July 2012, pp. 183–206: https://doi.org/10.1093/jel/.

137. World Bank, *Carbon tax guide: a handbook for policy makers. PMR Carbon Tax Guide – Translations*, Washington, D.C., World Bank Group, 2018.

138. World Bank, *Emissions Trading in practice: a handbook on design and implementation*, Washington, D.C., World Bank Group, 2016.

139. World Bank, *State and trends of carbon pricing 2019*, Washington, D.C., World Bank Group, 2019.

140. World Bank, *Commodity Markets Outlook*, Washington, D.C, 2020.

D.3 DATABASES

1. DG ENER, EU Buildings Database, European Commission.

2. DG ENER, Weekly Oil Bulletin, Taxes and Prices datasets, European Commission.

3. DG TAXUD, Excise Duty Tables – Part II Energy products and Electricity, European Commission, January 2020.

4. DG TAXUD, Excise Duty Tables Tax Receipts Energy products, 2008-2018.

5. DG TAXUD, Taxes in Europe Database (TEDB), situation on 1 January 2020.

6. EEX European Energy Exchange, EUA auction market platform and datasets.

7. Eurostat, database of macroeconomic and microeconomic time series.

8. Eurostat, Energy and Environment databases.

9. Eurostat, Energy Balance in the MS Excel file format (2020 edition); previous edition available since 2010 edition.

10. Eurostat, Environment tax revenues (env_ac_tax), database.

11. Eurostat, National Tax List, tables 9 ESA 2010.

12. Eurostat, Physical energy flow accounts (env_pefa), database.

13. Eurostat, Prices database on energy and environmental sources.

14. Eurostat, Structural business statistics (sbs), data on purchases of energy products

15. IEA, World Energy Balances, statistics 2016-2017.

16. OECD statistical portal, Environmentally related tax revenues.

17. OECD, Policy Instrument for the Environment (PINE) database.

18. World Bank, Carbon Price Dashboard, database.

EUROPEAN COMMISSION

Study on Energy Taxation Indicators

Final Report

Volume 3 Technical Annexes

Directorate-General for Taxation and Customs Union

2020

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ANNEX I – LIST OF INTERVIEWEES AND WORKSHOP PARTICIPANTS

1. List of Interviewees with European and International Entities

#	Name	Affiliation	Position (Unit - Department)	Date of Interview
1	Monika Wozowczyk	European Commission – DG ESTAT	Team Leader (Unit E2 - Monetary Environmental Accounts and Forest Accounts and Statistics)	20/05/2020
2	Dorothea Jung		Statistical Assistant (Unit E2 - Monetary Environmental Accounts)	
3	Ian Parry	International Monetary Fund (IMF)	Principal Environmental Fiscal Policy Expert (Fiscal Affairs Department)	22/06/2020
4	Kurt Van Dender	Organisation for Economic Development and Cooperation (OECD)	Head of the Tax and Environment Unit (Centre for Tax Policy and Administration)	08/07/2020
5	Jonas Teusch		Economist (Centre for Tax Policy and Administration)	
6	Florens Flues		Economist (Centre for Tax Policy and Administration)	
7	Konstantinos Theodoropoulos		Statistician (Centre for Tax Policy and Administration)	
8	Dirk Heine	The World Bank	Fiscal Economist (Macroeconomics Department)	20/07/2020
9	Tom Howes	International Energy Agency (IEA)	Head of Energy and Environment Division	23/07/2020
10	Roberta Quadrelli		Head of Energy Balances, Prices, Emissions, RDD & Efficiency Statistics	

2. List of Participants in the Workshop on June, 5 – Morning Session

#	Name	Affiliation	Position (Unit / Department)	Country
1	Ana Xavier	European Commission - DG TAXUD	Head of Unit (Unit D4 - Economic analysis, Evaluation and Impact assessment support)	EU
2	Clare Southworth	European Commission - DG TAXUD	Head of sector (Unit D4 - Analysis of tax fairness)	EU
3	Milena Mathé	European Commission - DG TAXUD	Policy Coordinator (Unit E2 - Inter-institutional relations)	EU
4	Manuel Godinho De Matos	European Commission - DG TAXUD	Economist (Unit D4 - Analysis of tax efficiency)	EU
5	David Arranz	European Commission - DG TAXUD	Economist (Unit D4 - Support for impact assessments and evaluations; data dissemination; taxation structures)	EU
6	Amel Chikhi	European Commission - DG TAXUD	Secretary (Unit D4)	EU
7	Mauricio Belaunde	Federal Ministry for Climate Action	Policy Analyst (Department for Energy Policy and Energy-Intensive Industries)	Austria
8	Boris De Kock	Federale Overheidsdienst FINANCIEN	Macroeconomic Attaché, Environmental Taxation (Research Department)	Belgium
9	Violeta Gadjeba Baeva	Ministry of Finance	..	Bulgaria
10	Goran Šekoranja	Croatian Ministry of Finance	Senior Advisor (Central Custom Office)	Croatia
11	Boris Drazenovic	Ministry of Environment and Energy	Senior Advisor	Croatia
12	Nayia Symeonidou	Ministry of Finance of Cyprus	Senior VAT Officetr (Tax Department)	Cyprus
13	Píša Viteslav	Ministry of Finance of Czech Republic	Indirect Tax Expert (Excise Duty Department)	Czech Republic
14	Veli Auvinen	Ministry of Finance - Vvaltiovarainministeriö	Economist (Excise Tax Unit, Tax Department)	Finland
15	Jussi Kiviluoto	Ministry of Finance - Vvaltiovarainministeriö	Tax Department Excise Tax Unit	Finland
16	Aver	Ministry of Finance	..	France
17	Ulrike Diehls	Federal Ministry of Finance	..	Germany
18	Julie Vasileiou	Ministry of Finance	..	Greece
19	Nikolaos Zografakis	Greek Ministry of the Environment, Energy and Climate Change	Energy Expert and Director (Regional Development Fund of Crete / Regional Energy Agency)	Greece
20	Peter Toth	Ministry of Finance - Hungarian Government	Director (Tax Policy and Research Unit / Department of Tax Policy and International Taxation)	Hungary
21	Niall O'sullivan	Department of Finance	Economist (Department of Finance Government Buildings)	Ireland
22	Jolanta Poskeviciene	Ministry of Finance of the Republic of Lithuania	Chief Specialist (Indirect taxation Division)	Lithuania
23	Virginija Kalesinskiene	Ministry of Environment of the Republic of Lithuania	Chief Specialist (Economic Instrument Application Policy Division)	Lithuania

24	Marie Paule Niederweis	Ministry of Finance - The Luxembourg Government	Chief Inspector (Customs and Excise Agency)	Luxemburg
25	Jacques Wilhelm	Ministry of Finance - The Luxembourg Government	Officer (Customs and Excise Agency)	Luxemburg
26	Annalise Grima	Ministry for Finance	Economic Officer (Economic Policy Department)	Malta
27	Maikel Kogenhop	Ministry of Finance - Government of the Netherlands	General Tax Policy Department	Netherlands
28	Tomasz Ormaniec	Ministry of Finance	Senior Specialist (Department of Economic Policy Support)	Poland
29	Tomir Nowakowski	Ministry of Finance	Director General (Office of the Director General)	Poland
30	Rui Collaço	Autoridade Tributária e Aduaneira	Advisor (Customs and Excise)	Portugal
31	Manuela Anculescu	Ministry of Finance	Advisor	Romania
32	Gheorghita Nicodim	Ministry of Environment, Waters and Forests	Expert (UNFCCC National Focal Point)	Romania
33	Nicoleta Datcu	Ministry of Environment, Waters and Forests	Advisor (Climate Change Unit - EU ETS Scheme)	Romania
34	Sergiu Cruceanu	Ministry of Environment, Waters and Forests	Senior Policy Advisor (Climate Change Unit)	Romania
35	Jaroslav Bukovina	Ministry of Finance	Senior Economic Analyst (Institute for Financial Policy)	Slovakia
36	Tjasa Kralj	Ministry of Finance	Advisor (Department for the System of Indirect Taxation and Customs)	Slovenia
37	Raquel Cantero Rangel	Treasury - Ministerio de Hacienda	Deputy Inspector (Sub-directorate General for Special Taxes and Foreign Trade / General Directorate of Taxes)	Spain
38	Thomas Sundqvist	Ministry of Finance - Finansdepartementet	Senior Advisor (Division of Tax Policy Analysis)	Sweden

3. List of Participants in the Workshop on June, 5 – Afternoon Session

#	Name	Affiliation	Position (Unit / Department)	Country
1	Ana Xavier	European Commission - DG TAXUD	Head of Unit (Unit D4 - Economic analysis, Evaluation and Impact assessment support)	EU
2	Clare Southworth	European Commission - DG TAXUD	Head of sector (Unit D4 - Analysis of tax fairness)	EU
3	Milena Mathé	European Commission - DG TAXUD	Policy Coordinator (Unit E2 - Inter-institutional relations)	EU
4	Manuel Godinho De Matos	European Commission - DG TAXUD	Economist (Unit D4 - Analysis of tax efficiency)	EU
5	David Arranz	European Commission - DG TAXUD	Economist (Unit D4 - Support for impact assessments and evaluations; data dissemination; taxation structures)	EU
6	Mauricio Belaunde	Federal Ministry for Climate Action	Policy Analyst (Department for Energy Policy and Energy-Intensive Industries)	Austria
7	Samantha Haulotte	Federal Public Service for Public Health, Food Chain Safety and Environment	Climate Policy Expert (Federal Public Service for Public Health, Food Chain Safety and Environment)	Belgium
8	Boris Drazenovic	Ministry of Environment and Energy	Senior Advisor	Croatia
9	Richard Jurik	Ministry of Environment of Czech Republic	Regulatory Impact Analyst (Ministerial Council)	Czech Republic
10	Eva Suurkaev	Ministry of the Environment Republic of Estonia	Enviornmental Charges Expert (Environmental Management Department)	Estonia
11	Outi Honkatukia	Ministry of the Environment	Chief Negotiator for Climate Change (Environmental Protection Department)	Finland
12	Isabelle Cabanne	Ministère de la Transition Écologique	(Direction générale de l'énergie et du climat)	France
13	Ramona Koska	Ministry of Innovation and Technology - Hungarian Government	Climate Policy Officer (Ministry of Innovation and Technology)	Hungary
14	Virginija Kalesinskiene	Ministry of Environment of the Republic of Lithuania	Chief Specialist (Economic Instrument Application Policy Division)	Lithuania
15	Ana Daam	Portuguese Environment Agency	Director (Sustainable Finance and Adaptation Unit)	Portugal
16	Gheorghita Nicodim	Ministry of Environment, Waters and Forests	Expert (UNFCCC National Focal Point)	Romania
17	Nicoleta Datcu	Ministry of Environment, Waters and Forests -Climate Change	Advisor (Climate Change Domain - EU ETS Scheme)	Romania
18	Kristína Mojzesova	Ministry of Environment of the Slovak Republic	Environmental Analyst (Institute for Environmental Policy)	Slovakia
19	Carlos Redondo	Ministry of Industry, Energy and Tourism	General Directorate for Climate Change Policies	Spain

ANNEX II – DOCUMENTS FOR THE WORKSHOP

This annex provides the two synthesis documents shared with stakeholders, including 1) the instructions for the workshop; 2) the agendas; and 3) the summary of the preliminary study findings and the issues for discussion (tailored to the different audience). The two documents are provided as follow:

- Synthesis document for the workshop with representatives from the Ministries of Finance;
- Synthesis document for the workshop with representatives from the Ministries of Environment.

Study on Energy Taxation Indicators

SYNTHESIS DOCUMENT

WORKSHOP WITH
MEMBER STATES REPRESENTATIVES

ONLINE
JUNE 5TH, 2020

REPRESENTATIVES FROM THE MINISTRIES OF FINANCE

INSTRUCTIONS FOR THE WORKSHOP

- You will receive an invitation via e-mail. Kindly confirm your attendance to the meeting.

- The meeting will be held on the Webex platform.

- The meeting can be accessed from 9:45 onwards via one of the following modalities:

  - Online. If available, please use the Chrome browser;
  - By downloading the Cisco Webex Meeting application;
  - Via phone (landline or mobile). National call-in numbers can be found at the following link.

- To access the meeting online or via the application, click on the green button in your e-mail invitation. To access the meeting via phone, please take note of the meeting number and password, both included in your e-mail invitation.

- All participants will be muted at the beginning of the meeting and the Chair will unmute speakers when appropriate.

- To ask for the floor, type your name and organisation in the chat box.

- When giving you the floor, the Chair will unmute you. Please mute yourself again at the end of your intervention.

- Participants should keep their cameras off, unless when speaking

- Each session is structured as follows:

  - The Consultants will deliver a presentation (10 to 15 minutes), reporting on the preliminary findings of the Studies;
  - This will be followed by questions and discussions; participants are kindly asked to provide feedback on the Study findings and methodologies, addressing the themes for discussions and questions included in this document.

AIM AND AGENDA

Aim of the meeting

The workshop aims at sharing preliminary findings from the Study with Member State representatives, in view of eliciting feedback and inputs on indicators used to inform national energy tax policies**,** policy needs, and information gaps. The information collected via the workshop and the online / e-mail questionnaire will be used to finalise the analysis and provide recommendations and ways forward on the use of existing indicators, their refinement, and the creation of new tools. The workshop will be complemented by a parallel exercise with the Ministries of Environment, which will review more in details environmental aspects.

Agenda

09:45 **Meeting opens, participants dial in**

10:00 **Introduction to the Study**

10:10 **Section 1. State of the art: existing indicators and their use in policymaking**

- What we aim at assessing: the appraisal framework
- Overview of existing energy taxation indicators, best practices, issues identified

10:35 **Section 2. Energy taxation: definition and revenue generation**

- What an energy tax is, what is not, by whom
- Current issues with energy tax definition: revenue flows, VAT, quasi-fiscal measures (RES charges, ETS)
- Indicators for measuring the role of energy taxes in revenue generation

11:00 **Coffee break**

11:10 **Section 3. Effective tax rate on energy and carbon**

- Implicit and effective tax rate for countries and sectors: state of play
- Measuring energy subsidies
- Carbon pricing and climate policies indicators

11:35 **Section 4. Information gaps, policy needs and way forward**

- What information current indicators can provide to policymakers
- The use of energy tax indicators at the European level and eventually for the European Semester
- Information gaps and available sources to fill them

11:50 **Questions and Answers, Closing remarks.**

12:00 **End of the meeting**

PRELIMINARY FINDINGS FROM THE STUDY AND ISSUES FOR DISCUSSION

Policy Background

The importance of energy and climate change policies has been escalating rapidly in the agenda of the EU, with ambitious greenhouse gas emission reduction objectives set in a number of policy initiatives, lastly culminated in the EU Green Deal. Energy taxation has increasingly been called to contribute to the achievement of these objectives through both a reform of the Energy Taxation Directive and as part of the focus on sustainable growth in the framework of the European Semester.

State of the art: existing indicators and their use in policymaking

Many indicators on energy taxation are available in the public domain, from both European and international organisations, although with varying levels of detail. Also, private bodies have been extensively involved in the production of indicators from ad hoc studies commissioned by different DGs with a certain regularity. In this respect, there is no lack of information, as the available indicators cover many different and complementary aspects relevant for policymaking. The Study so far has reviewed 29 of such indicators, and grouped them into four main families:

1. Indicators to measure ***revenues from energy taxation*** and their weight on certain reference values (typically, GDP and total taxation revenues).
2. ***Implicit or effective tax rates***, aiming at measuring the average tax burden, net of subsidies, for a country, industrial sector, energy use, or fuel. This can be done starting from actual energy tax revenues. They are usually expressed in EUR per volume (e.g. tonne, 1000 litres) or energy content (e.g. TOE, GJ, MWh).
3. ***Carbon pricing tools*** attempt at measuring the tax burden associated to carbon emissions in a given country, sector or use, as resulting from the joint effect of energy and carbon taxes and ETS permits; they are usually expressed d in EUR ($) per tonne of CO_2 equivalent.
4. Another family of relevant indicators do not measure taxes, strictly speaking, but ***subsidies***, i.e. foregone tax revenues, because of exemptions, reimbursements, or rebates. Subsidies can be measured (i) top-down, based on the price-gap methodology, (ii) bottom-up, by compiling a list of direct transfers and tax expenditures, or (iii) based on a Pigouvian rationale, i.e. measuring the difference between actual rates and those that would cover external costs caused by energy consumption (e.g. climate change, air pollution, congestion)

Other energy taxation indicators that have been introduced on a more experimental or non-continuous basis, including (i) indicators of ***corrective tax rates*** that would compensate for the environmental damage (the so called externalities) of the different energy products, and (ii) ***indicators from models and correlations*** that try to put into relation tax indicators with other phenomena that may be affected (e.g. energy efficiency). Finally, the review also includes two still unexploited indicators on ***energy consumption*** which could be eventually used to build other composite indicators (e.g. based on NACE classification) or as contextual indicators.

The full list of indicators is reported in Appendix A. For each of them, the Consultants have assessed their policy relevance, analytical soundness, and measurability; the appraisal framework is reported in Appendix B.

The more 'traditional' energy tax indicators, i.e. those measuring ***revenues*** and ***implicit tax rates***, were designed to measure the fiscal burden in countries and on sectors and products, so to assess the extent to which national fiscal policies pursued 'green' objectives. Their methodology remains analytically sound even today, and present no or very limited issue of measurability, credibility, and transparency. However, their policy relevance has diminished for two reasons. First, the growing relevance of quasi-fiscal measures and tradable permits (e.g. renewables charges, emission trading system) that poorly fit with traditional classification criteria. Secondly, the shift of the policy agenda towards climate change objectives that increasingly challenge the significance of energy taxation as a standalone analytical category. Also, the policy evolution strained the definition of 'energy tax', on which these indicators are based, thus reducing their capacity to produce meaningful cross-country comparisons. Finally, these indicators are usually unfit to measure the sectoral energy tax burden, especially on energy intensive industries. On the other hand, there are two families of indicators whose policy relevance has grown over the last years: carbon prices and subsidies. However, being newer, their methodology is not yet settled, they remain more complex to communicate, and their publication is less frequent, with considerable time-lag. More in details:

- On ***carbon pricing***, the two leading analyses and indicators are currently published by the IMF and the OECD, measuring both the price of carbon as resulting from the joint effect of energy and carbon taxes and tradable permits policies, as well as the distance between national policies and the efforts required to limit climate change.
- As for ***subsidies***, the amount of information is large and growing, both in quantity of countries and measures covered, and quality of data. In this area, the crux is the measurement of tax expenditures, which strongly depends on the benchmark used. Most importantly, subsidy indicators can sometimes respond distortedly to policy choices, as an increase in energy tax rates can at the same time worsen the subsidy estimates.

In conclusion***, the change in policy priorities over the last decade reduced the policy relevance of traditional energy tax indicators***, those with an established and clear methodology. Therefore, they should be revamped and adjusted to allow their instrumental use in policymaking. On the other side of the spectrum, ***new indicators emerged to address the new policy needs, but their methodologies are not yet consolidated***. Importantly, the EU is not among the main producers of these new indicators. The objective of improving, refining, and extending all families of indicators thus seems meaningful and worth investing, while acknowledging the limits of a pure quantitative approach, as well as feasibility constraints. Indeed, there appears to be no 'silver bullet' around, but several possible improvements and ways forward.

Themes for discussion

- *Considering the indicators included in Appendix A, are they used to inform policymaking in your country? Please provide examples on their use*
- *Has your country developed additional or different energy tax indicators? If yes, are they used to inform policymaking? Please provide examples of their use*
- *Do you have any feedback on the appraisal framework included in Appendix B (e.g. missing elements, unclear aspects)?*

Energy taxation: definition and indicators of revenue generation

Public energy taxation datasets are based on ***definitions*** of what an energy tax is built for environmental accounts purposes and compliant with national accounting principles defined at the UN and EU level (i.e. European System of Accounts). Whenever ***policy information needs are at odds*** with these principles, *ad hoc* datasets have to be built, and this partly explains the proliferation of other indicators, studies and reports.

It is therefore important to have a better view of whether i) other additional datasets have been created or are being considered at national level to fill information gaps and address policy needs; ii) this should result in the compilation of comparable/harmonised indicators at EU level; iii) the creation of these datasets, at national or EU level, presented or is likely to present feasibility problems, and how and through which efforts they should be addressed.

In particular in the current energy taxation datasets:

1. do not envisage any ***classification of energy taxation by type of energy tax*** (e.g. carbon taxes, fuel excises, electricity excises, taxes to finance renewables), even when they are regulated by the common Energy Taxation Directive that could be used as a framework for reference. The OECD has been working on such categorisation, but there are other possible classification needs;
2. ***mixes energy taxes with carbon taxes and Emission Trading System (ETS) revenues unrelated to energy*** in a way that can be confusing to follow (this is also being addressed by the OECD);
3. have to follow ESA rules in classifying ***ETS revenues***, which, because of compliance with the territoriality principle, do not account for revenues from non-residents. Such effect was negligible, but ETS share on total energy taxes has grown recently, as the price for permits has risen. In a multinational scheme like the EU ETS, this is bound to increasingly distort monitoring of financial flows and net revenues, because an increasing share of resources remains unallocated;
4. don not account for certain ***reimbursements*** and other forms of consumption-related fiscal compensation;
5. leave Member States discretion to carry out the separate identification of taxation revenues from ***renewables/biomasses/biofuels***, and of the related tax expenditures, because these are not necessarily considered as <u>environmental</u> taxes;
6. leave Member States discretion in classifying ***revenues from renewable charges*** as <u>taxes</u> or not (also on feasibility grounds), creating discrepancies between datasets (e.g. Eurostat vs. OECD) and, within the same datasets, limiting comparability of revenue data and related indicators;
7. also on feasibility grounds, the current definition does not include ***non-deductible VAT on energy taxes***, which again is a cause of potential distortion in the downstream indicators;
8. does not include revenues from ***oil and gas production***, although, again, the OECD has been proposing to include them, as well from ***carbon mining*** (resource rent revenues).

As a consequence, the indicators on energy taxation revenues on total revenues suffers from the following ***paradoxes***:

- the ***decision of financing Renewable Energy Sources (RES)*** by means of an energy or carbon tax rather than through quasi-fiscal mechanisms (e.g. RES charges) artificially increases the indicator without any real substantial reason, as burden on consumers and net revenues for Government remain the same. The amounts at stake can definitely have a macro dimension, although they seem bound to decrease in the near future;
- also because VAT on energy taxes is currently not included, the recourse to ***reduced VAT rates*** as a subsidy artificially increases the value of the indicator[1];
- revenue data are recorded at their net value, i.e. net of reductions and exemptions, but are not representative of ***other subsidies***. This means that countries offering in-kind or cash rebates have an artificially higher indicator compared to countries using reductions and exemptions;
- because of compliance with the UN environmental accounting principles and of cross-border trade of permits, ***revenues from ETS auctions*** are fully recorded only for Member States with a relatively worse GHG reduction performance, while they are underestimated for the others.

A number of *ad hoc* studies have been commissioned to fill the policy making gaps, e.g. to: i) an estimate of the VAT on energy taxes; ii) the separate identification of the total RES charges; or iii) an assessment of energy tax revenues net of subsidies.

However, based on the publicly available energy taxation revenue datasets, two main energy taxation indicators have been mainstreamed in the current practice:

1) ***energy taxation revenues as a percentage of GDP***;
2) ***energy taxation revenues as a percentage of total taxation***.

Since there is no particular theoretical macroeconomic or policy meaning attached to aggregated energy taxation revenues data defined in this way for merely statistical purposes, both indicators have limitations in their practical use. The former can be distorted by the energy intensity of a country and other factors. The comparison of the latter with the similar ratios concerning labour taxes and social security contributions is the only EU indicator available to monitor the so called ***"double dividend"*** argument and revenue recycling aspects. Moreover, the policy relevance of both indicators can be ambiguous, as the tax base decreases the more successful environmental taxation is. Finally, as mentioned above, there are limitations in the level of data granularity to build other descriptive indicators. It will therefore be important to investigate whether additional or complementary energy tax revenue indicators have been developed at national level and whether these rely on different definitions of energy taxes, methodologies, or datasets.

Finally, should carbon taxation substantially increase its importance in the achievement of GHG pledges, ***revenue recycling policies*** would likely become key. However, in existing datasets, there is limited available information on earmarking practices and the use made of energy tax revenues in general, and carbon tax revenues in particular. Also in this case, views will be elicited on whether this is an information gap worth redressing at the EU level, and how.

[1] VAT is included only in the denominator (as part of total taxation), but not in the numerator (as it is not accounted among energy taxes). Therefore, if reduced VAT is applied to VAT products, the denominator decreases while the numerator remains the same, thus the ratio increaes.

Themes for discussion

- *What is the level of data disaggregation of energy tax revenues currently used in your country? What level should be available at the EU level? Does the current disaggregation allow for the assessment of tax revenues per type of incentive provided? Have you felt the need to use tax classification other than 'energy taxation'? (e.g. OECD climate change taxes)? How are RES revenue classified?*
- *To what extent does the current treatment of RES charges and VAT distort energy tax revenue indicators? Is there a need to harmonise the treatment of RES charges?*
- *Should action be taken to remedy some of the paradoxes of the existing energy tax revenue indicators? Should other complementary indicators be devised to better reflect net revenues? Have you taken action in this respect? If so, how do you net off revenues from indirect subsidies?*
- *Is there a need to strengthen EU indicators on revenue recycling policies? Is it feasible and worth the effort?*

Effective tax rate on energy and carbon

Implicit and effective tax rates aim at measuring the average tax burden on energy consumption, defined in physical terms (volume, energy content) or monetary terms (energy costs and price). Implicit and effective tax rates can be estimated:

- For the economy as a whole, such as the Commission's Implicit Tax Rates on or the OECD's Effective Tax Rate on energy;
- By product, such as DG ENER's Oil Price Bulletin;
- By use or sector, such as, again, the OECD's Effective Tax Rate on energy.

In these various declinations, they allow for considerations of ***competitiveness*** – of a whole country or specific industries - ***affordability***, as well as for the more general ***consistency*** of the tax system, when interpreted as the homogeneous taxation on a per energy or per emission content basis.

The Commission is currently publishing three implicit tax rates for the economy as a whole, as the ratio of energy tax revenues over total consumption:

1. Nominal Implicit Tax Rates, by TAXUD;
2. Implicit Tax Rates on energy (deflated with the GDP implicit deflator, base year 2010), by Eurostat;
3. Implicit Tax Rates on energy (deflated with the final demand deflator, base year 2010), by TAXUD.[2]

The OECD Effective Tax Rates on energy is not based on revenue data, but extensively relies on extrapolations from available tax rates at a given date and energy consumption data as provided by the IEA. It draws on one fundamental idea: statutory tax rates at a given date are converted into rates per unit of energy (€/GJ), accounting for reductions, exemptions, and other subsidies as reported in the OECD energy subsidy repository. The ETR does neither include all taxes on energy products or production nor on other pollutants; it only encompasses taxes on energy uses, since those "alter the relative price of energy use and that can in principle be used to reflect marginal environmental damages": carbon taxes, excises on fuels, excises on electricity.

To the contrary, ***the current availability of implicit and effective tax rates per fuel or per sector is limited***:

[2] TAXUD intends to align the deflator with Eurostat going forward.

1. At ***product level***, implicit tax rates have hardly been published as such, and limited information is available on tax revenues per product. DG TAXUD's Excise Duty Tables would be the main source to this purpose; however, they only cover one type of energy taxes, and their compilation is not harmonised and supervised by Eurostat.
2. At ***sectoral level***, data on energy taxation are available per economic activity (64 2-digit NACE sectors) and for eight paying entities. However, no indicator is currently published by the European Commission estimating a sectoral average tax rate based on these data. It is unclear whether this is due to lack of demand from policymakers or issues with data availability (e.g. on consumption per sector) or quality.

The measurement of the effective energy tax rates is especially important for ***energy-intensive industries***, as the cost of energy is an important determinant of their competitiveness. However, available statistics and the level of granularity provided by the NACE classifications do not provide sufficient insights in this area. In recent years, two attempts have been made by the European Commission to estimate the effective tax burden on electricity and natural gas paid by these industries. These were done via a top-down approach,[3] starting from available statistics, as well as bottom-up[4], i.e. starting from data on prices, costs, consumptions, and subsidies obtained at plant level. The latter's results are very promising, though estimates are not available for all Member States given the current business participation to the survey.

To estimate the true implicit tax rate, a complete list of ***energy subsidies***, including an estimate of their monetary value per user, should be compiled. Many studies, databases, and repositories have been developed in this area by European and international institutions over the recent years, such as DG ENER, DG ENV, the IMF, and the OECD. The estimation of energy subsidies is based on three approaches:

- ***Top-down approach***: the subsidy is calculated as the difference between international and local retail prices. This approach is of limited relevance in the EU, as tax-inclusive prices tend to be invariably higher than international benchmarks.
- ***Bottom-up approach***: the subsidy is calculated as the sum of direct transfers granted to energy producers and consumers, and foregone revenues not levied.
- A third approach, used only by the IMF, is ***pigouvian***. In this case, subsidies are calculated as the difference between all the environmental externalities generated by the consumption of the various energy products and tax rates.

Significant methodological differences exist among the various sources of information of subsidies, starting from the lack of an agreed definition of what an 'energy subsidy' is. ***The definition of a benchmark is the most important problem for these indicators***. Benchmarks can be defined as exogenous to the fiscal system and derived from a policy objective. Otherwise, as is commonly the case, the benchmark is endogenous to the tax system, and consists in the highest applicable tax rate for comparable uses. This means that any reduction or exemption from the highest tax rate is considered a tax expenditure, and then a subsidy. From a policy perspective,

[3] Trinomics, Study on Energy Prices, Costs and Subsidies and their Impact on Industry and Households, Final Report, for DG ENER, European Commission, 2018.
[4] Centre for European Policies Studies *et al.,* Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries, Final Report for DG GROW, European Commisison, 2018.

endogenous benchmarks create ***paradoxes and distorted policy incentives***. For instance, if the rate of gas oil is increased and exemptions remains, subsidies would increase. Hence, a government decision to increase taxation of fossil fuels would result in a worsening of its fuel subsidy indicator. The OECD repository circumvents the benchmark definition problem by relying on 'nationally-established benchmarks'; this implies that rather than defining what a uniform methodology for establishing a benchmark, it accepts the quantification of tax subsidies carried out at national level. It goes without saying that this admittedly limits the comparability of tax expenditures estimates.

Finally, over the last years a number of publications appeared in the area of ***carbon pricing*** and related indicators, in particular by the OECD and the IMF. The theme of carbon pricing goes beyond the fiscal area, covering not only energy and carbon taxation, but any policy which explicitly or implicitly, directly or indirectly, put a price of carbon, and in particular ETS systems. The existing indicators thus focus on three market-based tools: ***ETS, carbon taxes, and energy taxes.*** The effects of these policies are summed or combined to obtain a single estimate, expressed in EUR / tonne of CO_2 of the fiscal and non-fiscal price of carbon in a given jurisdiction. The full value of energy taxes is attributed to the carbon price, without consideration of the pricing of other externalities. The methodologies also attempt to account for overlaps between ETS and carbon taxes; while these overlaps are usually limited, there is little information on this aspect.

The OECD also publishes the ***share of emissions priced above given thresholds*** and the ***Carbon Pricing Gap***, which can be used to monitor the distance between the current carbon price and what is deemed necessary to mitigate the harm from climate change. These indicators can be considered more policy relevant than the carbon price, because they directly answer the question "to what extent are fiscal and other policies correctly pricing carbon" and require no aggregation. Unfortunately, current estimates suffer from a time-lag of up to three years, which would need to be significantly narrowed if these are to become an indicator used to monitor fiscal policies.

Themes for discussion

- *Are current indicators on implicit / effective tax rate per country level sufficient for policymaking use? Are they used in your country? Could they be integrated within the European Semester framework?*
- *Is there a need to provide additional / better indicators on implicit tax rates per sector or energy products? Have they been developed in your countries?*
- *Should the assessment of energy subsidies be included among monitoring indicators for fiscal policies? If yes, through which methodology / data source? What is the experience of your country in measuring energy subsidies, and how are these estimates used in policymaking?*
- *Are carbon prices relevant in the definition of fiscal policies in your countries? If yes, how are these indicators used in policymaking? Are there any short-comings to the definition and use of these indicators?*

Information gaps, policy needs and way forward

The importance of ***energy and climate change policies*** has been increasing rapidly in the agenda of the EU, with ambitious greenhouse gas emission reduction objectives set in a number of policy initiatives, lastly culminated in the EU Green Deal. Energy taxation has increasingly been called to contribute to the achievement of these objectives through both a reform of the Energy Taxation Directive) and a more general reconsideration of the national energy taxation policies in the framework of the European Semester

As the EU embarks in the Green Deal initiative and seems geared towards the achievement of ambitious CO_2 reduction objectives, the analysis above shows the limitations in the availability of ***fully comparable energy taxation indicators at the EU level***, and those existing are relatively disconnected from the underlying policy framework. At present the EU publishes indicators on i) energy taxation revenues as a percentage of GDP and ii) as a percentage of total tax revenues. ESTAT and TAXUD also publish the implicit tax rate (nominal and variously indexed) for the economy as a whole. There are no EU indicators on carbon pricing or implicit tax rate per industrial sector. Energy affordability indicators have been borrowed from statistics on the price of electricity, natural gas, and heating fuels (but not kerosene) from the Oil Price Bulletin.

At the moment, the European semester monitoring process includes two indicators related to environmental taxes, that are the ratio of environmental taxes to labour taxes and the environmental taxes as a share of GDP. However, no energy tax indicator is included.[5]

Within the framework of the Excise Duty Tables, Member States provide non-harmonised data that allow the calculation with some degree of approximation of a further indicator on revenues from transport fuels, which could then be compared to GDP and total (energy) tax revenues. A further breakdown by type of product is provided by some Member States, but there is no regular information system based on the categories of the Excise Duty Tables. Furthermore, there are very limited indicators linking ***energy taxation with the broader objectives of EU energy policy*** or with the related policy tools (e.g. air pollutants, effort sharing regulation, energy security).

Any substantial improvement to this scenario presupposes some interventions on the underlying ***datasets***. The information is often already collected, but its classification is unfit for policy purposes, and disagreements remain among different sources. In other cases, datasets should be built from scratch or substantially updated. Finally, certain data can be retrieved from existing non-EU data providers, such as the IMF and the OECD. All this raises possible feasibility constraints, as different Member States can be in different positions to meet these information needs.

Themes for discussion

- *Are there policy information needs insufficiently covered at the EU level? What are the areas where comparison with other experiences is most sought after and where the EU can provide added value by ensuring comparability and harmonisation of data?*
- *Which of the existing EU indicators should be further strengthened, and how?*

[5] A simplified version of the NACE 64 sectoral breakdown was used among the indicators to monitor the Europe 2020 strategy, and in particular the Resource Efficiency Flagship Initiative. Still, the underlying dataset has some limitations in data comparability (e.g. comparability of vintage versions, treatment of non-residents).

- *Is there a need to create new EU indicators, or retrieve them from other institutions? Which ones?*
- *Which energy tax indicator(s) – existing or not – could be used as a monitoring tool within the framework of the European Semester? Is there a need for contextual indicators to complement specific energy tax indicators?*
- *To what extent are improvements or new indicators feasible and realistic? Should, in parallel, energy taxation information systems be strengthened in your countries? If so, in which areas?*

APPENDIX A. INDICATORS REVIEWED

Indicator	Source	Type
Energy taxation revenues		
1. Revenue from Energy Taxation as a % of GDP	Eurostat, DG TAXUD	Database
2. Revenue from Energy Taxation as a % of GDP	OECD	Database
3. Revenue from Energy Taxation as a Share of Total Revenues	Eurostat, DG TAXUD	Database
4. Energy Taxes by Paying Entities and Industrial Sector	Eurostat	Database
5. Transport Fuel Taxation as a % of GDP	DG TAXUD	Reports
6. Transport Fuel Taxation as a Share of Total Revenues	DG TAXUD	Reports
Implicit/Effective Tax Rates		
7. Implicit Tax Rates	DG TAXUD, Eurostat	Database
8. Effective Tax Rate: Taxing Energy Use	OECD	Database
9. Share of Taxes on Gasoline and Diesel Fuel Prices. Oil Weekly Bulletin	DG ENER	Reports
10. RES - Effective Tax Rates	CEER	Reports
11. Natural Gas and Electricity Prices	Eurostat	Database
12. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries	DG GROW	Reports
13. Energy Prices, Costs, and Subsidies	DG ENER	Reports
Carbon pricing		
14. Effective Carbon Price	IMF	Reports
15. Effective Carbon Rate	OECD	Reports
16. Share of Emissions Priced at a Given Level	OECD	Reports
17. Carbon Pricing Gap	OECD	Reports
18. State and Trends of Carbon Pricing	World Bank	Database
Corrective Tax Rates		
19. Corrective Tax Rates on Fuels	IMF	Database
20. Corrective Tax Rates on Emissions	IMF	Database
21. Transport Taxes and Charges	DG MOVE	Reports
Correlation and Model-based Indicators		
22. Correlation between Average Effective Tax Rates and Energy Intensity of GDP	OECD	Reports
Assessment of Energy Subsidies		
23. Energy Taxation and Subsidies in Europe	International Association of Oil and Gas Producers	Reports
24. Europe's Fossil Fuel Subsidies	ODI	Reports
25. Support and Tax Expenditures for Fossil Fuels	DG ENV	Reports / Database
26. Inventory of Fossil Fuel Subsidies	OECD	Reports / Database
27. Total Amount of Fossil Fuel Subsidies	IMF	Database
Energy consumption		
28. Physical Energy Flow Accounts	Eurostat	Database
29. Purchases of Energy Product	Eurostat	Database

APPENDIX B. APPRAISAL FRAMEWORK

Key Indicator Features	Judgment Criteria	Ways of Measurement	Critical Questions
Policy relevance	What are the goals of the indicator? What does it aim to highlight?	Policy Relevance Non-Ambiguity	▪ Does the indicator relate to important policy debates? Is there consensus among policymakers / stakeholders on the issues worth monitoring? ▪ Are the concepts used clearly defined? Or are there areas of ambiguity in definitions?
	Is the indicator helpful to highlight a clear need for intervention or to monitor existing policies?	Responsiveness Comprehensiveness	▪ Does the indicator correctly reflect change in underlying policies? ▪ Is it possible to change the indicator (only) by means of policy action? ▪ Are there benchmarks / reference points available to define the adequacy of underlying policy? ▪ Is the indicator unambiguous in its interpretation about the existence / magnitude of policy needs / outcomes of existing policies? ▪ Does the indicator need to be integrated/complemented by other indicators to cover other concurrent aspects?
Analytical soundness	Is the indicator technically robust and based on reliable data?	Analytical Soundness Robustness in assumptions Robustness over time	▪ Does the indicator directly measure the problem? ▪ To what extent is the indicator sensitive to changes in underlying assumptions? ▪ Is the indicator consistent over time, and what is the resulting uncertainty? ▪ Is the indicator consistent with other similar indicators referred to the same period?
	Does the indicator have a transparent methodology?	Transparency Communicability	▪ Has the methodology been published? ▪ Is the indicator fully replicable by third parties based on available public data or does it depend on hidden/proprietary variables? ▪ Can a layman understand how the indicator has been built?
	Has the indicator been proposed by a reliable source?	Credibility Independence	▪ Does the indicator come from a credible source? ▪ Are the indicator inputs validated by an independent statistical entity or provided by Government sources?
Measurability	What is the geographical coverage?	Geographical Coverage Intra EU Comparability Extra EU Comparability	▪ Are all EU Member States covered? ▪ Is coverage homogenous between Countries or are there differences in indicator composition / data availability? ▪ Are comparisons available / possible with third countries?
	What is the timing and frequency of the indicator?	Frequency Timeliness Regularity Sustainability	▪ What is the time period of the indicator? ▪ How quickly can policy results be expected to materialise ▪ Has the indicator been released just once on a pilot basis, or is it published / updated at regular intervals? ▪ Can it be reasonably deemed that the indicator is sustainable and will be also available in the future?
	What is the scope of the indicator?	Completeness Level of detail Range of available versions	▪ Is it feasible to include in the indicator all the items that are deemed necessary? ▪ If not, what is the degree of coverage of the requested items? Is the indicator available at the requested level of disaggregation? ▪ Is the indicator available upon request in multiple versions (e.g. both with and without certain optional or controversial items?

Study on Energy Taxation Indicators

SYNTHESIS DOCUMENT

WORKSHOP WITH
MEMBER STATES REPRESENTATIVES

ONLINE
JUNE 5TH, 2020

REPRESENTATIVES FROM THE MINISTRIES OF ENVIROMENT

INSTRUCTIONS FOR THE WORKSHOP

- You will receive an invitation via e-mail. Kindly confirm your attendance to the meeting.
- The meeting will be held on the Webex platform.
- The meeting can be accessed from 14:45 onwards via one of the following modalities:
    - Online. If available, please use the Chrome browser;
    - By downloading the Cisco Webex Meeting application;
    - Via phone (landline or mobile). National call-in numbers can be found at the following link.
- To access the meeting online or via the application, click on the green button in your e-mail invitation. To access the meeting via phone, please take note of the meeting number and password, both included in your e-mail invitation.
- All participants will be muted at the beginning of the meeting and the Chair will unmute speakers when appropriate.
- Participants should keep their cameras off, unless when speaking
- To ask for the floor, type your name and organisation in the chat box.
- When giving you the floor, the Chair will unmute you. Please mute yourself again at the end of your intervention.
- Each session is structured as follows:
    - The Consultants will deliver a presentation (10 to 15 minutes), reporting on the preliminary findings of the Studies;
    - This will be followed by questions and discussions; participants are kindly asked to provide feedback on the Study findings and methodologies, addressing the themes for discussions and questions included in this document.

AIM AND AGENDA

Aim of the meeting

The workshop aims at sharing preliminary findings from the Study with Member State representatives, in view of eliciting feedback and inputs on indicators used to inform national energy tax policies, policy needs, and information gaps. The information collected via the workshop and the online / e-mail questionnaire will be used to finalize the analysis and provide recommendations and ways forward on the use of existing indicators, their refinement, and the creation of new tools. The workshop will be complemented by a parallel exercise with the Ministries of Finance, which will review more in details fiscal aspects. Background materials, instructions for the workshop, and the questionnaire will be shared with participants one week in advance

Agenda

14:45 **Meeting opens, participants dial in**

15:00 **Introduction to the Study** [DG TAXUD]

15:10 **Section 1. State of the art: existing indicators and their use in policymaking**

- What we aim at assessing: the appraisal framework
- Overview of existing energy taxation indicators, best practices, issues identified

15:35 **Section 2. How to link energy taxation indicators with climate change policies**

- Carbon taxes as a subset of energy taxes
- Measuring energy subsidies
- Carbon pricing and climate policies indicators

16:00 **Coffee break**

16:10 **Section 3. Energy taxation and coherence with other goals of energy policies**

- Energy taxation and the role of implicit tax rates as determinants of energy efficiency
- Energy taxation and energy security, including affordability
- Energy taxation and air pollution other than CO_2 emissions

16:35 **Section 4. Information gaps, policy needs and way forward**

- What information current indicators can provide to policymakers
- The use of energy tax indicators at the European level and eventually for the European Semester
- Information gaps and available sources to fill them

16:50 **Questions and Answers; Closing remarks**

17:00 **End of the meeting**

PRELIMINARY FINDINGS FROM THE STUDY AND ISSUES FOR DISCUSSION

Policy Background

The importance of energy and climate change policies has been escalating rapidly in the agenda of the EU, with ambitious greenhouse gas emission reduction objectives set in a number of policy initiatives, lastly culminated in the EU Green Deal. Energy taxation has increasingly been called to contribute to the achievement of these objectives through both a reform of the Energy Taxation Directive) and as part of the focus on sustainable growth in the framework of the European Semester.

State of the art: existing indicators and their use in policymaking

Many indicators on energy taxation are available in the public domain, from both European and international organisations, although with varying levels of detail. Also, private bodies have been extensively involved in the production of indicators from ad hoc studies commissioned by different DGs with a certain regularity. In this respect, there is no lack of information, as the available indicators cover many different and complementary aspects relevant for policymaking. The Study so far has reviewed 29 of such indicators, and grouped them into four main families:

1. Indicators to measure ***revenues from energy taxation*** and their weight on certain reference values (typically, GDP and total taxation revenues).
2. ***Implicit or effective tax rates***, aiming at measuring the average tax burden, net of subsidies, for a country, industrial sector, energy use, or fuel. This can be done starting from actual energy tax revenues. They are usually expressed in EUR per volume (e.g. tonne, 1000 litres) or energy content (e.g. TOE, GJ, MWh).
3. ***Carbon pricing tools*** attempt at measuring the tax burden associated to carbon emissions in a given country, sector or use, as resulting from the joint effect of energy and carbon taxes and Emission Trading System (ETS) permits; they are usually expressed d in EUR ($) per tonne of CO_2 equivalent.
4. Another family of relevant indicators do not measure taxes, strictly speaking, but ***subsidies***, i.e. foregone tax revenues, because of exemptions, reimbursements, or rebates. Subsidies can be measured (i) top-down, based on the price-gap methodology, (ii) bottom-up, by compiling a list of direct transfers and tax expenditures, or (iii) based on a Pigouvian rationale, i.e. measuring the difference between actual rates and those that would cover external costs caused by energy consumption (e.g. climate change, air pollution, congestion).

Other energy taxation indicators that have been introduced on a more experimental or non-continuous basis, including (i) indicators of ***corrective tax rates*** that would compensate for the environmental damage (the so called externalities) of the different energy products, and (ii) ***indicators from models and correlations*** that try to put into relation tax indicators with other phenomena that may be affected (e.g. energy efficiency). Finally, the review also includes two indicators on ***energy consumption*** which are, or can be, used to build other indicators (e.g. implicit and effective tax rates)***.***

The full list of indicators is reported in Appendix A. For each of them, the Consultants have assessed their policy relevance, analytical soundness, and measurability; the appraisal framework is reported in Appendix B.

The more 'traditional' energy tax indicators, i.e. those measuring ***revenues*** and ***implicit tax rates***, were designed to measure the fiscal burden in countries and on sectors and products, so to assess the extent to which national fiscal policies pursued 'green' objectives. Their methodology remains analytically sound even today, and present no or very limited issue of measurability, credibility, and transparency. However, their policy relevance has diminished for two reasons. First, the growing relevance of quasi-fiscal measures and tradable permits (e.g. Renewable Emission Sources – RES – charges, Emission Trading System – ETS) that poorly fit with traditional classification criteria. Secondly, the shift of the policy agenda towards climate change objectives that increasingly challenge the significance of energy taxation as a standalone analytical category. Also, the policy evolution strained the definition of 'energy tax', on which these indicators are based, thus reducing their capacity to produce meaningful cross-country comparisons. Finally, these indicators are usually unfit to measure the sectoral energy tax burden, especially on energy intensive industries.

On the other hand, there are two families of indicators whose policy relevance has grown over the last years: carbon prices and subsidies. However, being newer, their methodology is not yet settled, they remain more complex to communicate, and their publication is less frequent, with considerable time-lag. More in details:

- On ***carbon pricing***, the two leading analyses and indicators are currently published by the IMF and the OECD, measuring both the price of carbon as resulting from the joint effect of energy and carbon taxes and tradable permits policies, as well as the distance between national policies and the efforts required to limit climate change.
- As for ***subsidies***, the amount of information is large and growing, both in quantity of countries and measures covered, and quality of data. In this area, the crux is the measurement of tax expenditures, which strongly depends on the benchmark used. Most importantly, subsidy indicators can sometimes respond distortedly to policy choices, as an increase in energy tax rates can at the same time worsen the subsidy estimates.

In conclusion***, the change in policy priorities over the last decade reduced the policy relevance of traditional energy tax indicators***, those with an established and clear methodology. Therefore, they should be revamped and adjusted to allow their instrumental use in policymaking. On the other side of the spectrum, ***new indicators emerged to address the new policy needs, but their methodologies are not yet consolidated***. Importantly, the EU is not among the main producers of these new indicators.

The objective of improving, refining, and extending all families of indicators thus seems meaningful and worth investing, while acknowledging the limits of a pure quantitative approach, as well as feasibility constraints. Indeed, there appears to be no 'silver bullet' around, but several possible improvements and ways forward.

Themes for discussion

- *Considering the indicators included in Appendix A, are they used to inform policymaking in your country? Please provide examples on their use*
- *Has your country developed additional or different energy tax indicators? If yes, are they used to inform policymaking? Please provide examples of their use.*
- *Do you have any feedback on the appraisal framework included in Appendix B (e.g. missing elements, unclear aspects)?*

How to link energy taxation indicators with climate change policies

Fiscal measures, including energy taxes, are included among carbon pricing tools, i.e. those market-based instruments which "put a price" on carbon emissions. The main carbon pricing tools include ***carbon taxes, ETS permits, and energy taxes***. Carbon taxes and ETS are the main market-based mechanisms used to put an explicit price on carbon. Implicit pricing tools include those that indirectly result in a carbon price, even though the relevant price or rate is not expressed per tonne of CO_2 equivalent. This is for instance the case of energy taxes, whose rates are normally expressed per calorific content or unit of volume.

The EU framework does not explicitly provide for a carbon tax. An attempted revision of the Energy Taxation Directive in 2011 failed to tax energy products partly based on their carbon content. Ten EU Member States have introduced carbon taxes, usually within the existing tax framework, i.e. under the umbrella of the Energy Taxation Directive: Denmark, Estonia, Finland, France, Ireland, Latvia, Poland, Portugal, Slovenia, and Spain. The tax rate and coverage are defined at the national level; most of the EU countries exempt emissions covered by the ETS from the excise carbon component.

Data revenues from carbon taxes are available in the EU National Tax List only for few countries (e.g. Denmark, Ireland) In a number of countries, revenues from carbon taxes are accounted among excise duties, and not shown separately. Furthermore, information on whether they overlap with other energy taxes and ETS is also limited. Except for what is reported in the OECD PINE database, there is no information on whether carbon taxes are earmarked, as this information is provided only as far as revenues from ETS auctions are concerned. As for the overlaps between ETS and carbon taxes, this seemingly happens in a limited number of cases; however, very little information is available on this specific aspect.

Over the last years, a number of publications attempted to quantify ***carbon pricing*** and to build a number of policy indicators based on such estimates, in particular by the OECD and the IMF. The existing indicators focus on three market-based tools discussed above: ETS, carbon taxes, and energy taxes. The effects of these policies are summed or combined to obtain an estimate, expressed in EUR / tonne of CO_2 of the price of carbon in a given jurisdiction. In the OECD publication, a breakdown of carbon pricing for six different sectors of the economy is also available (road transport, off-road transport, industry, agriculture and fisheries, residential and commercial, and main electricity generation).

However, ***methodologies differ between the OECD and IMF***. First, the OECD captures the carbon price "as it is today", while the IMF tries to calculate the level of carbon price needed to achieve Paris pledges, also taking into consideration the contribution of other policies. Secondly, the two publications adopt a different method for aggregating the effects of the three tools. All in all, this seemingly results in potentially divergent estimates of carbon prices.

Both the IMF and the OECD accompany their carbon pricing estimates with other indicators ***assessing the distance between carbon price levels, and those which would achieve certain results in terms of CO_2 reduction.*** These indicators can be considered more policy relevant than the carbon price, because they directly answer the question "to what extent are fiscal and other policies correctly pricing carbon" and require no aggregation. Unfortunately, current estimates suffer from a time-lag of up to three years, which would need to be significantly narrowed if these are to become an indicator used to monitor fiscal policies.

More in detail, the OECD publishes both the share of emissions priced above a certain level and the Carbon Pricing Gap. The former provides an assessment of the share of CO_2 emissions above thresholds that are considered sufficient to limit impacts of climate change (0 / 5 / 30 / 60 EUR/tonne of CO_2), the latter measures the difference between a country's carbon pricing policy and that needed to meet the necessary benchmark prices. While OECD benchmarks are exogenous, the IMF measures the distance against nationally (endogenously) determined targets.

Finally, many studies, databases, and repositories have been developed on ***energy subsidies*** by European and international institutions over the recent years, such as DG ENER, DG ENV, the IMF, and the OECD. The estimation of energy subsidies is based on three approaches:

- ***Top-down approach***: the subsidy is calculated as the difference between the price of an energy source (e.g. the international price of oil) and local tax-inclusive retail prices (e.g. the price of gasoline). This approach is of limited relevance in the EU, as tax-inclusive prices tend to be invariably higher than international benchmarks.
- ***Bottom-up approach***: the subsidy is calculated as the sum of direct transfers granted to energy producers and consumers, and foregone revenues not levied. While the calculation of direct budgetary support is relatively straightforward, the matter is for tax expenditures, because they can only be measured against a benchmark.
- A third approach, used only by the IMF, is ***pigouvian***. In this case, subsidies are calculated as the difference between all the environmental externalities generated by the consumption of the various energy products and tax burdens.

Significant methodological differences exist among the various sources of information of subsidies, starting from the lack of an agreed definition of what an 'energy subsidy is'. Other discrepancies concern the measures in scope of the estimates, the various providers of subsidies considered, and the measurement of the value of subsidies especially for tax expenditures.

The definition of a benchmark is the most important problem for these indicators. Different benchmarks can result in estimates varying by one or two orders of magnitude. Benchmarks can be defined as exogenous to the fiscal system and derived from a policy objective. Otherwise, as is commonly the case, the benchmark is endogenous to the tax system, and consists in the highest applicable tax rate for comparable uses. This means that any reduction or exemption from the highest tax rate is considered a tax expenditure, and then a subsidy. From a policy perspective, endogenous benchmarks create ***paradoxes and distorted policy incentives***. For instance, if the rate of gas oil is increased and exemptions remains, subsidies would increase. Hence, a government decision to increase taxation of fossil fuels would result in a worsening of its fuel subsidy indicator. The OECD repository circumvents the benchmark definition problem by relying on 'nationally-established benchmarks'; this implies that rather than defining what a uniform methodology for establishing a benchmark, it accepts the quantification of tax subsidies carried out at national level. It goes without saying that this admittedly limits the comparability of tax expenditures estimates.

Themes for discussion

- *Are more data needed on the revenues from and design of carbon taxes to better inform policymaking at EU or national level?*

- *Do you consider the existing carbon price indicators fit for policymaking use? What is your view on the strengths and weaknesses of the methodologies proposed?*
- *Are carbon prices relevant in the definition of fiscal policies in your countries? If yes, how are these indicators used in policymaking?*
- *Should the assessment of energy subsidies be included among monitoring indicators for fiscal policies? If yes, through which methodology / data source? What is the experience of your country in measuring energy subsidies, and how are these estimates used in policymaking?*

Energy taxation and coherence with other goals of energy policies

From an environmental policy perspective, energy taxation aims firstly at increasing prices to reduce consumption, and therefore increasing energy efficiency in the long run (net of the rebound effects). However, energy taxes can also be designed to promote the achievement of other objectives, both in the environmental and other policy areas. The EU energy policy objectives include:

1. ***energy security*** – which would require that domestic sources of energy were taxed at preferential rates compared to imports;
2. ***energy affordability,*** which would require that taxation of primary energy products should not disproportionally weight on the available income of the poorer segments of the population.
3. within the environmental policy areas, ***reduction of air pollutants*** (e.g. NO_X, SO_X and PM), other than greenhouse gases**.**

The achievement of these objectives by means of fiscal measures, e.g. preferential tax rates, is not always mutually compatible and ***trade-offs*** may emerge. The most notable ones can be summarised as follows:

- an increase in the ***level of energy taxes*** has a positive impact on energy efficiency and reduces energy consumption. Depending on the source of energy, this could also translate in lower Greenhouse Gas (GHG) and air pollutant emissions. However, taxes increasing the prices of electricity or heating negatively affect energy affordability;
- ***support to renewables*** decreases GHG emissions and air pollution and can improve primary energy availability, thus reducing dependence on imports. Price increases due to RES charges can contribute to energy efficiency. In that case, if related costs are borne by households this may worsen energy affordability. If support to RES is paid, instead, by means of general taxation GHG emissions are reduced and energy availability is improved, but the incentive to improve energy efficiency disappears, together with the negative effect on energy affordability;
- ***carbon taxes*** can increase the level of energy prices, or may aim be designed to be price neutral by substituting other energy taxes. When this is the case, they cannot further contribute to the achievement of energy efficiency objectives but would maintain nevertheless a long-term incentive to decrease GHG emissions by switching to low-carbon energy sources;
- the promotion of ***biomasses and biofue*ls** can contribute to GHG reduction (although this is debated in the literature), but related preferential taxation can be detrimental in terms of air pollutants. Depending on their nature, biomasses and biofuels can still substantially contribute to increase other polluting emissions (e.g. particulate matter, nitric or sulphur oxide);
- the ***structure of the energy taxes and excise rates*** can be geared towards energy efficiency by means of preferential rates. This can go to the detriment of pollution and GHG emission reduction, if rates do not reflect the carbon content or the impact

on air pollution (e.g. diesel vs. gasoline for cars). The same can be said of preferential tax rates favouring national fossil sources (e.g. coal, peat) for energy security purposes, which can reduce dependence on imports but be detrimental for climate change and air pollution;

- national ***carbon or coal taxes applied on companies under the ETS*** do contribute to local pollution reduction and increase the level of national prices thereby providing incentives for energy efficiency. They might reduce the total CO_2 emissions at the national level, but this impact extends to the EU level only under certain conditions, i.e. that the ETS does not operate 'by the cap', otherwise the total impacts net off.
- although addressed to other environmental externalities, ***taxes on emissions of air pollutants*** can also crowd out the GHG reduction efforts under the ETS and reduce the price of permits;
- ***reduced VAT rates and excise rebates*** can be provided to smooth energy affordability; however, these tax expenditures reduce incentives for energy efficiency. Other forms of consumer revenue support may not act on prices and therefore maintain these incentives.

The field of indicators to monitor the contribution of energy taxation to the achievement of other policy objectives has just been opened and still appears relatively ***underdeveloped***. In some areas, progress has been achieved:

- Indicators on ideal tax rates to compensate externalities have been developed by the IMF (so called ***corrective tax rates***) and become the focus of attention in a number of policy areas (e.g. transport fuels). The robustness of these indicators, however, crucially depends on assumptions, and in particular on the value of a statistical life.
- The OECD has attempted to introduce an innovative correlation indicator between effective tax rates and energy intensity, to demonstrate the energy saving impact of taxation levels;
- Indicators on the contribution of taxation to the prices of electricity and natural gas, as well as of heating fuels, exist, covering ***energy affordability*** aspects;
- Comparisons with the external benchmark achieve a certain policy objective has been extensively used in the field of GHG emission reductions only (e.g. the 30 and 60 EUR/tonne of CO^2 used by the OECD). This approach has not been extended to other policy areas yet.

However:

- There is no breakdown available at the EU level of energy-related taxation of air pollutants (an environmental tax classification inclusive of taxation of air pollutants is being proposed by the OECD in their methodological guidelines, but it is unclear whether revenue data will be separately collected);
- Measurement of contribution to energy efficiency would presuppose an index of energy prices that is not there;
- To the best of our knowledge nobody has ever calculated an implicit tax rate of imported vs. domestic energy sources;
- Revenues from ETS cannot be split by energy and process-related emissions or by sector;
- There are GHG emission reduction targets under the Effort Sharing Regulation, but there are no data on emission-related taxation revenues collected in the same areas covered by this instrument, so no assessment is possible of the level of taxation effort devoted to the achievement of these objectives.

Given the above, very little can be said about the contribution of energy taxation to the achievement of other objectives. To ***measure coherence*** between energy taxation and other polices, the underlying incentives provided by taxes should be measured in a homogenous way, and the effects allocated to the various objectives by means of a pre-defined policy reference framework. However, this requires a revolution in the way information is made available. The resulting matrix could allow to calculate both the share of fiscal resources devoted to the different policy objectives, and the amount of incentives simultaneously pursuing conflicting ones.

Themes for discussion

- *Have other indicators been developed at the national level to measure the contribution of energy taxation to the achievement of other objectives? If yes, please describe the indicators, their use, and lessons to be learnt*
- *Have IMF estimates of corrective tax rates been used in policymaking at national level? Have similar estimates been developed? Are there reservations on their policy use and data comparability?*
- *Is it feasible to make energy taxation data classification more granular to improve the possibility of correlation with other policy objectives?*
- *Is measuring coherence among policy objectives that can be achieved via tax rates and incentives necessary for policymaking purposes?*

Information gaps, policy needs and way forward

The importance of ***energy and climate change policies*** has been increasing rapidly in the agenda of the EU, with ambitious greenhouse gas emission reduction objectives set in a number of policy initiatives, lastly culminated in the EU Green Deal. Energy taxation has increasingly been called to contribute to the achievement of these objectives through both a reform of the Energy Taxation Directive) and as part of the focus on sustainable growth in the framework of the European Semester

As the EU embarks in the Green Deal initiative and seems geared towards the achievement of ambitious CO_2 reduction objectives, the analysis above shows the limitations in the availability of ***fully comparable energy taxation indicators at the EU level***, and those existing are relatively disconnected from the underlying policy framework. At present the EU publishes indicators on i) energy taxation revenues as a percentage of GDP and ii) as a percentage of total tax revenues. ESTAT and TAXUD also publish the implicit tax rate (nominal and variously indexed) for the economy as a whole. There are no EU indicators on carbon pricing or implicit tax rate per industrial sector. Energy affordability indicators have been borrowed from statistics on the price of electricity, natural gas, and heating fuels (but not kerosene) from the Oil Price Bulletin.

At the moment, the European semester monitoring process includes two indicators related to environmental taxes, that are the ratio of environmental taxes to labour taxes and the environmental taxes as a share of GDP. However, no energy tax indicator is included.[6]

Within the framework of the Excise Duty Tables, Member States provide non-harmonized data that allow the calculation with some degree of approximation of a further indicator on revenues from transport fuels, which could then be compared to GDP and total (energy) tax

[6] A simplified version of the NACE 64 sectoral breakdown was used among the indicators to monitor the Europe 2020 strategy, and in particular the Resource Efficiency Flagship Initiative. Still, the underlying dataset has some limitations in data comparability (e.g. comparability of vintage versions, treatment of non-residents).

revenues. A further breakdown by type of product is provided by some Member States, but there is no regular information system based on the categories of the Excise Duty Tables. Furthermore, there are very limited indicators linking ***energy taxation with the broader objectives of EU energy policy*** or with the related policy tools (e.g. air pollutants, effort sharing regulation, energy security).

Any substantial improvement to this scenario presupposes some interventions on the underlying ***datasets***. The information is often already collected, but its classification is unfit for policy purposes, and disagreements remain among different sources. In other cases, datasets should be built from scratch or substantially updated. Finally, certain data can be retrieved from existing non-EU data providers, such as the IMF and the OECD. All this raises possible feasibility constraints, as different Member States can be in different positions to meet these information needs.

Themes for discussion

- *Are there policy information needs insufficiently covered at the EU level? What are the areas where comparison with other experiences is most sought after and where the EU can provide added value by ensuring comparability and harmonization of data?*
- *Which of the existing EU indicators should be further strengthened, and how?*
- *Is there a need to create new EU indicators, or retrieve them from other institutions? Which ones?*
- *Which EU energy tax indicator – existing or not – could be used as a monitoring tool within the framework of the European Semester? Is there a need for contextual indicators to complement specific energy tax indicators?*
- *To what extent are improvements or new indicators feasible and realistic? Should, in parallel, energy taxation information systems be strengthened in your countries? If so, in which areas?*

APPENDIX A. INDICATORS REVIEWED

Indicator	Source	Type
Energy taxation revenues		
1. Revenue from Energy Taxation as a % of GDP	Eurostat, DG TAXUD	Database
2. Revenue from Energy Taxation as a % of GDP	OECD	Database
3. Revenue from Energy Taxation as a Share of Total Revenues	Eurostat, DG TAXUD	Database
4. Energy Taxes by Paying Entities and Industrial Sector	Eurostat	Database
5. Transport Fuel Taxation as a % of GDP	DG TAXUD	Reports
6. Transport Fuel Taxation as a Share of Total Revenues	DG TAXUD	Reports
Implicit/Effective Tax Rates		
7. Implicit Tax Rates	DG TAXUD, Eurostat	Database
8. Effective Tax Rate: Taxing Energy Use	OECD	Database
9. Share of Taxes on Gasoline and Diesel Fuel Prices. Oil Weekly Bulletin	DG ENER	Reports
10. RES - Effective Tax Rates	CEER	Reports
11. Natural Gas and Electricity Prices	Eurostat	Database
12. Composition and Drivers of Energy Prices and Costs in Selected Energy Intensive Industries	DG GROW	Reports
13. Energy Prices, Costs, and Subsidies	DG ENER	Reports
Carbon pricing		
14. Effective Carbon Price	IMF	Reports
15. Effective Carbon Rate	OECD	Reports
16. Share of Emissions Priced at a Given Level	OECD	Reports
17. Carbon Pricing Gap	OECD	Reports
18. State and Trends of Carbon Pricing	World Bank	Database
Corrective Tax Rates		
19. Corrective Tax Rates on Fuels	IMF	Database
20. Corrective Tax Rates on Emissions	IMF	Database
21. Transport Taxes and Charges	DG MOVE	Reports
Correlation and Model-based Indicators		
22. Correlation between Average Effective Tax Rates and Energy Intensity of GDP	OECD	Reports
Assessment of Energy Subsidies		
23. Energy Taxation and Subsidies in Europe	International Association of Oil and Gas Producers	Reports
24. Europe's Fossil Fuel Subsidies	ODI	Reports
25. Support and Tax Expenditures for Fossil Fuels	DG ENV	Reports / Database
26. Inventory of Fossil Fuel Subsidies	OECD	Reports / Database
27. Total Amount of Fossil Fuel Subsidies	IMF	Database
Energy consumption		
28. Physical Energy Flow Accounts	Eurostat	Database
29. Purchases of Energy Product	Eurostat	Database

APPENDIX B. APPRAISAL FRAMEWORK

Key Indicator Features	Judgment Criteria	Ways of Measurement	Critical Questions
Policy relevance	What are the goals of the indicator? What does it aim to highlight?	Policy Relevance Non-Ambiguity	▪ Does the indicator relate to important policy debates? Is there consensus among policymakers / stakeholders on the issues worth monitoring? ▪ Are the concepts used clearly defined? Or are there areas of ambiguity in definitions?
	Is the indicator helpful to highlight a clear need for intervention or to monitor existing policies?	Responsiveness Comprehensiveness	▪ Does the indicator correctly reflect change in underlying policies? ▪ Is it possible to change the indicator (only) by means of policy action? ▪ Are there benchmarks / reference points available to define the adequacy of underlying policy? ▪ Is the indicator unambiguous in its interpretation about the existence / magnitude of policy needs / outcomes of existing policies? ▪ Does the indicator need to be integrated/complemented by other indicators to cover other concurrent aspects?
Analytical soundness	Is the indicator technically robust and based on reliable data?	Analytical Soundness Robustness in assumptions Robustness over time	▪ Does the indicator directly measure the problem? ▪ To what extent is the indicator sensitive to changes in underlying assumptions? ▪ Is the indicator consistent over time, and what is the resulting uncertainty? ▪ Is the indicator consistent with other similar indicators referred to the same period?
	Does the indicator have a transparent methodology?	Transparency Communicability	▪ Has the methodology been published? ▪ Is the indicator fully replicable by third parties based on available public data or does it depend on hidden/proprietary variables? ▪ Can a layman understand how the indicator has been built?
	Has the indicator been proposed by a reliable source?	Credibility Independence	▪ Does the indicator come from a credible source? ▪ Are the indicator inputs validated by an independent statistical entity or provided by Government sources?
Measurability	What is the geographical coverage?	Geographical Coverage Intra EU Comparability Extra EU Comparability	▪ Are all EU Member States covered? ▪ Is coverage homogenous between Countries or are there differences in indicator composition / data availability? ▪ Are comparisons available / possible with third countries?
	What is the timing and frequency of the indicator?	Frequency Timeliness Regularity Sustainability	▪ What is the time period of the indicator? ▪ How quickly can policy results be expected to materialise ▪ Has the indicator been released just once on a pilot basis, or is it published / updated at regular intervals? ▪ Can it be reasonably deemed that the indicator is sustainable and will be also available in the future?
	What is the scope of the indicator?	Completeness Level of detail Range of available versions	▪ Is it feasible to include in the indicator all the items that are deemed necessary? ▪ If not, what is the degree of coverage of the requested items? Is the indicator available at the requested level of disaggregation? ▪ Is the indicator available upon request in multiple versions (e.g. both with and without certain optional or controversial items?

ANNEX III - QUESTIONNAIRE FOR MEMBER STATES

	Participant's data
Name	
Surname	
Member State	
Institution	

1. General Appraisal Framework

1.1 Please consider the appraisal framework used to assess energy tax indicators, as included in Appendix B of the Synthesis Document. In case you have additional aspects that should be considered or do not agree on how the various questions and criteria are defined, please provide your comments in the box below.

2. Energy Taxation Revenues

2.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking? Please tick all that apply.

	Energy Taxation Revenues as % GDP (Eurostat, DG TAXUD)
	Energy Taxation Revenues as % total taxation (Eurostat, DG TAXUD)
	Energy Taxation Revenues by Paying Entity / NACE 64 Classification (Eurostat)
	Transport Fuel Taxation Revenues on GDP (DG TAXUD)
	Transport Fuel Taxation Revenues on Total Revenues (DG TAXUD)

2.2 If you ticked any indicator in Question 2.1, please describe briefly how it is used in policymaking, including monitoring or evaluation.

2.3 Please rate the importance of improving the following features of EU Energy Taxation Revenues indicators, also to improve EU data comparability?

	Low	Medium	High
Better accounting of ETS revenue flows			
Removing all subsidies from revenue estimates			
Including also non-deductible VAT charged on energy taxes among revenues from energy taxation			
Better breakdown of revenue data by type of tax			
Better breakdown of revenue data by type of energy product			
Better breakdown revenue data by type of user / industrial sector			
Better identification of RES-related revenue flows			
Separate identification of revenues from ETS on energy emissions and process emissions			

Separate indication of revenues from taxation of environmentally-friendly products (renewables, biofuels, etc)			
Additional indicators on revenue recycling and earmarking			
Better (shorter) timeliness of release			
Availability of indicators in real terms (if you wish, please specify the deflator_________________)			
Other aspects please specify …			

2.4 Please add any further comment you might deem relevant to substantiate your assessment above.

3. Implicit and Effective Tax Rates

3.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking? Please tick all that apply.

	OECD Effective Tax Rate on Energy
	Nominal Implicit Tax Rates on Energy (DG TAXUD)
	Implicit Tax Rates on Energy, deflated (DG TAXUD)
	Implicit Tax Rates on Energy, deflated (Eurostat)
	OECD inventory of fossil fuel subsidies

3.2 If you ticked any indicator in Question 3.1, please describe briefly how it is used in policymaking.

3.3 Please rate the importance of having harmonised indicators at the EU level in the following areas.

	Low	Medium	High
Average tax burden on energy consumption net of subsidies, per country			
Average net tax burden net of subsidies per energy product			
Average tax net tax burden net of subsidies per industry			
Average net tax burden net of subsidies for energy-intensive industries			
Subsidies on energy use / products / consumption			

4. Carbon Pricing

4.1 In your country, is or was any of the following indicators used to monitor and evaluate policies, or as an input to policymaking? Please tick all that apply.

	OECD Effective Carbon Rate
	OECD Carbon Pricing Gap
	Share of emissions above certain thresholds
	IMF Effective Carbon Price

4.2 If you ticked any indicator in Question 4.1, please describe briefly how it is used in policymaking.

4.3 Please rate the importance of addressing the following features of current Carbon Price indicators to help compliance with CO_2 reduction pledges and improve EU data comparability?

	Low	Medium	High
Better distinguish carbon tax revenues from excise duties			
Better distinguish ETS revenues by type of GHG emission (energy vs. process emissions)			
Improve analysis of overlaps between ETS and energy / carbon taxes			
More detail by sector			
More detail of impact of carbon cost on price of electricity production			
Improve transparency of methodology			
Improve timeliness / frequency of indicators			

5. Policy Coherence

5.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking? Please tick all that apply.

	IMF Corrective Tax Rates on Energy Related Air Emissions
	IMF Corrective Tax Rates on Fossil Fuels
	OECD Comparisons between Actual and Expected Energy Intensity and Effective Tax Rates Correlation Coefficients

5.2 If you ticked any indicator in Question 5.1, please describe briefly how it is used in policymaking.

5.3 Please rate the importance of improving the following aspects for the developing of possible future common EU energy taxation indicators?

	Low	Medium	High
Better classify energy taxation revenues by type of correspondent EU relevant policy (e.g. Effort Sharing Regulation, Energy Taxation Directive)			
Harmonise measurement of subsidies granted for energy affordability purposes			
Develop implicit tax rates for domestic and imported sources of energy			

Estimate tax gaps for energy-related air pollutants taxation based on corrective tax rates.			
Classify tax expenditures and other subsidies by type of policy objective pursued (e.g. energy efficiency, affordability, GHG reduction)			
Build overall indicators of policy coherence to measure trade-off among policy objectives			
Other please specify …			

5.4 Please report any domestic indicator you have already developed for any of the areas in question 5.3 above and explain how it is used in policymaking.

6. National Indicators

6.1. Please report if energy taxation indicators on the following areas have been developed / refined in your country and used to monitor energy, fiscal and climate change policies and provide reference to the indicators used.

	Indicator(s) and reference (e.g. publication, weblink)
Energy Taxation Revenues	
Implicit or Effective Tax Rates	
Carbon Pricing	
Estimates of energy subsidies	
Corrective Tax Rates accounting for externalities	
Other different indicators (please specify)	

6.2 If you reported any indicator in Question 6.1, please briefly describe the indicator and explain how it is used in policymaking.

7. The Way Ahead – Summary Overall Assessment

7.1 Please assess the extent to which indicators or quantitative information in the following areas is already reasonably available.

	Sufficient information at international, EU or national level	Insufficient information, additional effort is warranted	Insufficient information, but no additional effort justified
Energy Taxation Revenues			
Energy Taxation Revenues per type of tax (e.g. energy taxes as compared to carbon taxes, intermediate energy production taxes)			

Revenue Recycling and Earmarking Practices			
Implicit / Effective Tax Rates per countries			
Implicit / Effective Tax Rates per sectors			
Carbon Pricing			
Estimates of energy subsidies			
Corrective tax rates accounting for externalities			
Other (please specify)			

7.2 For the areas where further effort is warranted please rate the importance of investing resources to improve data availability and further develop indicators at the EU level.

	Low	**Medium**	**High**
Energy Taxation Revenues			
Energy Taxation Revenues per type of tax			
Revenue Recycling and Earmarking Practices			
Implicit / Effective Tax Rates per countries			
Implicit / Effective Tax Rates per sectors			
Carbon Pricing			
Estimates of energy subsidies			
Corrective Tax Rates accounting for externalities			
Other (please specify)			

7.3 Please tick up to three area which should be monitored via the European Semester.

	Priority #1	**Priority #2**	**Priority #3**
Energy Taxation Revenues (e.g. nominal, real, as a share of GDP)			
Energy Taxation Revenues per type of tax			
Revenue Recycling and Earmarking Practices			
Implicit / Effective Tax Rates per countries			
Implicit / Effective Tax Rates per sectors			
Carbon Pricing			
Estimates of energy subsidies			
Corrective Tax Rates accounting for externalities			
Other (please specify)			

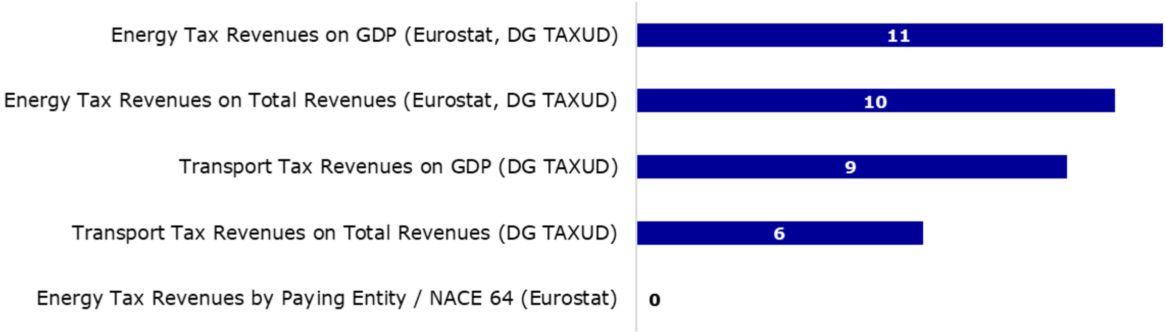
ANNEX IV - SYNOPSIS REPORT

This Annex provides a summary of results of the Member States Survey carried out in the framework of the Assignment. The survey was launched concurrently the Workshop (June, 5) and it remained open until 15 July 2020. A total of 13 responses were received from 11 MS.

The questionnaire consists of 20 questions, grouped into seven sections. Hereby we report results for closed-ended questions. Results from open-ended questions are not relayed due to confidentiality with respondents.

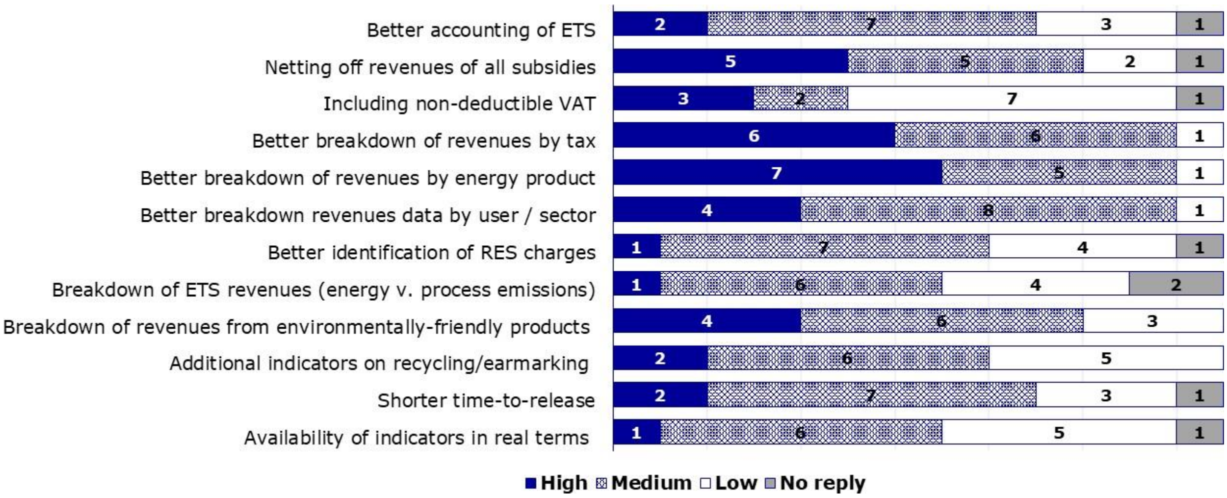
Question 2.1: In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking?

Figure 1 - Number of responses to question 2.1



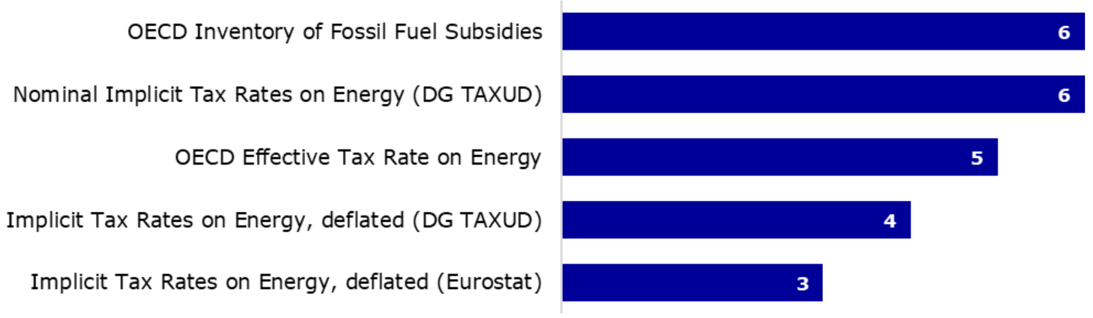
Question 2.3 Please rate the importance of improving the following features of EU Energy Taxation Revenues indicators, also to improve EU data comparability?

Figure 2 - Number of responses to question 2.3



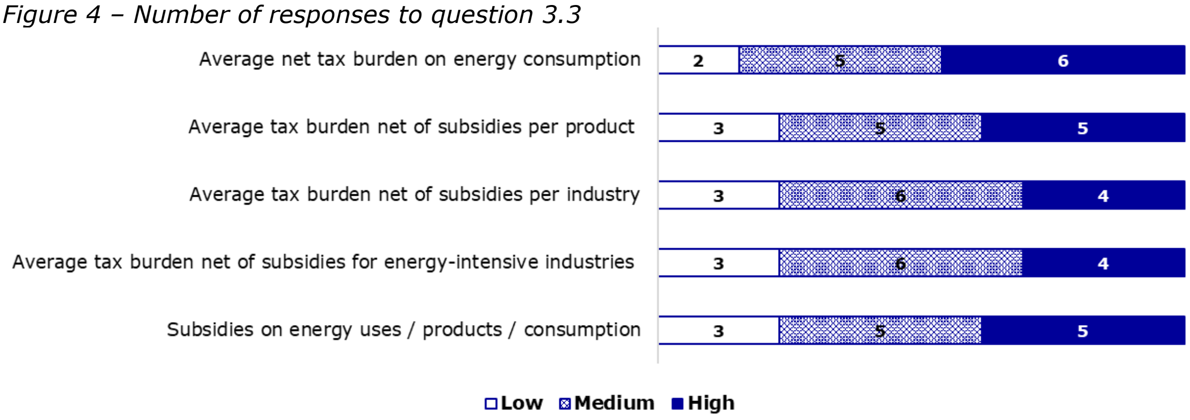
Question 3.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking?

Figure 3 - Number of responses to question 3.1



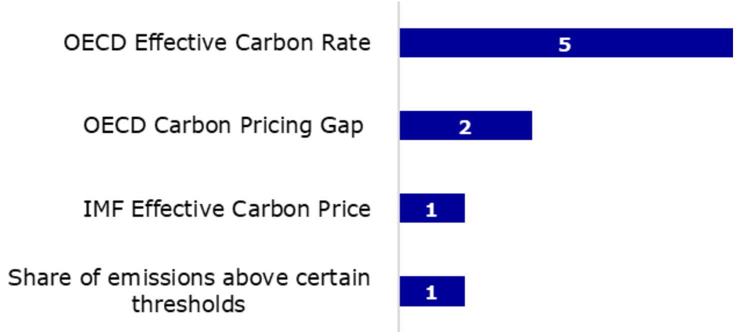
Question 3.3 Please rate the importance of having harmonised indicators at the EU level in the following areas.

Figure 4 – Number of responses to question 3.3



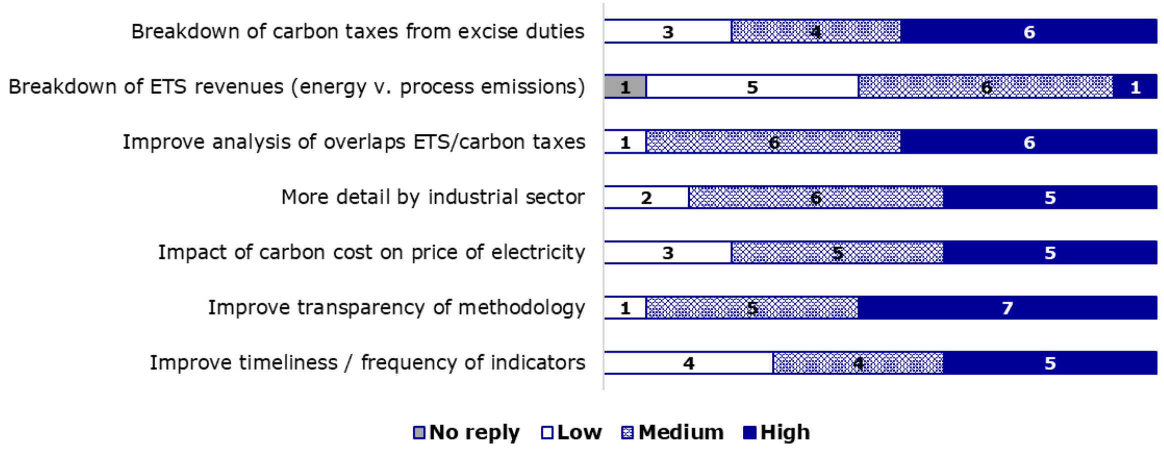
Question 4.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking?

Figure 5 – Number of responses to question 4.1



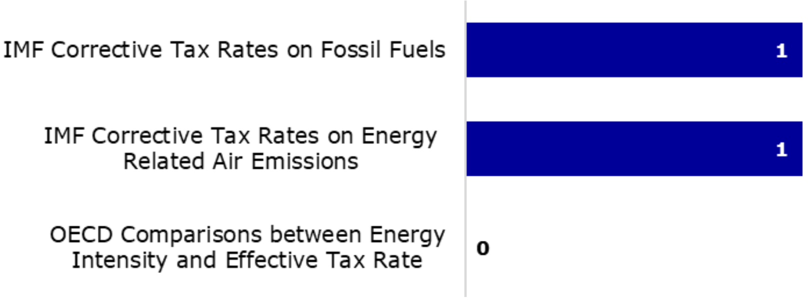
Question 4.3 Please rate the importance of addressing the following features of current Carbon Price indicators to help compliance with CO_2 reduction pledges and improve EU data comparability?

Figure 6 – Number of responses to question 4.3



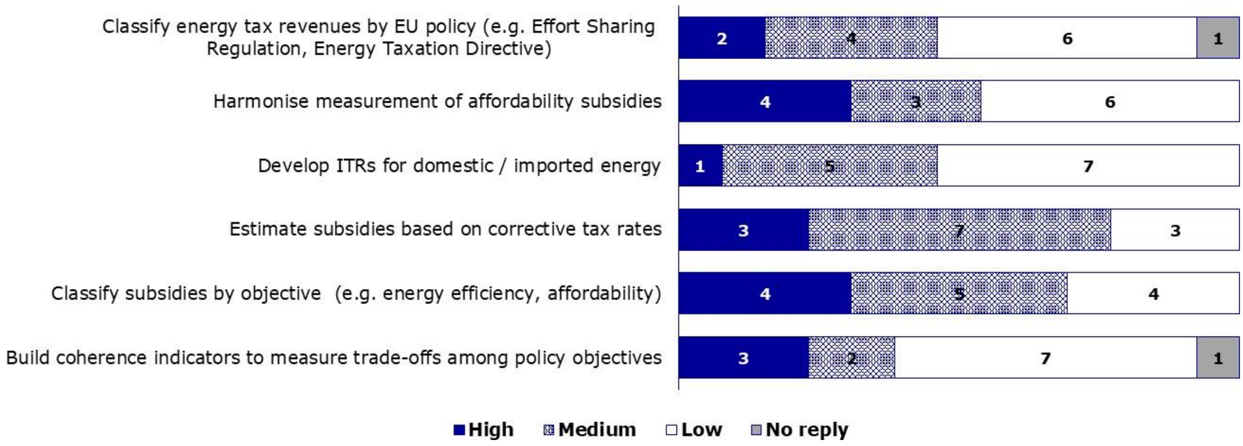
Question 5.1 In your country, is any of the following indicators used to monitor and evaluate policies, or as an input to policymaking? Please tick all that apply.

Figure 7 – Number of responses to question 5.1



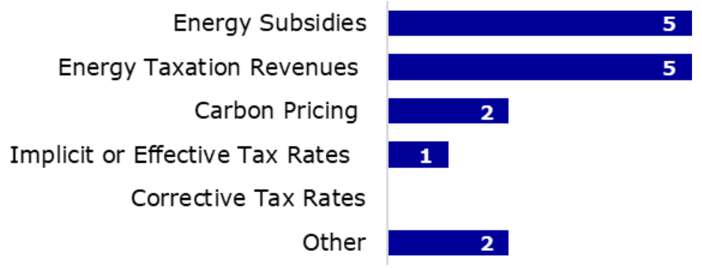
Question 5.3 Please rate the importance of improving the following aspects for the developing of possible future common EU energy taxation indicators?

Figure 8 – Number of responses to question 5.3



Question 6.1. Please report if energy taxation indicators on the following areas have been developed / refined in your country and used to monitor energy, fiscal and climate change policies and provide reference to the indicators used.

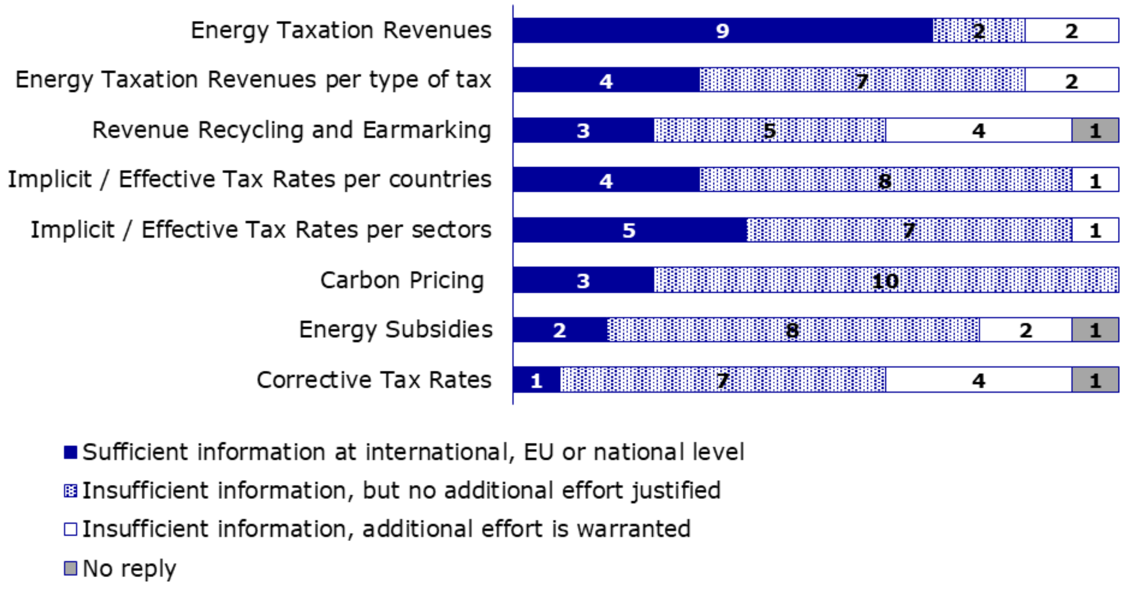
Figure 9 – Number of responses to question 6.1



Note: No specification was inidcated for area "Other"

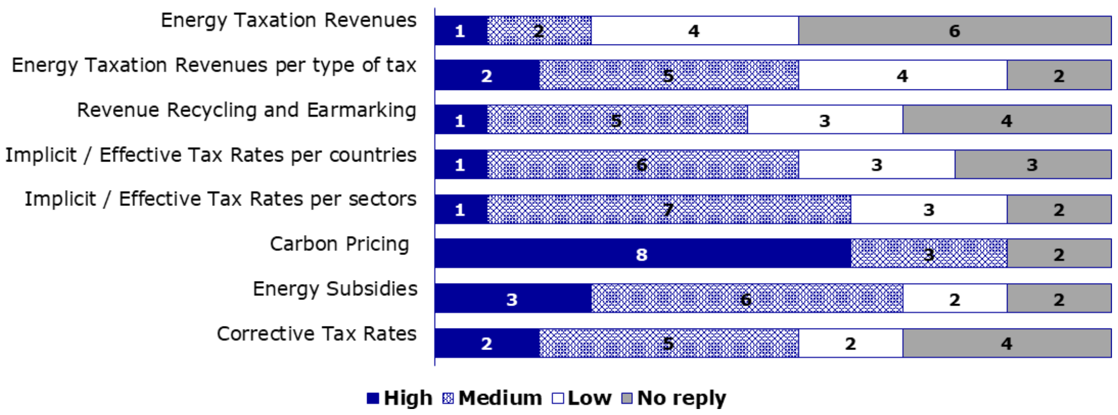
Question 7.1 Please assess the extent to which indicators or quantitative information in the following areas is already reasonably available

Figure 10 – Number of responses for question 7.1



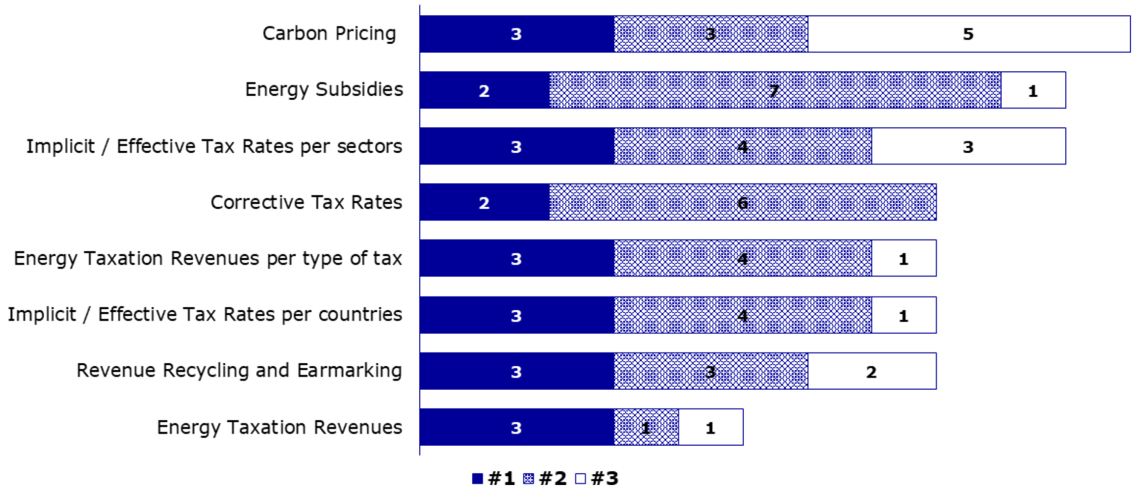
Question 7.2 For the areas where further effort is warranted please rate the importance of investing resources to improve data availability and further develop indicators at the EU level

Figure 11 – Number of responses for question 7.2



Question 7.3 Please tick up to three area which should be monitored via the European Semester (Priority #1; Priority #2; Priority #3).

Figure 12 – Number of responses for question 7.3



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