



Cumulative Cost Assessment (CCA) of the EU Glass Industry

Final Report

Written by:
CEPS, Economisti Associati and Ecorys
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Table of contents

List of acronyms.....	5
PART A. METHODOLOGY AND SAMPLE	8
1 General understanding.....	9
1.1 Putting the Cumulative Cost Assessment of the EU ceramics and glass industry in context.....	9
1.2 The rationale and scope of a Cumulative Cost Assessment.....	10
1.3 Content of the Study.....	12
2 Methodology.....	13
2.1 Proposed methodology for assessing regulatory costs	13
2.1.1 Direct costs	14
2.1.2 Indirect costs	17
2.1.3 Enforcement costs	18
2.2 Aggregating and cumulating regulatory costs.....	18
2.3 Methodological issues	20
2.3.1 Business as usual	20
2.3.2 Main cost parameters associated with SOs and IOs	21
2.3.3 Typical year	22
2.3.4 Additional issues.....	23
2.3.5 Data validation.....	23
3 Sample	25
3.1 Sampling criteria	25
3.2 Required composition of samples in selected sectors.....	28
3.3 Data collection strategy.....	36
3.4 Sample	38
PART B. ASSESSMENT OF REGULATORY COSTS	44
4 Legislation covered by the Cumulative Cost Assessment	45
5 Internal Market legislation	49
5.1 Construction Products Regulation and Directive	49
5.1.1 Description of the Act.....	49
5.1.2 Categories of regulatory costs	49
5.1.3 Methodological aspects.....	50
5.1.4 Cost assessment – Flat Glass	53
5.2 Internal Market for chemicals.....	57
5.2.1 Description of the Acts (REACH and CLP)	57
5.2.2 Methodological aspects.....	58
5.2.3 General findings relevant to all glass subsectors	58
5.2.4 Cost assessment – Packaging glass.....	59
5.2.5 Cost assessment – Flat glass.....	61
5.3 Measuring Instruments Directive	63
5.3.1 Description of the Act.....	63
5.3.2 Methodological aspects.....	63
5.3.3 Cost assessment – Glass tableware.....	63
6 Energy legislation.....	65
6.1 Overview and relevance of energy policy for the EU glass sector	65
6.1.1 Global developments in energy prices	66
6.1.2 Summary of the legislation covered	67

6.2	Methodological aspects.....	68
	6.2.1 General aspects.....	68
	6.2.2 Electricity specific aspects.....	70
	6.2.3 Natural gas specific aspects	72
	6.2.4 Energy efficiency specific aspects	72
6.3	Overview of the impact of energy costs on production costs.....	73
6.4	Electricity	81
	6.4.1 Description of the Acts	81
	6.4.2 Categories of regulatory costs	83
	6.4.3 Cost assessment – Packaging glass.....	83
	6.4.4 Cost assessment – Glass tableware.....	93
	6.4.5 Cost assessment – Flat glass.....	100
6.5	Gas	111
	6.5.1 Description of the Acts	111
	6.5.2 Categories of regulatory costs	112
	6.5.3 Cost assessment – Packaging glass.....	112
	6.5.4 Cost assessment – Glass tableware.....	122
	6.5.5 Cost assessment – Flat glass.....	128
6.6	Energy efficiency	139
	6.6.1 Description of the Acts	139
	6.6.2 Categories of regulatory costs	139
	6.6.3 Cost assessment – Packaging glass.....	139
	6.6.4 Cost assessment – Glass tableware.....	143
	6.6.5 Cost assessment – Flat glass.....	145
7	Climate legislation	149
	7.1 Description of the Acts	149
	7.2 Phase 1 (2005-07)	150
	7.3 Phase 2 (2008-12)	150
	7.4 Phase 3 (2013-20)	150
	7.5 Categories of regulatory costs.....	151
	7.6 Methodological aspects.....	152
	7.6.1 Data validation.....	152
	7.6.2 Model.....	152
	7.6.3 Substantive compliance costs.....	153
	7.6.4 Indirect costs	153
	7.6.5 Administrative burdens	154
	7.7 Cost assessment – Packaging glass	155
	7.7.1 Sample	155
	7.7.2 Direct regulatory costs	155
	7.7.3 Indirect regulatory costs.....	156
	7.7.4 Cumulative regulatory costs.....	157
	7.8 Cost assessment – Glass tableware	159
	7.8.1 Sample	159
	7.8.2 Direct regulatory costs	159
	7.8.3 Indirect regulatory costs.....	160
	7.8.4 Cumulative regulatory costs.....	161
	7.9 Cost assessment – Flat Glass	162
	7.9.1 Sample	162
	7.9.2 Direct regulatory costs	162
	7.9.3 Indirect regulatory costs.....	163

	7.9.4	Cumulative regulatory costs.....	164
8		Environmental legislation for the glass sector	168
	8.1	Description of the Act.....	168
	8.2	Categories of regulatory costs.....	169
	8.3	Methodological aspects.....	172
	8.4	Cost assessment – Hollow glass (packaging glass and glass tableware)	174
	8.4.1	Sample	174
	8.4.2	Substantive compliance costs.....	174
	8.4.3	Administrative Costs	175
	8.4.4	Cumulative regulatory costs.....	175
	8.5	Cost assessment – Flat glass	177
	8.5.1	Sample	177
	8.5.2	Substantive compliance costs.....	177
	8.5.3	Administrative Costs	178
	8.5.4	Cumulative regulatory costs.....	179
9		Waste legislation	180
	9.1	Waste Framework Directive and Landfill of Waste Directive.....	180
	9.1.1	Description of the Acts	180
	9.1.2	Categories of regulatory costs	180
	9.1.3	Methodological aspects.....	182
	9.1.4	Cost assessment – Packaging glass.....	183
	9.1.5	Cost assessment – Glass tableware.....	185
	9.1.6	Cost assessment – Flat glass.....	186
	9.2	Packaging and packaging waste	188
	9.2.1	Description of the Acts	188
	9.2.2	Categories of regulatory costs	188
	9.2.3	Methodological aspects.....	189
	9.2.4	Cost assessment – Packaging glass.....	190
	9.2.5	Cost assessment –Glass tableware	192
10		Consumer and health legislation.....	195
	10.1	Description of the Acts (Materials and Articles in contact with food and General Product Safety Directive).....	195
	10.2	Categories of regulatory costs.....	196
	10.3	Methodological aspects.....	197
	10.4	Cost assessment – Packaging glass	197
	10.5	Cost assessment – Glass tableware	200
	10.6	Cost assessment – Flat glass	202
11		Workers’ safety and health legislation	205
	11.1	General workers’ safety and health and general workplace safety	205
	11.1.1	Description of the Acts	205
	11.1.2	Categories of regulatory costs	206
	11.1.3	Methodological aspects.....	207
	11.1.4	Cost assessment – Packaging glass.....	208
	11.1.5	Cost assessment – Glass tableware.....	209
	11.1.6	Cost assessment – Flat glass.....	210
	11.2	Special workers’ safety and health.....	213
	11.2.1	Description of the Acts	213
	11.2.2	Categories of regulatory costs	213
	11.2.3	Methodological aspects.....	214

11.2.4	Cost assessment – Packaging glass.....	216
11.2.5	Cost assessment – Glass tableware.....	218
11.2.6	Cost assessment – Flat glass.....	220
12	Other areas of legislation	223
12.1	Trade legislation.....	223
12.1.1	Trade analysis.....	223
12.1.2	Trade policy	227
12.2	Competition legislation.....	235
12.2.1	Antitrust legislation and merger control.....	235
12.2.2	State aid control.....	237
12.3	Transport legislation	240
12.3.1	Description of the Acts	240
12.3.2	Categories of regulatory costs	240
12.3.3	Relevance for the sectors	240
PART C. CUMULATIVE COST ASSESSMENT		242
13	Cumulative cost assessment.....	243
13.1	Hollow glass: packaging glass	245
13.1.1	EU	245
13.1.2	Central-Eastern Europe	248
13.1.3	Southern Europe	250
13.1.4	Northern-Western Europe	252
13.2	Hollow glass: Glass tableware	256
13.3	Flat glass.....	259
13.3.1	EU	259
13.3.2	Central-Eastern Europe	262
13.3.3	Southern Europe	265
13.3.4	Northern-Western Europe	269
14	Relevance ‘heat maps’	272
Annex I – Sectoral analysis of glass sectors not covered by the CCA		274
Introduction.....		274
Other glass, including technical glassware		274
Sectoral statistics		275
Annex II – International Comparison.....		278
Introduction.....		278
Packaging Glass		278
Flat Glass		280

List of acronyms

AB	Administrative Burdens
AD	Anti-Dumping
AEL	Associate Emission Level
AVCP	Assessment and Verification of Constancy of Performance
B2B	Business to business
BAT	Best Available Techniques
BAU	Business As Usual
BREF	Best Available Techniques Reference Document
CAPEX	Capital Expenditures
CBN	Cubic Boron Nitride
CCA	Cumulative Cost Assessment
CE	Conformité Européenne
CEE	Central-Eastern Europe / Central-Eastern European
CHP	Combined Heat and Power
CLP	Classification, Labelling and Packaging
COMEXT	Community External Trade Statistics
CPD	Construction Products Directive
CPR	Construction Products Regulation
DC	Direct Charges
DoP	Declaration of Performance
EAD	European Assessment Document
EBIT	Earnings Before Interest and Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EC	European Commission
ECHA	European Chemicals Agency
EEC	European Economic Community
EED	European Efficiency Directive
ELR	Eco-Label Regulation
ELV	Emission Limit Values
ETS	Emissions Trading System
EU	European Union
EUA	European Emissions Allowances
FC	Financial Costs
FPC	Factory Production Control
FTE	Full Time Equivalent
GHG	Greenhouse Gas

GJ	Giga Joule
GMP	Good Manufacturing Practice
HF	Hydrogen Fluorides
HS	Harmonized System
IA	Impact Assessment
IC	Indirect Costs
IED	Industrial Emissions Directive
IEP	Integrated Environmental Permit
IO	Information Obligation
IPPC	Integrated Pollution Prevention and Control
ISCO	International Standard Classification of Occupations
IT	Information Technology
ITT	Initial Type Testing
LDR	Lesser Duty Rule
MADB	Market Access Database
MES	Market Economy Status
Mo	Monetary Obligations
MRV	Monitoring, Reporting and Verification
MWh	Megawatt hour
NACE	Statistical Classification of Economic Activities in the European Community
NAP	National Allocation Plan
NO _x	Nitrogen Oxides
NWE	Northern-Western Europe / Northern-Western European
OPEX	Operating Expenditures
OSH	Occupational Safety and Health
PC	Personnel Costs
PRODCOM	European Community Industry Production
RAPEX	Rapid Alert System for non-food dangerous products
RCM	Regulatory Cost Model
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
REFIT	Regulatory Fitness and Performance Programme
RES	Renewable Energy Support
RSB	Regulatory Scrutiny Board
SCC	Substantive Compliance Costs
SCM	Standard Cost Model
SE	Southern Europe / Southern European

SME	Small Medium Enterprise
SO	Substantive Obligation
SOx	Sulphur Oxides
SVHC	Substances of Very High Concern
TBT	Technical Barriers to Trade
TDI	Trade Defence Instrument
TFEU	Treaty on the Functioning of the European Union
TL	Transaction Log
TTIP	Transatlantic Trade and Investment Partnership
UK	United Kingdom
US	United States
VAT	Value-Added Tax
WACC	Weighted Average Cost of Capital
WTO	World Trade Organisation

Part A. Methodology and sample

1 General understanding

1.1 Putting the Cumulative Cost Assessment of the EU ceramics and glass industry in context

Regulation is an essential part of modern society and good governance. At the EU level, it also plays a critical role in **meeting the strategic aims of the EU** and its Member States, **achieving the objectives of the EU Treaty** and **setting the conditions for smart, sustainable and inclusive growth**. When well drafted and designed, regulation provides legal certainty and creates safeguards for public interest. It ensures that rights of businesses, workers, consumers and citizens are protected. Importantly, EU rules create a common framework by aligning national laws while helping Member States work together on many fronts, such as to secure fundamental rights, preserve public interests and address cross-border challenges. In the glass and ceramics industries, for instance, EU regulation plays a crucial role in maximising the benefits of the Internal Market, assuring a certain level of health and safety standards for workers, protecting consumers and ensuring that the industries contribute to the EU's ambitions in the field of environment and sustainable development. In parallel, especially considering the 2008 economic and financial crisis, it is often claimed that EU regulation sets **burdensome requirements** and generates **additional costs for businesses**.

The **Commission's Better Regulation agenda**, as renewed on 19 May 2015, aims to **facilitate the achievement of public policy objectives at a minimum cost**, thus eliminating unnecessary red tape while improving the added value of EU intervention.¹ Since 2005, the Commission has approved more than 660 initiatives of simplification, codification or recasting, with more than 6,100 legal acts repealed, and some 300 proposals withdrawn.² As part of this agenda, in December 2012 the Commission initiated a **Regulatory Fitness and Performance Programme** (REFIT) with the aim of eliminating unnecessary regulatory costs while ensuring that EU legislation is **'fit for purpose'** to create growth and jobs.³ Recently, the European Commission has announced its intention to use also REFIT to stimulate innovation-driven investment.⁴ REFIT exercises are expected to provide a simple, stable and predictable regulatory framework for businesses, workers and citizens, by screening the stock of EU legislation in selected policy areas and reviewing it without compromising public policy objectives. More specifically, REFIT systematically reviews EU legislation to: i) check whether the original aims are met efficiently and effectively; ii) detect excessive regulatory burdens, gaps, and inefficiencies; iii) identify opportunities for simplification; and vi) enable the Commission to propose to the Council and the Parliament appropriate legislative revisions or repeals.

EU efforts under REFIT are underpinned, *inter alia*, by two concepts: i) **simplification**, i.e. making EU laws clearer and easier to understand; and ii) **reducing regulatory burdens**, i.e. diminishing the reporting, monitoring and other requirements imposed by EU laws and making it easier for businesses to meet them. In 2013, a major screening exercise of the *acquis communautaire* had identified key areas where a special effort should be made to cut unnecessary and burdensome regulations. This resulted in many evaluation exercises being initiated in a variety of different policy fields.⁵ For the first time, **cumulative cost studies** were included among those measures that can more effectively contribute to growth and economic recovery. A subsequent Communication in October

¹ Communication from the Commission, EU Regulatory Fitness, 12.12.2012, COM(2012)746.

² "REFIT – making EU law lighter, simpler and less costly", available at: http://ec.europa.eu/smart-regulation/docs/refit_update.pdf.

³ Communication from the Commission, EU Regulatory Fitness, 12.12.2012, COM(2012)746.

⁴ European Commission, Staff Working Document, "Better Regulation for Innovation-driven Investment", 2016, at http://ec.europa.eu/research/innovation-union/pdf/innovrefit_staff_working_document.pdf.

⁵ European Commission, Staff Working Document, Regulatory Fitness and Performance Programme (REFIT): Initial Results of the Mapping of the Acquis, 01.08.2013, SWD(2013)401.

2013 reviewed the achievements of the Smart Regulation initiative to date and defined next steps for the REFIT.⁶ In this document, the **Cumulative Cost Assessment (CCA)** was mentioned as a key instrument for identifying, assessing and quantifying the overall costs generated by EU rules on specific industrial sectors. In June 2014, the Commission adopted a new Communication on REFIT,⁷ which reaffirmed the importance of **measuring costs and benefits for smarter regulation**. The Commission announced that, as part of the horizontal REFIT actions, several CCAs would be undertaken, one of which would cover the **EU ceramics and glass industries**. It also stated that while CCAs provide an industry-wide assessment of a range of key cost factors, they are not meant to be the only basis for policy recommendations. Rather, the results will provide **inputs for evaluations, Fitness Checks and impact assessments**. As a result, in its Work Programme for 2015,⁸ the Commission included, a “*Cumulative cost assessment of the regulatory costs incurred by the most relevant EU legislation and policies for the EU glass and ceramics industry*”, i.e. the subject of this Study. Finally, in May 2015 the Commission launched its new Better Regulation Package as a step forward in the consolidation of the REFIT programme. From now on, REFIT will be backed by a new REFIT Stakeholder Platform and placed under oversight of the Regulatory Scrutiny Board (RSB) that is replacing the Impact Assessment Board. The RSB now includes three independent members, one Chair and three Commission internal full-time members. The commitment to REFIT initiatives is also clearly restated and shaped in the name of **sectoral competitiveness**.

1.2 The rationale and scope of a Cumulative Cost Assessment

A CCA aims to **identify, assess** and, where possible, **quantify the cumulative costs** generated by **selected areas of EU legislation** on a **given industrial sector**. It is retrospective, e.g. in the case of ceramics and glass, regulatory costs generated over the period 2006-15 have been assessed, and strictly centred on EU rules, i.e. additional costs generated by national implementation of EU rules should not be accounted for. The assessment of regulatory costs is based on a company’s cost structure, which is the building block of the CCA. Indeed, once regulatory costs are quantified, the CCA evaluates how much they affect: i) **the cost structure and profitability** of companies operating in the selected industry; and ii) **the competitiveness** of these companies *vis-à-vis* their international competitors.⁹

In terms of scope, the CCA considers several legislative acts rather than a single act, and adopts an *ex post* perspective rather than an *ex ante* one. This approach is similar to the one adopted in a ‘fitness check’, in the meaning of the 2012 Communication on Regulatory Fitness.¹⁰ Yet, a CCA has a narrower scope than a ‘fitness check’ as it focuses only on **how costly policies and rules are for a selected industry** rather than for the economy or society as a whole. In this respect, a CCA is not a new technique to assess *ex post* outcomes of a regulation. Rather, it relies on a set of existing tools used to meet the requirements of a new approach to policy appraisal: **focusing on all policies having an impact on one class of addressees**, rather than focusing on all addressees of one policy (or one small set of closely knit policies) as it is traditionally done. This change of approach leads to specific methodological choices to accurately answer the following question: **what are the costs of the EU *acquis* for a given industry/class of addressees?** This

⁶ Communication from the Commission, Regulatory Fitness and Performance (REFIT): Results and Next Steps, 2.10.2013, COM(2013)685.

⁷ Communication from the Commission, Regulatory Fitness and Performance Programme (REFIT): State of Play and Outlook, 18.6.2014, COM(2014)368.

⁸ Annex to the Communication from the Commission, Commission Work Programme 2015, A New Start, 16.12.2014, COM(2014)910.

⁹ Schrefler, L., G. Luchetta and F. Simonelli (2015), “A new tool in the box? The cumulated cost assessment”, European Journal of Risk Regulation, 1, Lexxion.

¹⁰ Communication from the Commission, EU Regulatory Fitness, 12.12.2012, COM(2012)746.

novelty encouraged the CEPS and Economisti Associati research team responsible for the CCAs on steel and aluminium industries¹¹ to devise a coherent methodology.

The CCA, *nomen omen*, is all about costs. Hence, it does not include the benefit side of rules,¹² nor does it assess the cost-benefit balance of the legislation. In this respect, since EU policy evaluation has to provide information on both costs and benefits, CCAs have to be supplemented with extensive information on benefits. Indeed, policies are adopted because they are expected to deliver a set of specific benefits, although those affected by the costs and benefits do not always coincide. This is often the case for so-called 'regulatory policies', which tend to have **concentrated costs and more diffuse benefits**.¹³ By measuring these concentrated costs, the CCA fills a gap that is not covered by existing tools. As in the case of other better regulation instruments, **the CCA is not meant to judge the content of policies**:¹⁴ it only provides evidence that potentially feeds into further policy decisions. Interestingly, its distinctive combination of logic and scope allows the CCA to operationalise key elements that are traditionally treated separately through the literature on policy appraisal on the one hand, and literature on competitiveness on the other. In terms of logic, a CCA is – in simplified terms – an **ex post evaluation of costs** generated by different policies. In terms of scope, however, because it applies to an entire sector and not to a single act/policy, it contributes to **measuring the cost competitiveness of a given sector**.

Competitiveness has indeed become the main aim of many economic policies at European, national and local level.¹⁵ **Industry competitiveness is affected by several forces** such as industry rivalry, threat of new entrants, bargaining power, etc.¹⁶ It depends, in part, on the business environment that is also influenced by the quality of regulation.¹⁷ In a globalised world, economic areas are more exposed to international competition; therefore, domestic companies are subject to fiercer pressure on their competitive advantage. Companies, sectors and regions whose strategies were more largely based on cost-competitiveness are particularly exposed. For this reason, EU policies have increasingly been steered towards the promotion of competitiveness, even more in the aftermath of the economic and financial crisis.¹⁸ To ensure that the flow of new legislation improves, or at least does not hamper the competitiveness of European companies, the European Commission released in 2012 a **competitiveness proofing toolkit** to

¹¹ CEPS and EA (2013), "Assessment of Cumulative Cost Impact for the Steel and Aluminium Industry", Study for the European Commission.

¹² As long as the legislation in the scope of the analysis does not result in revenues for the industry rather than costs, see e.g. the case of the ETS legislation and its mechanism of free allowances. Cf. CEPS and EA (2013), "Assessment of Cumulative Cost Impact for the Steel Industry", Study for the European Commission, June 2013, at §6.

¹³ Revesz, R.L. and M.A. Livermore (2008), "Retaking Rationality. How Cost-Benefit Analysis Can Better Protect the Environment and Our Health", New York: Oxford University Press.

¹⁴ Radaelli, C.M. (2008), "Evidence-based policy and political control: what does regulatory impact assessment tell us?", presentation held at the ECPR Joint Sessions of Workshops, University of Rennes, France.

¹⁵ European Commission, European Competitiveness Report 2013: "Towards Knowledge-Driven Reindustrialisation", SWD(2012)347.

¹⁶ Porter's 'Five Competitive Forces Model' (Porter, M.E. (1980), *Competitive Strategy*, New York: The Free Press) provides a comprehensive framework to assess industry competitiveness. Three 'forces' out of five account for the so-called 'horizontal competition' and include: i) industry rivalry; ii) threat of new entrants; and iii) threat of substitute products or services. Two additional forces account for the so-called 'vertical competition' and include: i) bargaining power of suppliers; and ii) bargaining power of customers/buyers. In order to complete the picture stemming from the application of the Five Competitive Forces Model, two additional 'forces' are usually added: i) the role of external stakeholders (which accounts also for the regulatory and institutional background); and ii) interactions with complementary industries.

¹⁷ Pelkmans, J. and G. Galli (eds) (2000), *Regulatory Reform and Competitiveness in Europe*, vol. I, Cheltenham: Edward Elgar.

¹⁸ Communication from the Commission, For a European Industrial Renaissance, COM(2014)14.

complement the Impact Assessment Guidelines.¹⁹ The toolkit reflects the need that “*all proposals with a significant effect on industry undergo a thorough analysis for their impacts on competitiveness*”.²⁰ The CCA provides useful data to assess two out of the three dimensions of enterprise competitiveness as defined by the European Commission:²¹ i) **cost competitiveness**, i.e. the impact on the costs of doing business; and ii) **international competitiveness**, i.e. the impact on the global market shares of EU industries, on trade indicators and, more generally, on keeping a competitive advantage *vis-à-vis* main international competitors.²²

1.3 Content of the Study

The **Final Reports** represent the last deliverable of the **Cumulative Cost Assessment (CCA) of the EU Ceramic and Glass industries**. While each of the two companion Reports focuses on one of the two industries covered by the Study, i.e. ceramics and glass, they are both structured as follows:

- **Part A (Methodology and sample)** comprises i) the general understanding of the Study (see above); ii) a description of the methodology applied by the Research Team to assess regulatory costs as well as to estimate production costs and key performance indicators; and iii) an overview of the main features of the samples on which the assessment of regulatory costs relies.
- **Part B (Assessment of regulatory costs)** presents the assessment of regulatory costs generated by the following areas of legislation: i) Internal Market for chemicals, ii) Internal Market for construction products, iii) electricity, iv) gas, v) energy efficiency, vi) climate, vii) environment, viii) waste, ix) packaging waste, x) general worker’s health and safety and workplace safety, xi) special worker’s health and safety, xii) consumers and health and xiii) the Measuring Instruments Directive; in addition, it discusses the role played by trade, competition and transport legislation in the sectors covered by this Study.
- **Part C (Cumulative cost assessment)** presents the overall regulatory costs generated by EU rules on the sectors under investigation, identifies the main cost components and compares regulatory costs with production costs and key performance indicators.

Finally, Annex I sketches a sector analysis of those sectors which have not been included in the CCA; Annex II compares production costs and margins registered by EU manufacturers of packaging glass and flat glass *vis-à-vis* those experienced by plants based in third countries.

¹⁹ European Commission, Impact Assessment Guidelines, SEC(2009)92.

²⁰ European Commission, Staff Working Document, Operational Guidance for Assessing Impacts on Sectoral Competitiveness within the Commission Impact Assessment System – A “Competitiveness Proofing” Toolkit for use in Impact Assessments, SEC(2012)91.

²¹ Commission, Competitiveness Proofing Toolkit, *supra* note 20, at p. 7.

²² Interestingly, while the Commission’s Competitiveness Proofing is intended for *ex ante* and forward-looking assessments (the IA), the CCA is based on a retrospective analysis.

2 Methodology

This Chapter describes the methodology to assess regulatory costs adopted in the context of this CCA. More specifically, the first part of this Chapter describes the **general methodology** adopted to **estimate direct and indirect regulatory costs**.²³ Then, the approach used to **cumulate regulatory costs** and compare them with production costs and margins is detailed. Finally, **some additional methodological issues** relevant to the current Study are presented and discussed.

Importantly, to assess costs stemming from certain pieces of legislation or provisions thereof, this general methodology is adapted for each policy area covered by the Study. For instance, additional assumptions or different approaches are needed to cope with challenges posed by the quality and quantity of primary data collected, or to analyse certain costs whose nature is specific to one or a few pieces of legislation. In this respect, any **adjustment of the methodology and limitations of estimated results** are flagged and discussed in the Chapters presenting the assessment of regulatory costs (see Part B of this Study).²⁴

At this stage, **two important caveats** need to be flagged:

- As discussed in Chapter 1, **the CCA by its very nature does not cover benefits**, nor does it assess the cost-benefit balance of the legislation. In this respect, it is worth remarking that the Better Regulation Toolbox includes 'cost savings' generated by EU rules within the scope of direct regulatory benefits.²⁵ In fact, the main benefit of Internal Market harmonisation lies in cost savings following the replacement of 28 different national rules with one harmonised EU regime.²⁶ Therefore, **cost savings are in principle out of the scope of the CCA**. Yet, as the CCA of the EU glass industry requires a diachronic analysis over a 10-year period, some cost savings introduced by EU rules might be captured and presented in the Chapters covering specific areas of legislation (see Part B of this Study). More specifically, whenever the relevant EU legislation changed over the period under observation (this is the case, e.g. for CPD/CPR and for the Waste Framework Directive), **cost savings (if any) introduced by new rules are expected to be reflected by declining regulatory costs over time**.
- The CCA is a retrospective analysis that aims to identify, assess and when possible quantify regulatory costs generated by selected EU rules on companies operating in a certain industrial sector (see Chapter 1). In this respect, as opposed to an impact assessment, the **CCA does not compare different policy options or costs generated by EU rules with costs hypothetically generated by national rules** which would develop in the absence of harmonising EU rules (the so-called 'baseline scenario'). This type of analysis would require devising complex 'counterfactual scenarios' that may undermine the essence of the CCA, which is based on hard-data collected from plants based in the EU. Comparing regulatory costs against hypothetical counterfactual scenarios is out of the scope of the Study.

2.1 Proposed methodology for assessing regulatory costs

Regulatory costs can be classified along different dimensions such as the type of cost *per se*, e.g. charges, non-monetary costs etc., frequency of occurrence (non-recurrent vs.

²³ Enforcement costs have proven to generate no or trivial regulatory costs in the context of this CCA, therefore no quantitative assessment is provided.

²⁴ European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, at p. 345.

²⁵ *Ibid.*, pp. 338, 341.

²⁶ *Ibid.*, p. 147.

recurrent costs), degree of certainty (cost vs. risk), target/addressee of the cost, e.g. business, consumers, public authorities, etc. Nonetheless, the most comprehensive classification, which has been adopted by the new better regulation guidelines,²⁷ relies on their relation with legislative acts; this classification leads to the identification of three different categories of regulatory costs: i) **direct costs**; ii) **indirect costs**; and iii) **enforcement costs**.

2.1.1 Direct costs

This CCA quantifies the so-called '**direct compliance costs**', which comprise **three main cost components** representing the bulk of regulatory costs across most of the areas of legislation in the scope of this CCA:²⁸

- administrative burdens;
- substantive compliance costs; and
- direct charges.

Administrative burdens are compliance costs incurred by companies to **provide information to public authorities and/or third parties**. They are generated by **information obligations** (IOs) included in the relevant legislation. More specifically, administrative burdens stem from those administrative activities that businesses only perform to comply with a legal obligation.²⁹ At the EU level, administrative burdens are normally assessed through the International Standard Cost Model³⁰ (SCM) whose main principles are then integrated in the EU's SCM.³¹ In a nutshell, the SCM methodology requires the identification of the annual cost of each relevant IO.

Substantive compliance costs include expenditures faced by businesses to comply with requirements imposed by legal rules. They are generated by **substantive obligations** (SOs), i.e. **provisions requiring businesses to take actions** to adapt their activities in order to comply with the legal obligation. The most common example would be the installation of anti-pollution filters to comply with emission limits. Regulatory costs other than administrative costs fall outside the scope of the International SCM; yet, they can be assessed via the so-called Regulatory Cost Model (RCM),³² which is based on the same principles of the SCM and broadens its scope of application. Again, the yearly cost per SO is assessed. For quantification purposes, **administrative burdens** and **substantive compliance costs** can be treated jointly in the broader category of **compliance costs** and assessed with the same methodological approach. This allows, *inter alia*, for reliance upon complementarities and synergies in identifying groups of addresses and collecting relevant data. The actions required to assess compliance costs (both administrative

²⁷ European Commission website on the guidelines for Better Regulation, at: http://ec.europa.eu/smart-regulation/guidelines/tool_51_en.htm.

²⁸ Direct costs can also materialise in the form of 'hassle' or 'irritation costs'; in this regard, qualitative comments collected during the interviews are included, where relevant, in the Chapters covering specific areas of legislation.

²⁹ Administrative burdens are usually computed as the difference between the overall administrative costs stemming from a certain IO and the 'so-called business-as-usual' (BAU) factor, i.e. costs that businesses would incur even in the absence of the obligation under investigation (European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, at p. 361).

³⁰ SCM Network (2005), "The International SCM Manual; Measuring and Reducing Administrative Burdens for Businesses", available at: http://www.administrative-burdens.com/filesystem/2005/11/international_scm_manual_final_178.doc.

³¹ European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, at p. 360.

³² KPMG (2009), "Handbook for Measuring Regulatory Costs", available at http://www.bertelsmann-stiftung.de/cps/rde/xbcr/SID-89F9FDDB-1D307B05/bst_engl/xcms_bst_dms_29039__2.pdf (last accessed on 26 Nov 2014).

burdens and substantive compliance costs) for this CCA are summarised in Box 1, which builds upon the methodology common to the EU SCM and RCM.

Box 1. Actions to assess compliance costs for a single addressee

Action 1.	Identifying the SOs or IOs generated by each legal provision under analysis.
Action 2.	Identifying the target group of addresses that have to comply with each SO and IO.
Action 3.	Segmenting , if appropriate, the target group by creating ‘case groups’ based on e.g. size, e.g. SMEs vs. large enterprises, or other dimensions, e.g. subsectors, products, regions. ³³
Action 4.	Estimating the mode of compliance with each SO or IO by a “normally efficient business”. ³⁴
Action 5.	Selecting those SOs and IOs that are expected to generate major regulatory costs ; this allows for determining which legal obligations need to be quantified.
Action 6.	Estimating the relevant cost parameters associated with each SO or IO , by accounting for: <ul style="list-style-type: none"> ▪ Personnel costs (PC), i.e. expenditures on salaries and wages for employees performing the activities requested by the legal obligation;³⁵ ▪ Other operating expenditures (OPEX), including annual expenditures on energy inputs, materials and supplies, purchased services, maintenance of equipment and out-of-pocket expenses, i.e. any external cost required for experts’ services or counselling; ▪ Investment costs which includes: <ul style="list-style-type: none"> • Capital expenditures (CAPEX), “annualised” over the period of the useful life of the equipment purchased; • Financial costs (FC), i.e. costs related to the financing of investment (normally considered in relation to CAPEX).
Action 7.	Estimating the business as usual (BAU) factor for each SO or IO , based on direct assessment or empirical data.
Action 8.	Estimating the yearly frequency of occurrence , i.e. by distinguishing between one-off obligations/costs and recurrent obligations/costs and measuring the yearly frequency of recurrent obligations/costs.

³³ If different case groups can be established, different notions of “normal efficiency” and BAU factors for each of the groups should be adopted (see actions #4 and #7). For the identification of case groups see Chapter 3 below.

³⁴ The concept of “normal efficiency” is needed in order not to factor into the analysis the inefficiency of some of the addressees. This means that the Research Team has to assess the “reasonable” actions that it will take for businesses to comply with the obligations stemming from legal rules. This relies upon the assumption that regulated entities handle their administrative and substantive tasks neither better nor worse than what may be reasonably expected.

³⁵ Personnel costs and out-of-pocket expenses are usually the main parameters for IO.

- Action 9.** **Multiplying the costs per single SO or IO** (Action #6), **net of the BAU factor** (Action #7), **by the yearly number of occurrence** (Action #8).
- Action 10.** **Dividing the yearly cost** (Action #9) **by the total output** produced by the addressee to obtain regulatory costs per unit of output.

Source: Authors' own elaboration on EU SCM and RCM.

More specifically, **actions 1 to 5 were performed to design the questionnaire** for data collection. In fact, the questionnaire adopted for this Study focuses on the IOs and SOs expected to generate major regulatory costs (Action 1 and Action 5), including questions which reflect the 'reasonable' actions taken by businesses to comply with legislation (Action 4) and are tailored to different subsectors and/or product categories (Action 2 and Action 3). **Actions 6 to 10 were performed to quantify and cumulate compliance costs based on the data and information collected from sampled plants** (see Chapter 3 below); the results of such actions are presented in this Study.

The last component of direct costs, i.e. **direct charges**, are usually generated by so-called '**monetary obligations**' (MOs). MOs are provisions requiring the business to bear monetary costs, such as costs of fees, taxes and levies. From a methodological standpoint, the assessment of direct charges is less complex than the assessment of compliance costs. In fact, such a cost component is relatively easier to assess as it requires multiplying the value of the charge paid by the addressee by the number of yearly occurrences and there is no need to estimate the BAU factor. Required actions are summarised in Box 2; in the same way as for compliance costs, **Actions 1 to 3 were carried out to draft the questionnaire** for data collection; **Actions 4 to 7 were performed to measure direct charges** on the basis of data collected at the plant level.

Box 2. Actions to assess direct charges for a single addressee

- Action 1.** **Identify the MOs** generated by each legal provision under analysis.
- Action 2.** **Identify the target group of addresses** that have to comply with each MO.
- Action 3.** **Segment**, if appropriate, **the target group by creating 'case groups'** based on e.g. size, e.g. SMEs vs. large enterprises, or other dimensions, e.g. subsectors, products, regions.
- Action 4.** **Estimate the unit cost of the charge**, e.g. cost of the fee, tax, license, and permit.
- Action 5.** **Estimate the frequency of the payment**, i.e. by distinguishing between one-off obligations/costs and recurrent obligations/costs and measuring the yearly frequency of recurrent obligations/costs.
- Action 6.** **Multiply the unit cost of the charge** (Action #4) **by the yearly number of occurrence** (Action #5).
- Action 7.** **Dividing the yearly cost** (Action #6) **by the total output** produced by the addressee to obtain regulatory costs per unit of output.

Source: Authors' own elaboration on EU SCM and RCM.

2.1.2 Indirect costs

The present CCA measures the so-called '**indirect compliance costs**', i.e. compliance costs experienced by entities operating in sectors and markets other than those under evaluation. In fact, businesses within one sector bear indirect compliance costs when other entities in related markets (usually upstream) have to comply with certain regulations and are able to pass on the related regulatory costs. More specifically, the impact of certain pieces of legislation is transmitted through regulation-induced price rises and/or the change in quality or availability of inputs, e.g. goods and services.

Broadly speaking, for indirect costs **the general methodology is the same as that proposed for assessing direct costs, with some adjustments**. More specifically, the methodology discussed above needs to be applied to the impact of specific areas/pieces of legislation on upstream players (e.g. electricity producers); then, **the portion of the direct cost borne by upstream operators that is passed on downstream** in the form of higher prices represents the indirect compliance cost affecting industry players in the scope of the CCA. With regard to the **pass-on rate**, in previous studies the Research Team relied on **secondary sources** and **specific assumptions** to estimate a reasonable rate, then coupled this rate with a **sensitivity analysis**, by adopting a **low-end and a high-end estimate**. Again, a case in point is the determination of the pass-on rate to measure the indirect costs generated by the EU ETS where the Research Team relies upon two different scenarios as further discussed in the Chapter presenting costs generated by climate legislation (see Part B of this Study).

At any rate, **clear boundaries** need to be set for indirect costs to ensure that the Study does not end up being too broad. A possible **selection criterion** for indirect costs may be that the causation link between the industry subject to the CCA and the indirect costs has to be proximate (the so-called '**proximity criterion**'). This means that only indirect effects originating from direct counterparts of the selected industrial sectors will be considered. Secondly, the indirect effects must be significant, i.e. resulting in a measurable cost impact for the selected industry (the so-called '**relevance criterion**'). This allows one to focus on the most relevant impacts, rather than trying to frame and quantify negligible, albeit existing, indirect effects. It is worth remarking that the approach proposed to select indirect costs is fully compliant with the Technical Specifications³⁶ for this Study, which require focusing on those pieces of legislation that generate the most significant costs for the glass industry.

Our assessment, based on CEPS³⁷ previous studies, other relevant literature as well as interviews with stakeholders,³⁸ indicates that the following indirect costs are proximate and significant for the EU glass industry:

- **Impacts of energy legislation on electricity and gas prices; and**
- **Impacts of climate legislation on electricity prices.**

Additional indirect impacts (such as those generated by transport legislation) were discussed in more qualitative terms, as players operating in the sectors under observation

³⁶ See Technical Specifications, pp. 23 and 24.

³⁷ CEPS (2014), Final Report for a Study on "Composition and Drivers of Energy Prices and Costs in Energy-Intensive Industries: The Case of the Flat Glass Industry".

³⁸ Arlinghaus, J. (2015), "Impacts of Carbon Prices on Indicators of Competitiveness: A Review of Empirical Findings", OECD Environment Working Papers, No. 87, OECD Publishing, Paris (<http://dx.doi.org/10.1787/5js37p21grzq-en>); see also Graichen, V. et al. (2008), "Impacts of the EU Emissions Trading Scheme on the industrial competitiveness in Germany", Environmental Research of The Federal Ministry of The Environment, Nature Conservation and Nuclear Safety, Research Report 3707 41 501 UBA-FB 001177.

do not have data on relevant regulatory costs; in fact, transport activities are mostly outsourced and regulatory costs are not visible in bills paid by glass producers.

2.1.3 Enforcement costs

Enforcement costs are linked to the administration and implementation of legislation. Since this CCA aims to assess the cumulative regulatory costs for the glass industry, the relevant part of the enforcement costs is **the part affecting industry players**, rather than public authorities. The most important costs in this respect are usually **adjudication/litigation costs** related to the use of the legal system or alternative dispute resolution procedures. Indeed, rules that generate high levels of litigation can become very burdensome, especially in the case of cross-border disputes.

Based on interviews with sectoral associations, **the magnitude of enforcement costs appears to be marginal compared to direct and indirect regulatory costs** generated by the areas/pieces of legislation under investigation. In a nutshell, some enforcement costs are expected to stem from trade legislation (albeit they are mainly incurred by sectoral associations rather than companies) and by competition rules, e.g. when companies intend to merge. Such costs are **discussed in qualitative terms** in the relevant Chapters included in Part B of this Study; when possible, tentative estimates are presented by relying on anecdotal data provided by EU and national sectoral associations.

2.2 Aggregating and cumulating regulatory costs

As detailed above, regulatory costs generated by each relevant piece of legislation were computed in terms of yearly cost per unit of output at the plant level. Such costs were then aggregated by cost category, e.g. administrative burdens, substantive compliance costs, indirect costs, and by area of legislation, e.g. energy, environment, climate. Once plant level costs were calculated, the following steps were undertaken for each area of legislation:

- **Computation of regional averages** as weighted averages of plant level regulatory costs, adopting as weights the yearly plant production in tonnes; to preserve data confidentiality, regional averages are presented only when based on observations from at least three independent companies.
- **Computation of EU averages** as weighted average of regional averages, adopting as weight the overall regional turnover in the specific sector (based on Eurostat data complemented by Amadeus data; see Chapter 3 below) in order to reflect the uneven distribution of production across the EU; to preserve data confidentiality, EU averages are presented only when based on observations from at least three different independent companies.

Regional averages per piece/area of legislation were cumulated to compute the **overall regulatory costs triggered by EU rules in each region**; in the same vein, EU averages per piece/area of legislation were cumulated to complete the **EU cumulative cost assessment**. Finally, cumulative regulatory costs (in €/unit of output) were compared with production costs and key performance indicators, e.g. EBITDA, EBIT (see Box 3).

Box 3. Methodology to estimate production costs and key performance indicators

Production costs and margins are estimated through **primary data collected at the plant level**. The **following information was requested from sampled plants**:

- Annual production output, e.g. in tonnes;
- Turnover;
- Production costs;

- Earnings before interest, taxes, depreciation, and amortization (EBITDA);
- Earnings before interest and taxes (EBIT);
- Profit/loss before tax.

Companies generally have access to this kind of information at the plant level, the only exception being EBIT and profit/loss before tax that, for organisations operating multiple plants, might be recorded only at the company level or country level. At any rate, in all circumstances **where respondents were able to provide only data at the company or country level** (as opposed to plant level) for their production in a certain sector, they were then requested to also share data on the annual production output in that sector at the company or country level. This enabled the Research Team to estimate key performance indicators per tonne of output by comparing, e.g. country level financials with country level production.

When plants did not provide the requested key performance indicators, the Research Team **estimated production costs and margins** per unit of output by relying on **company balance sheets** and **profit and loss accounts** retrieved from the Amadeus database compiled by Bureau Van Dijk.³⁹ This solution proved to be workable only for plants: i) that have indicated the VAT number of their managing business entity; ii) that have provided the overall output (in tonnes) produced by the managing business entity; and iii) whose managing business entity operates only in the sector under investigation (non-diversified company).

It is worth remarking that **margins measured in this Study are expected to be higher than average margins experienced by the sectors in the scope of the CCA across the period under observation**. This is mainly due to sample selection (see Chapter 3). In fact, all samples include only plants that were already operating in 2006 and are still operating today; therefore, all sampled plants have survived the 2008 economic and financial crisis. Such plants are very likely to be more efficient and profitable than those that have shut down between 2006 and 2015.

To perform an **international comparison**, an estimate of **production costs of international competitors** is required. As data cannot be collected from extra-EU companies, the Research Team **collected data via EU companies operating production facilities outside the EU**. Such companies were detected in cooperation with the relevant industry associations. In line with the methodology for estimating EU production costs and margins described above, international indicators are collected by requesting the full set of information from the relevant company. **Annex II presents the international comparison for packaging glass and flat glass. Only a very limited number of glass tableware companies provided such information and compliance with confidentiality rules does not allow for presenting the international comparison in this sector**. The limited response rate may be ascribed to two main factors: i) only a limited number of EU producers surveyed for this Study manage plants based in third countries; ii) key performance indicators of plants based in third countries are considered highly confidential information, especially if one considers that those producers that operate in third countries tend to focus on a limited group of countries and they fear that any figure presented in the Study could be traced back to a specific respondent.

Source: Authors' own elaboration.

³⁹ <https://amadeus.bvdinfo.com/version-2016921/home.serv?product=amadeusneo>.

2.3 Methodological issues

As mentioned above, the assessment of regulatory costs entails some methodological issues that need to be addressed to perform a CCA. This section of the Study discusses **cross-cutting issues and assumptions that apply to all the areas of legislation** in the scope of the CCA. Additional methodological aspects pertaining only to certain pieces/areas of legislation are flagged and discussed in the Chapters included in Part B of this Study.

2.3.1 Business as usual

By definition, both administrative burdens and substantive compliance costs are net of the **business as usual (BAU) factor**, i.e. the share of 'regulatory' costs that a company would bear even in the absence of a regulation (see Action 7 in Box 1). Indeed, determining the BAU factor allows for distinguishing between the mere legislative 'consolidation' of industry practices and cases in which a regulation creates a truly additional burden.

With respect to BAU, three cases may occur. First, certain obligations have by their very nature a BAU factor of 0%. This is the case with respect to certain authorisation processes, e.g. the Integrated Emission Permit or registration application to ECHA in the context of REACH, which companies carry out only because it is mandated by the legislation.⁴⁰ Secondly, certain obligations are assigned a BAU factor of 100%, because they are part and parcel of good business practices and are usually requested by customers. This is the case with respect to certain quality control activities codified under the CPR. A third case concerns obligations whose activities are only partly done because of normal business practices and partly because of legislative requirements. For instance, investments made to comply with applicable environmental standards are only partially motivated by environmental legislation; in fact, other company motivations may apply, such as the achievement of energy savings or other types of cost savings.

In the latter case, companies participating in the CCA were requested to estimate **the extent to which 'activities' (and costs) related to EU rules would occur even in the absence of any specific legal obligation**. More specifically, for each relevant obligation or group thereof, the BAU was measured via a Likert scale going from 1 (no costs incurred in the absence of the legal obligation) to 5 (all costs incurred even in the absence of the legal obligation). The BAU factor was then calculated by applying the following conversion table (Table 1), which is based on two main assumptions:

- When a plant states that **costs are entirely due to EU rules (1)**, the BAU factor needs to be lower than 100% for two main reasons. First, it is likely that some of the activities generating those costs would at any rate be performed by that plant. For instance, in case a piece of legislation imposes the substitution of certain machines, compliance costs will include the purchase of new equipment; however, in assessing the cost associated with this investment, account can be taken of the fact that existing equipment would be replaced anyway at some point in time; compliance costs thus represent, at least partially, an investment which sooner or later would have become necessary. Second, there may be administrative or legal gold-plating by Member States in terms of different modalities of implementing legal obligations of EU origin. For this reason, even when plants report that an activity is fully motivated by the legislation, regulatory costs are discounted by a

⁴⁰ Note that in these circumstances the removal of EU rules would not necessarily eliminate all regulatory costs; in fact, national legislation may replace EU legislation in the same area. At any rate, as mentioned above, the CCA does not compare costs generated by EU rules with costs hypothetically generated by national rules which would develop in the absence of harmonising EU rules.

15% BAU factor (set at this level based on follow-up interviews with company experts).

- When **activities would be performed even in the absence of any legal obligation** (5), legal obligations still determine a certain way to carry out those activities which might not be the most efficient, thus generating some extra costs (85% BAU based on follow-up interviews with company experts). For instance, any company pursuing a corporate social responsibility strategy puts in place actions that are in line with the general and specific objectives of the EU waste legislation or workers' health and safety legislation; yet, from an operational standpoint compliance with legislation requires some adjustments which have an impact on company efficiency.

Table 1. Conversion table for the BAU Factor

Likert scale	BAU Factor
1	15%
1.5	24%
2	33%
2.5	41%
3	50%
3.5	59%
4	68%
4.5	76%
5	85%

Source: Authors' own elaboration.

2.3.2 Main cost parameters associated with SOs and IOs

The assessment of compliance costs requires estimating relevant cost parameters associated with SOs and IOs (see Action 6 in Box 1). In the context of the CCA, the estimate of personnel costs and CAPEX presents some elements of complexity from a methodological standpoint, which are discussed below.

Personnel costs

Personnel costs are a complex cost component and any estimate entails several assumptions, especially when data provided by plants are not immediately comparable. In a nutshell, personnel costs have to be computed by:

- **Estimating or measuring the time devoted to comply with a legal obligation.** The time indicated by respondents, in person-hours, -days, -months or in Full Time Equivalent (FTE), is **converted in person-hours per year**:
 - A **person day** is assumed to correspond to **8 hours**.⁴¹
 - A **person-month** is assumed to correspond to **142 hours**.⁴²
 - A **working year (or FTE)** is assumed to correspond to **1,700 hours**.⁴³
- **Multiplying the time by the hourly fee of the staff fulfilling the obligation.** Relevant categories of workers carrying out activities related to each legal

⁴¹ Eurofound (2016), "Working time developments in the 21st century: Work duration and its Regulation in the EU".

⁴² Ibid.

⁴³ Ibid.

obligation in a 'normally efficient business' were identified via follow-up interviews with company experts.⁴⁴ The monetisation of personnel costs relies on average hourly earnings per category of workers at the Member State level based on Eurostat data.⁴⁵ The hourly fees include non-wage labour costs and overhead costs.

Investment costs (CAPEX and Financial Costs)

As explained above, the CCA aims to measure regulatory costs per unit of output incurred by plants based in the EU on a yearly basis. This requires **annualising the value of investments made to abide by EU rules**. In other words, the total value of each relevant asset purchased over the period 2006-15 has to be divided by the useful life (in years) of the asset to estimate annual CAPEX. In line with the application of the 'normally efficient business' concept, **standard 'useful life' per category of assets** was computed by relying on useful lives indicated by respondents to the questionnaire during follow-up interviews and available secondary sources. Further details for each area of legislation are presented in Part B of this Study.

CAPEX are generally accompanied by **financial costs** as companies have to finance their investment through **a combination of debt financing**, e.g. selling bonds or borrowing money from banks, **and equity**, e.g. issuing common stocks or preferred stocks. Both debt and equity come at a price; in fact, lenders, e.g. bondholders or banks, provide the company with debt financing in exchange for interests and shareholders expect returns in the form of dividends. Against this background, the so-called **Weighted Average Cost of Capital (WACC)** represents the rate that a company pays on average to finance its assets by taking into account the cost of the two components of the capital structure (debt and equity). Based on data collected by professor Damodaran of the Stern School of Business at New York University⁴⁶ **the average WACC for EU companies operating in building materials** (including flat glass, brick and tiles, and ceramic tiles) **and packaging** (including hollow glass) over the period 2006-15 can be estimated at **7.4%**. This rate has been used throughout the Study to compute financial costs of investments made to comply with EU rules.

2.3.3 Typical year

Regulatory costs generated by electricity, gas, energy efficiency and climate legislation as well as key performance indicators, production costs and quantities of output were **collected for each year of the time span covered by the CCA**. Therefore, in the analysis below, such costs and margins vary across years in both absolute value and €/tonne (by reflecting variations in the production output of sampled plants).

Regulatory costs generated by legislation in the field of Internal Market for chemicals, Internal Market for construction products,⁴⁷ the Measuring Instruments Directive, waste (including packaging waste), general workers' health and safety and workplace safety, special worker's health and safety and consumers and health were **quantified for a 'typical year'**. In fact, such cost data are less sensitive to variations in production output.

⁴⁴ Interestingly, salaries paid per category of workers are considered highly confidential information, because salary structures and policies are key drivers for competition in the manufacturing industries. Against this background, in order to increase the response rate to the questionnaire, the Research Team did not collect hourly fees paid by each plant.

⁴⁵ Note that hourly fees were computed by SG C1 and provided to CEPS and Economisti Associati in the context of a parallel study. For further details on Eurostat data see: <http://ec.europa.eu/eurostat/web/microdata/structure-of-earnings-survey>.

⁴⁶ The entire dataset is available at: http://people.stern.nyu.edu/adamodar/New_Home_Page/datacurrent.html.

⁴⁷ Regulatory costs generated by legislation in the field of Internal Market for construction were collected for two different 'typical years', i.e. before and after the entry into force of CPR. Data for a 'typical year' before the introduction of CPR capture cost impacts of CPD.

Therefore, over the period under observation, such cost items vary only in terms of €/tonne, reflecting changes in production outputs of sampled plants.

With regard to regulatory costs generated by environmental legislation, a **cumulated approach** was adopted as, in any given year, each plant incurs costs related to investments made in the same year as well as costs linked to investments made in previous years. As the Research Team did not collect investment costs incurred before 2006, a realistic cost estimate is possible only for the last year of the period under analysis, i.e. 2015. In practice, in 2015, cumulated compliance costs include: i) the depreciation for the investments made that year as well as depreciation for all the investments made since 2006; ii) the operating costs linked to the investments between 2006 and 2015; and iii) the financial costs incurred for the financing of all investments made since 2006. Therefore, **2015 was selected as a 'typical year'** and in the analysis below costs generated by environmental legislation vary across years only in terms of €/tonne as a result of changes in quantities produced by sampled plants.

2.3.4 Additional issues

Regulatory costs, be they direct or indirect, should be **attributed to a certain tier of government**. In the context of the CCA, **the focus is on costs generated by EU rules**, rather than on overall regulatory costs. This was reflected in the questionnaires used for data collection, which were drafted with the objective of collecting information confined to EU regulatory costs. In the same vein, interviews were conducted with the main purpose of eliciting regulatory costs generated by EU legislation.⁴⁸ In this respect, data triangulation and ensuing requests for clarifications have served, *inter alia*, the purpose to reduce discrepancies generated by diverse national implementation of EU rules.

Another issue to be addressed in the analysis stems from the **different impact that identified costs have on individual firms, depending** on their features and most notably **on their size**. A classical case in point is the proportionally higher impact of compliance costs on SMEs than on larger firms. Ideally, cumulative costs borne by SMEs have to be compared with cumulative costs borne by large enterprises. Nonetheless, as further discussed below (see Chapter 3), SMEs appear to play a marginal role in the sectors of the EU glass industry in the scope of this Study; hence, cost impact on SMEs is not relevant to the CCA of the EU glass industry.

2.3.5 Data validation

Finally, in the current CCA, which is mainly based on primary data collected at the plant level, **data validation played a key role** to ensure the quality of the findings. In this respect, **data were triangulated** with: i) any secondary source available, including Eurostat data, data from national statistics offices, published reports and private databases, e.g. the Amadeus database; ii) data provided by other companies operating in the same sector; iii) data provided by other companies operating in a different sector; iv) results of the 'Validation Workshop' which was held in January 2017; and v) evidence requested from outliers, such as balance sheet, profit/loss accounts, electricity bills and gas bills. It is worth remarking that all data were collected via either face-to-face or phone interviews; this contributed to increasing the overall quality of data and enabled a progressive validation process by checking with new interviewees some of the responses

⁴⁸ As mentioned at the beginning of this Chapter, it is worth remarking that one of the main benefit of EU rules pursuing Internal Market harmonisation objectives lies in cost savings following the replacement of 28 different national rules with one harmonised EU regime. This is for instance the case of the Industrial Emissions Directive. Nonetheless, the Better Regulation Toolbox (European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, pp. 338, 341) includes cost savings generated by EU rules within the scope of direct regulatory benefits. Therefore, costs savings are out of the scope of the CCA.

collected in previous interviews. Interestingly, triangulation led to the identification of two categories of outliers:

- **Plants that are outliers for a specific reason.** For instance, some questionnaire respondents cannot be considered 'typical' plants in certain areas of legislation due, for example, to the specific technology they use, e.g. furnaces powered by oil rather than natural gas, or products they produce, e.g. niche products with high costs/high margins. Outliers belonging to this category were excluded from samples, as their regulatory costs or production costs per tonne of output were not representative of the EU production of glass. Nonetheless, data collected, e.g. energy prices, value of investments for environmental purposes, have still been used to validate data provided by other plants in the same region/Member State.
- **Plants that are outliers without apparent reason.** Plants belonging to this category were contacted to verify data and information provided and either rectify them or explain the main drivers justifying the detected inconsistencies. Supporting evidence was also requested. Only fully validated observations were included in the final sample.

3 Sample

In line with the consolidated methodological approach to CCAs,⁴⁹ the CCA of the EU glass industry adopted a **bottom-up approach**. Hence, the bulk of regulatory costs stemming from EU rules was assessed by **collecting primary data** from manufacturers based in EU Member States. More specifically, data collection was carried out at the plant level; hence, the **sampling units** for this Study are expressed in terms of **production sites**, rather than companies.

Given the large number of plants producing glass in the EU, data on regulatory costs cannot be collected from the entire population of EU producers or from a statistically representative sample (see Box 4). Hence, **a small sample of 'typical' plants** were selected. Against this background, this Chapter aims to:

1. discuss sampling criteria used to partition the EU population of glass producers into more homogenous groups;
2. describe the required composition of samples of glass producers to perform the present CCA;
3. summarise the strategy adopted to collect data at the plant level;
4. detail the main features and composition of the current samples of respondents.

3.1 Sampling criteria

A proper selection of sampling criteria is crucial to carry out a CCA while complying with the **'principle of a proportionate analysis'**. In fact, the 2015 Better Regulation Toolbox endorses the need to respect the principle of a proportionate analysis and make transparent compromises about data quality, including limiting fieldwork to a sample of Member States or population segments.⁵⁰ In the case of CCAs, the **trade-off between data granularity and population coverage** cannot be resolved in favour of the latter. As acknowledged by the OECD in its guidelines for compliance cost assessment, "statistically valid surveys may be expensive and time consuming to administer, both for government and for stakeholders, and may therefore not be appropriate or feasible [...] however, **small-scale surveys can provide broad indications of the scale of expected regulatory impacts.**"⁵¹

In this context, in order to measure regulatory costs, and in particular direct compliance costs and administrative burdens, **international best practices** suggest that researchers should carry out at least **five interviews for each major substantive or information obligation**, and then, if necessary, follow up with additional interviews in case of substantial discrepancies between collected data.⁵² Also, international experience points out that regulatory costs tend to follow a "Pareto distribution", in which 20% of the obligations represent roughly 80% of the total costs to be measured.

Box 4. Representativeness

The **Study does not rely upon a statistically representative sample**. In fact, the number of observations required by a statistically representative sample would not have allowed for collecting data via interviews with plants, especially in light of the amount and level of detail of data required to cover all the pieces of legislation covered by this CCA. In this respect, **data on regulatory costs were collected from a small sample**

⁴⁹ Schrefler, L., G. Luchetta and F. Simonelli (2015), "A new tool in the box? The cumulated cost assessment", European Journal of Risk Regulation, 1, Lexxion.

⁵⁰ European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, p. 345.

⁵¹ OECD (2014), OECD Regulatory Compliance Cost Assessment Guidance, OECD Publishing, p. 35.

⁵² International SCM Manual, also quoted in the Better Regulation "Toolbox", pp. 368-370.

of 'typical' plants, selected on the basis of sampling criteria summarised in this Chapter. As mentioned, this approach is fully compliant with the "principle of a proportionate analysis" and the International Standard Cost Model (also quoted in the Better Regulation "Toolbox") and international best practices, e.g. the OECD Regulatory Compliance Cost Assessment Guidance. For the sake of clarity, in each sector **the share of EU turnover represented by respondent companies is presented below** (see Table 6).

Source: Authors' own elaboration.

This suggested approach was adjusted to match the specific features of this Study. First, not all sampled plants were subject to all obligations to be measured; this provided a first reason to include more than five plants in the sample. Second, experience with previous similar projects has shown that while for the simplest cost items data present limited discrepancies, the **variance of complex cost items** can hardly be tackled with only five data points. In this respect, rather than carrying out five interviews per obligation, it is crucial to **partition the population of EU companies in homogenous groups**, based on selected sampling criteria, and then **collect at least five observations for each of these groups**.

Against this background, for the purpose of the CCA, the **sampling strategy** for the glass industry considered the following criteria:

- Sectors;
- Geographical distribution;
- Company features:
 - Size/ownership;
 - Configuration of the company's value chain;
- Plant features:
 - Plant capacity;
 - Production technology/Product range.

Sectors. Due to the differences between sectors in terms of, for example, product range, production technologies and configuration of the value chain, data for the CCA need to be collected and analysed at a NACE 4-digit level. Therefore, each sector under analysis was subject to a separate assessment.

Geographical distribution. Based on the results of the previous CCA published by the European Commission,⁵³ variations in the magnitude of regulatory costs can be explained to some extent by the plant location. In particular, for some pieces of legislation, regulatory costs vary across the EU since the national legislative and regulatory framework prior to the implementation of a certain EU rule differed substantially. Therefore, data are likely to be more homogenous within a given country. Nonetheless, as the production of all the sectors is concentrated in a limited number of Member States (see Box 8), to ensure the broadest geographical coverage, data were aggregated at a regional level. This prevented disclosing identifiable information on specific plants in case of too few respondents from a certain Member State.

The following way to identify regions homogeneously across sectors was adopted:

⁵³ CEPS and EA (2013), "Assessment of Cumulative Cost Impact for the Steel and Aluminium Industry", Study for the European Commission.

- **Northern-Western Europe (NWE):** Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, the UK;
- **Southern Europe (SE):** Cyprus, Greece, Italy, Malta, Portugal, Spain;
- **Central-Eastern Europe (CEE):** Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

Company features: size/ownership. Although the analysis remains plant-based, company size/ownership may have an impact on regulatory costs as well as on overall production costs and margins, as larger companies may be able to benefit from, for example, economies of scope, economy of scale, better bargaining power *vis-à-vis* suppliers of raw materials or subcontractors. As a result, in principle each sample should be divided in two main groups: i) **large enterprises**; and ii) **small and medium-sized enterprises**.⁵⁴

Company features: configuration of the company's value chain. The configuration of the company value chain is another important feature to take into account while performing a CCA, as different pieces of legislation affect different activities. To be sure, it is not possible to retrieve information on the value chain of a given company from secondary sources. Hence the configuration of the value chain cannot be used as an *ante* sampling criterion. In this respect, it is worth stressing that a CCA should focus on the same number and typology of activities, i.e. value chain links, in all the sampled plants within a given sector and, where possible, across sectors. This aspect is crucial for a meaningful aggregation of results at regional as well as EU level and to compare results between sectors. Yet, different plants may be characterised by different levels of vertical integration. Hence, once an agreement is reached on the activities covered by the CCA, the level of vertical integration of the interviewees should be taken into account for the categorisation of regulatory costs. In a nutshell, rules affecting a certain activity are expected to generate either direct costs, when such activity is carried out within a company, or indirect costs, when the same activity is outsourced. This is for instance the case of regulatory costs triggered by transport legislation.

Plant features: capacity. Costs generated by EU rules are likely to be affected by **plant capacity** in several policy areas (for instance the ETS Directive as well as the Industrial Emission Directive apply only to installations above certain capacity thresholds). In addition, production capacity is a crucial factor in determining production costs and margins, especially for homogenous products manufactured in large quantities where economies of scale do matter. Unfortunately, plant capacity is considered 'sensitive' information and, as in the case of value chain configuration, no data are available from public sources or sectoral associations.⁵⁵ Since no quantitative information can be retrieved via desk research, as a mitigating measure the sample should be analysed *ex post* to account for differences in regulatory costs generated by different plant capacities.

⁵⁴ For statistical purposes a workable definition of SME is the one adopted by Eurostat, which is based on the number of people employed. In this respect, it is worth remarking that this definition was recently adopted by the European Commission in the latest "SME performance review" (Muller, P., C. Caliendo, D. Gagliardi and C. Marzocchi (2015), "Annual Report on European SMEs 2014/2015 – SMEs start hiring again", European Commission). Nonetheless, this definition tends to overestimate the number of SMEs as it does not consider: i) the other two thresholds that are relevant to the EU definition of SME, i.e. annual turnover and balance sheet total; and ii) the fact that number of employees, turnover and total assets of partner or linked enterprises have to be (totally or partially) cumulated to assess compliance with thresholds set for SMEs (see Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (Text with EEA relevance) (notified under document number C(2003) 1422)).

⁵⁵ All surveyed plants were requested to provide information on plant capacity. In this respect, confidentiality of such information is protected by a non-disclosure agreement between the Consortium and the respondents.

Plant features: production technology/product range. Production technology and product range are two additional plant features that can be relevant to partition the population of EU companies into homogenous groups. In this respect, two considerations are necessary: i) in the specific case of the glass industry, these variables are closely intertwined because similar products are usually manufactured via similar production processes; ii) performing separate CCA at sectoral level (NACE 4-digit) helps increasing homogeneity among sampled plants, especially in those sectors comprising a limited variety of products, and reduces the relevance of production technology/product range as sampling criteria. Still, within some sectors covered by this Study, e.g. hollow glass, differences in products and production technologies should be taken into account when devising a sample strategy.

3.2 Required composition of samples in selected sectors

In what follows, the **composition of samples in selected sectors** of the EU glass industry is discussed. More specifically, this section focuses on the two NACE 4-digit sectors in the scope of this CCA (see Box 5 for further details on the selection of sectors covered by the Study):

- Manufacture of **Flat glass** (NACE rev.2 23.11);
- Manufacture of **Hollow glass** (NACE rev.2 23.13).

Box 5. Reasons to refrain from launching a CCA of the EU manufacture and processing of other glass, including technical glassware

The **Technical Specifications for this CCA required covering three sectors of the EU glass industry:**

- 23.11 Manufacture of flat glass;
- 23.13 Manufacture of hollow glass;
- *23.19 Manufacture and processing of other glass, including technical glassware.*

The EU associations representing the manufacture and processing of other glass, including technical glassware were contacted during the Inception Phase of this Study to enquire about the willingness of their members to provide cost data for the CCA. In this respect, they have explained that any attempt to collect primary data at plant level from their members would have faced major obstacles, mainly due to the highly fragmented structure of the sector. In the absence of cooperation from these stakeholders, **collection of primary data for the CCA would have been very difficult**; hence, any cost assessment for the manufacture and processing of other glass sector would have relied almost exclusively on secondary sources and theoretical cost modelling, which would compromise the ultimate accuracy of the results.

Furthermore, an additional methodological obstacle exists: the **high level of heterogeneity** in terms of products, production processes and technologies as well as value chains featuring this sector would make it quite **difficult to identify 'typical' plants and thus to aggregate data**. In this respect, even selecting the most appropriate unit of measurement for costs and margins would prove challenging. In fact, the manufacture and processing of other glass covers a wide range of products, from laboratory glassware to paving blocks, jewellery and optical glass; even within each product category, elements of heterogeneity can be detected, e.g. jewellery items. In addition, this sector comprises both manufacturers and downstream processing

companies, the latter being out of the scope of the CCA (see Annex I for further details on manufacture and processing of other glass, including technical glassware).

Finally, it is worth remarking that sectors covered by the CCA represent the lion's share of the EU glass industry. In fact, in 2015 manufacturers of flat glass and hollow glass were responsible for some **79% of the overall turnover in the EU glass sectors** listed in the Technical Specifications. Hence, a CCA confined to manufacture of flat glass and hollow glass still covers a **substantial share of the EU glass industry turnover**. At any rate, no conclusion for the missing sector can be drawn by relying on data collected in the sectors under observation.

Source: Authors' own elaboration.

To partition the EU population of flat glass and hollow glass producers into homogenous groups, the following sampling criteria need to be taken into account:

- **sectors;**
- **geographical distribution.**

In addition, in both sectors **plant features** concerning **production technology** and **product range** play a crucial role in devising the sample strategy.

On the one hand, whereas the **flat glass** sector is rather homogeneous in terms of product range, it includes two main production technologies, namely float glass and rolled and patterned glass. Nonetheless, according to Eurostat PRODCOM data, in 2015 some 87% in value of production sold by EU plants was based on the float process. Hence, the proposed sample comprises only plants manufacturing **float glass** (see Box 6 for a description of the production process).

Box 6. Float glass: classification and overview of the production process

Flat glass includes all **glass products originally manufactured in flat form**. It is mostly used in buildings, automotive, solar-energy equipment as well as interior design, electronics and appliances. Even though the flat glass industry makes use of two different production processes, namely float process and rolled process, the former represents around 90% of the sector's output. More specifically, glass produced using the float process (also called "float glass") consists in large sheet glass (with an average size of 6x3.1 m) made from the **floating of molten glass** on a bath of molten tin, immediately after the molten glass flows out of the furnace. The resulting product is rather homogenous with low variation, even though the variety of products is very large to meet customers' needs, e.g. different thickness, colours, size and composition. Most of the float glass produced is further processed to give the glass certain qualities and characteristics.

According to the **NACE (Rev.2) statistical classification** of economic activities in the European Community, the manufacturing of float glass is included in the class 23.11, encompassing manufacturers of flat glass. More specifically, it includes the following NACE 8-digit codes:

- 23.11.12.12: Non-wired sheets, of float, surface ground or polished glass, having a non-reflecting layer;
- 23.11.12.14: Non-wired sheets, of float, surface ground or polished glass, having an absorbent or reflective layer, of a thickness ≤ 3.5 mm;

- 23.11.12.17: Non-wired sheets, of float, surface ground or polished glass, having an absorbent or reflecting layer, not otherwise worked, of a thickness >3.5 mm;
- 23.11.12.30: Non-wired sheets, of float, surface ground or polished glass, coloured throughout the mass, opacified, flashed or merely surface ground;
- 23.11.12.90. Other sheets of float/ground/polished glass, n.e.c.

Float glass is manufactured through a standardised production process, which confers the product with uniform thickness (ranging from 0.4mm to 25mm) and a very flat surface. The float process includes **six main stages**: i) preparation of the raw materials (batching and mixing); ii) melting and refining; iii) float bath (tin bath); iv) annealing; v) inspection; and vi) cutting to order. A type of float glass processing, i.e. 'online' coating, is sometimes performed between stages iii) and iv) although 80% of glass coating activities take place 'offline', on separate production sites.

Preparation of raw materials. The exact raw materials composition differs depending on the kind of glass produced (e.g. coloured glass or extra-clear glass) but nearly all float glass is soda-lime silicate glass. Borosilicate float glass is a rare composition for specialty applications in research, industry, optics and appliances. The soda-lime silicate float glass preparation requires sand (69-74%), soda ash (10-16%) and lime (5-14%). These inputs are mixed in a batch plant together with "cullet glass", i.e. recycled glass. As cullet melts at lower temperatures, it allows for reducing natural gas consumption as well as CO₂ emissions; nevertheless, as float glass is extremely sensible to even low level of contaminations, mostly pre-consumer cullet is used and the use of external cullet is limited.

Melting and refining. The batched raw materials are transported from a mixing silo to a furnace where they are melted down at 1600°C to remove impurities and bubbles. The furnace is a wide tank made of refractory materials where glass is fired from above from alternating sides. It is heated from alternating sides, using natural gas and waste gases to produce flames above the raw materials and molten glass.

Float bath (tin bath). Once molten, the glass flows from the furnace onto the surface of an enclosed bath of 1100°C molten tin; a refractory lip is used to ensure a correct spreading of the glass. As the glass passes over the bath, this acquires uniform flatness; in addition, adjustable rollers are used to govern the thickness of the glass and to achieve a ribbon of uniform viscosity. Eventually, the glass leaves the float bath at a temperature of 600°C.

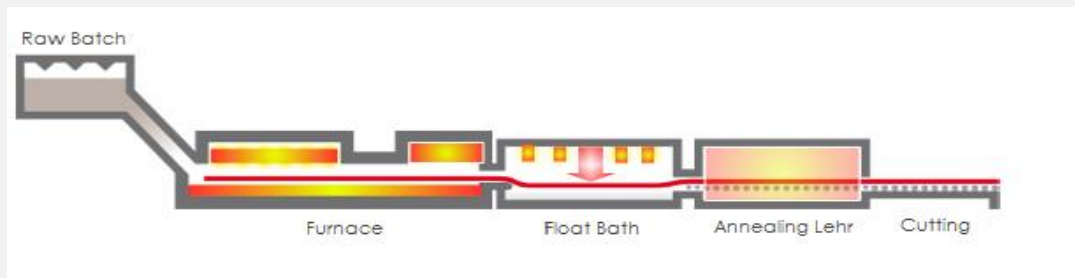
Annealing. Annealing is a heat-treatment meant to relieve internal stresses and to ensure perfect flatness of the ribbon. Thus, once glass reaches a temperature of 600°C, this is taken out of the tin bath and passed through a temperature-controlled tunnel, the so-called "lehr". This operation might take time and space as ribbons need to cool down from 600°C to 60°C in a controlled manner.

Inspection. Automated on-line inspections allow for achieving two different results. On the one hand, it reveals process faults upstream so they can be corrected. On the other, it enables computers downstream to design cuts around potential flaws; in other words, data gathered during the inspection stage drive cutters, further improving product quality.

Cutting to order. Once having reached lower temperatures, glass is washed and transported to the cutting area where diamond wheels cut the ribbon to size dictated by a computer. Moreover, stressed edges (also called "selvedge") are trimmed off and recycled as cullet. Finally, glass sheets are packed and stored, either for direct sale or for secondary processing.

Online Coating (optional). Some float glass plants are equipped with online coating technology to directly process the ribbon of float glass. Further explanation is provided below under 'secondary processing'.

Figure 1. Production process for the float glass sector



Source: Authors' elaboration on <http://cyberglasstrade.com/product.html>.

Secondary processing. Flat glass produced by way of the float process is often further processed to give it certain qualities or specificities, thus meeting the various requirements and needs of the end market. Common examples of secondary processing are:

- **Toughening:** Glass is treated to be more resistant to breakage and to break in a more predictable way, thus providing a major safety advantage in almost all of its applications. Toughened glass is made from annealed glass treated with a thermal tempering process.
- **Laminating:** Laminated glass is made of two or more layers of glass with one or more "interlayers" of polymeric material bonded between the glass layers. Laminated glass offers safety and security advantages as well as colouring, sound dampening, resistance to fire, ultraviolet filtering properties
- **Mirroring:** A metal coating, generally made of silver, aluminium, gold or chrome, is applied to one side of the glass in order to give it reflective properties.
- **Coating.** A transparent layer of metallic oxides is deposited onto the hot glass ribbon. Coating profoundly modifies the optical properties of the glass ribbon and/or confers the same low-emissivity, solar control or self-cleaning properties. This is what confers energy-efficiency properties to float glass used in buildings for example. Most glass coating takes place 'offline', on separate sites, where the vapour is applied to the cold glass surface in a vacuum vessel. As mentioned, in some cases, 'online' coating is performed by relying on online chemical vapour deposition (CVD). Coatings are applied directly onto the hot glass ribbon in the float glass plant. The ribbon of glass flowing out of the float bath goes through the coater before entering the annealing "lehr".
- **Painting.** A coat of paint is applied onto the glass for decorative purposes.

Source: Authors' own elaboration.

On the other hand, whereas technologies adopted in the **hollow glass** sector are homogenous irrespective of the final shape of the products, e.g. bottles, jars, drinking glasses (see Box 7 for a description of the production process), stakeholders have stressed some elements of heterogeneity (especially in terms of production costs) between **packaging glass**, e.g. bottle and jars, flacons, and **glass tableware**, e.g. drinking glass. Therefore, the sample should reflect this heterogeneity and include both plants manufacturing packaging glass and plants manufacturing glass tableware. Yet, companies and plants producing glass tableware in the EU are limited in number, especially when

compared with facilities producing packaging glass (according to Eurostat PRODCOM data, in 2015 glassware represented some 17% of the values of the EU production of hollow glass) and this makes it difficult to collect the same number of observations in both subsectors; hence, to capture specificity of the glass tableware production while complying with the 'principle of a proportionate analysis', the Research Team **dropped the geographical distribution criterion for this segment**.

Finally, it is worth remarking that **within both the packaging glass subsector and the glass tableware subsector additional elements of heterogeneity exist**. With regard to packaging glass, **producers of flacons** represent a small segment (in volume) characterised by high costs/high margins; therefore, data collected from plants operating in this segment cannot be averaged with those collected from producers of bottles and jars. In the same vein, **glassware of lead crystal** is a special segment of the glass tableware subsector, with specificities which do not allow for averaging data collected from producers of crystal glass with those from other producers of glass tableware. Unfortunately, as further discussed below, the limited number of plants producing flacons or glassware of lead crystal in the EU did not allow us to collect and present figures for these two segments.

Box 7. Hollow glass: classification and overview of the production process

Hollow glass has been used as packaging in all aspects of everyday life since ancient times. The main products of the hollow glass sector are **bottles**, e.g. for wines, sparkling wines, beers and ciders, soft drinks and mineral water, **jars**, e.g. for jams, milk products, sauces, oil, vinegar, and **other containers**, e.g. flacons for perfumery, cosmetics and pharma, which come in **different colours and shapes** in order to achieve additional features. For instance, brown glass is used to pack light/UV-sensitive contents, such as medicine, juice or beverages containing beer to prolong shelf life. As mentioned, besides **packaging**, the hollow glass sector also includes **tableware**, e.g. drinking glasses, pitchers, dishes. The two categories of products are quite different when it comes to production costs, revenues, value-to-weight ratio and international trade, which is considerably higher for glass tableware, thus making these products globally tradable.

Class 23.13 of the **NACE (Rev.2) statistical classification** of economic activities in the European Community comprises the manufacturing of hollow glass. More specifically, the following NACE 8-digit codes are covered by the present CCA:

- **Packaging glass:**

- 23.13.11.10: Glass preserving jars, stoppers, lids and other closures (including stoppers and closures of any material presented with the containers for which they are intended);
- 23.13.11.30: Glass containers of a nominal capacity ≥ 2.5 litres (excluding preserving jars);
- 23.13.11.40: Bottles of colourless glass of a nominal capacity < 2.5 litres, for beverages and foodstuffs (excluding bottles covered with leather or composition leather, infant's feeding bottles);
- 23.13.11.50: Bottles of coloured glass of a nominal capacity < 2.5 litres, for beverages and foodstuffs (excluding bottles covered with leather or composition leather, infant's feeding bottles);

- 23.13.11.60: Glass containers for beverages and foodstuffs of a nominal capacity <2.5 litres (excluding bottles, flasks covered with leather or composition leather, domestic glassware, vacuum flasks and vessels);
- 23.13.11.80: Glass containers of a nominal capacity <2.5 litres for the conveyance or packing of goods (excluding for beverages and foodstuffs, for pharmaceutical products, containers made from glass tubing);
- **Glass tableware:**
 - 23.13.12.20 Drinking glasses (including stemware drinking glasses), other than of glass ceramics, of lead crystal, gathered by hand;
 - 23.13.12.40: Drinking glasses (including stemware drinking glasses), other than of glass ceramics, of lead crystal, gathered mechanically;
 - 23.13.12.60: Drinking glasses (excluding stemware drinking glasses and products of glass ceramics or lead crystal), of toughened glass;
 - 23.13.13.50: Table/kitchen glassware with linear coefficient of expansion $\leq 5 \times 10^{-6}/K$, temperature range of 0°C to 300°C excluding glass-ceramics, lead crystal/toughened glass, drinking glasses;
 - 23.13.13.90: Table/kitchen glassware (excluding drinking), toughened glass.

As mentioned, the CCA does not cover the EU production of flacons or of glassware of lead crystal.

Usually, hollow glass production includes **five main stages**:⁵⁶ i) preparation of the raw materials (batching and mixing); ii) melting and refining; iii) forming (**blow-and-blow** and **press-and-blow process**); iv) annealing and (online) coating;⁵⁷ v) and, finally, inspection.

Preparation of raw materials. Raw materials employed depend on the kind of glass produced, e.g. soda-lime glass, lead glass and borosilicate glass. In spite of this potential heterogeneity, hollow glass is primarily of the soda-lime kind⁵⁸ whose preparation requires silicon dioxide (sand/silica) (70-74%), sodium oxide (12-16%), calcium oxide (5-11%), magnesium oxide (1-3%) and aluminium oxide (1-3%).⁵⁹ These inputs are mixed in a batch plant together with "cullet glass", i.e. recycled glass. As cullet melts at lower temperatures, it allows to reduce natural gas consumption as well as CO₂ emissions;⁶⁰ in fact, the loss on ignition or fusion loss can vary, depending on the quantity of cullet used, there being less fusion loss the greater the quantity of cullet.

Melting and refining. The batched raw materials are transported from a mixing silo to a furnace where they are melted down at 1,500°C; operating continuously, furnaces are characterised by an investment life between 10 and 15 years. It takes approximately 24 hours for a batch of raw materials to be converted into molten glass and refined to remove bubbles. Subsequently, it is conveyed to the forming area.

Forming. Having been conditioned by careful temperature control in the forehearth, i.e. a channel-like structure fired by a number of small burners, the molten glass enters

⁵⁶ Consol (2014), "Glass Manufacturing Process" (www.consol.co.za/business/why-glass/glass-manufacturing-process). See also Robertson, G.L. (2013), *Food Packaging: Principles and Practice*, Boca Raton, FL: CRC Press, p. 234.

⁵⁷ Coating can be also carried out offline as a downstream activity.

⁵⁸ Robertson, G.L. (2013), "Food Packaging: Principles and Practice", Boca Raton, FL: CRC Press, pp. 230-231.

⁵⁹ Ecorys (2008), "Competitiveness of the Glass Sector". Within the Framework Contract of Sectoral Competitiveness Studies, ENTR/06/054, Final Report, October, p. 48.

⁶⁰ See International Energy Agency (2007), *Tracking Industrial Energy Efficiency and CO₂ Emissions*, In support of the G8 Plan of Action.

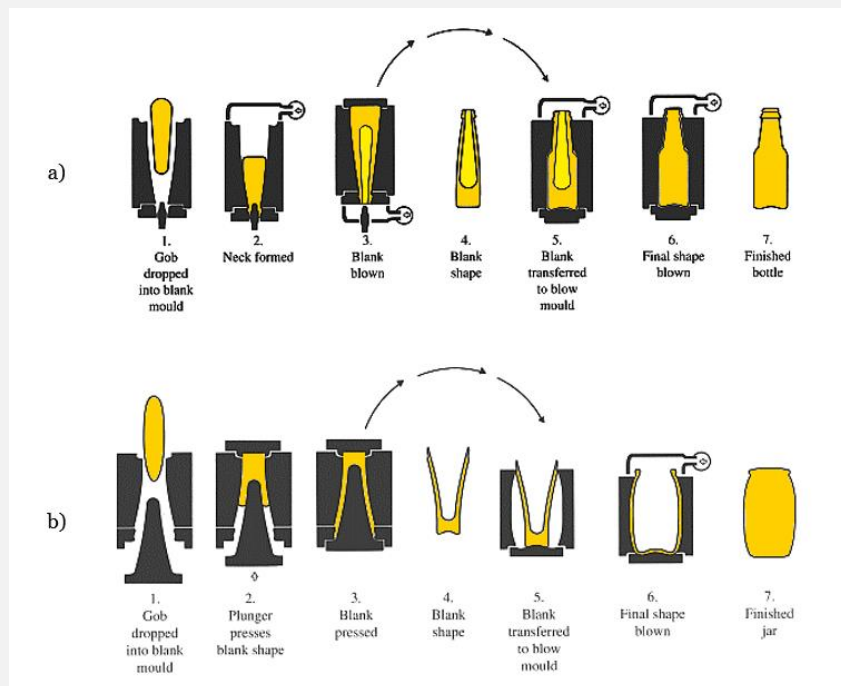
the feeder and flows through holes in an orifice plate. Streams of glass are cut into gobs of a predetermined weight, which are then guided into individual moulds. In a first stage the gob of glass falls into a blank mould to produce a parison. Depending on the kind of product, hollow glass is formed through two different two-step processes. In the **blow-and-blow process**, used for narrow-neck containers, e.g. bottles, compressed air is blown into the molten gob to create a cavity while this is in the blank mould. The result is a hollow and partly formed container, which is subsequently subjected again to compressed air to blow and mould the final shape. The second process, known as the **press-and-blow method**, is generally used for jars and tapered narrow-neck containers. Here, a metal plunger instead of air is used to press a cavity into the gob in the blank mould before compressed air is used to form the container in the blow mould. Figure 2 provides a schematic illustration of the two above-mentioned shaping processes.

Annealing and (on-line) coating. The formed hollow glassware is removed from the mould and transferred by conveyor to a temperature-controlled tunnel, also called "lehr", to cool down in a controlled manner. In other words, annealing consists in a heat-treatment meant to relieve internal stresses, prevent uneven cooling and ensure mechanical stability; this process might take up to two hours. While still in the lehr, the external surface is first coated with a thin layer of tin oxide to increase its strength. Eventually, before leaving this phase, the product is coated also with polyethylene wax to protect the surface and prevent scuffing.

Inspection. The hollow glassware undergoes visual inspection by high-resolution camera equipment as well as by trained specialists. Rejected containers are sent to the recycling operation to be turned into cullet and re-enter the production process.

Finally, the products are **packed and stored**, either for direct sale or for secondary processing.

Figure 2. Schematic illustration of the blow-and-blow (a) and press-and-blow (b) forming processes



Source: Authors' elaboration <http://cyberglasstrade.com/product.html>.

Source: Authors' own elaboration.

Against this background, considering that at least five observations are required to measure costs generated by a given obligation, a minimum of 15 interviews per **flat glass** and of 20 interviews per **hollow glass**, i.e. 15 per **packaging glass** and five per **glass tableware**, are necessary (Table 2).⁶¹

Table 2. Minimum number of plants to be interviewed in the glass industry

Geographical regions	Flat glass	Hollow glass	
	Float glass	Packaging glass	Glass tableware
Southern Europe	5	5	
Central-Eastern Europe	5	5	5
Northern-Western Europe	5	5	
Total	15	15	5

Source: Authors' own elaboration.

Notwithstanding the same minimum number of interviews per geographical regions, as mentioned in Chapter 2 above, when aggregating data at EU level, the Research Team computed **weighted average** by adopting as weights the share of turnover per geographic area. In this respect, Table 3 presents the average distribution of production value across the EU over the period 2006-15; EU averages were computed by relying on annual values of such distribution. In a nutshell, responses from Northern-Western European countries were weighted more than responses from Southern European and Central-Eastern European countries to reflect the uneven distribution of production across the EU.

Table 3. Distribution of production value across the EU (2006-15, average)

Geographical regions	Flat glass	Hollow glass
Southern Europe	25.22%	28.79%
Central-Eastern Europe	19.36%	13.05%
Northern-Western Europe	55.42%	58.16%

Note: Missing data on turnover for flat glass and hollow glass were estimated via Amadeus.

Source: Authors' own elaboration on Eurostat Structural Business Statistics and Amadeus.

As regards the other sampling criteria discussed above, it is worth remarking that both sectors are almost **entirely composed of large companies**. This was confirmed by the relevant EU industry associations and is coherent with Eurostat SBS data. In fact, in 2014 the turnover of the EU glass industry (NACE rev.2 23.1) was mainly generated by large- (63%) and medium-sized (24%) companies. These shares of turnover underestimate the role played by large companies in the manufacturing of flat and hollow glass if one

⁶¹ As mentioned, segmenting the population into more homogenous groups allows for mapping regulatory costs by collecting at least five observations for each group. Yet, if necessary, additional observations need to be collected in case of substantial discrepancies between gathered data. Note that the International Standard Cost Model (see above) does not require a statistically representative sample to map regulatory costs. At any rate, the share of total turnover represented by sampled plants is reported below.

considers that figures for the EU glass industry cover also sectors such as 'shaping and processing of flat glass' (NACE rev.2 23.12) where a relatively larger number of SMEs operate. In addition, Eurostat classifies companies only on the basis of the number of employees and this tends to overestimate the role of SMEs, as it does not take into account that some small or medium-sized companies may be part of larger pan-European groups. Accordingly, **company size is not a relevant sampling variable** for flat and hollow glass manufacturing.

When it comes to the **value chain configuration**, according to the Technical Specifications, "shaping and processing of flat glass" are out of the scope of this CCA. Hence, the flat glass value chain in the scope of the assessment does not include any downstream activity. Conversely, in the hollow glass value chain, downstream activities appear to play a minor role and, with few exceptions, e.g. some decorating and/or labelling activities, are performed within the same plant producing packaging glass or tableware. In this respect, as respondents were not able to single out the share of regulatory costs pertaining to downstream activities, the Research Team included in the sample either plants producing finished products (hence including all finishing activities) or outsourcing a minor share of finishing activities.

It is worth remarking that, as the time span covered by the Study is from 2006 to 2015, to the extent possible, **only plants that were already operating in 2006 were included in the sample**. As this piece of information was not available *ex ante*, a preliminary question was asked to each plant in the scoping phase of the data collection exercise (see below).

3.3 Data collection strategy

On the grounds of the sampling criteria and composition of the sample discussed above, the Research Team prepared three different lists of companies to be contacted during the data collection phase of this CCA:

- A '**main list**' including randomly selected companies/plants that were directly asked to participate in the data collection phase;
- A '**mirror list**' including randomly selected companies/plants that were contacted in case some players included in the 'main list' refused to cooperate;
- A '**reserve list**' including companies/plants suggested by the relevant EU industry associations, based on their availability to participate in the CCA; the Research Team resorted to this list only in case the response rate from players included in the 'main list' and 'mirror list' did not allow for performing the required number of interviews.

Interestingly, **the flat (float) glass industry** is very concentrated and comprises only seven companies and some 40 plants across the EU. In this respect, the three lists mentioned above included virtually the entire population of EU manufacturers of float glass. It is worth remarking that **all the members of Glass for Europe confirmed their availability to cooperate in the Study**. This is equivalent to saying that the 'reserve' list included more than 30 plants; hence, the Research Team was able to randomly select plants even among those ready to provide data for the CCA.

As regards **hollow glass**, the 'main list' and 'mirror list' were compiled by resorting to the Amadeus database and lists of members of both FEVE and EDG. With regard to the Amadeus database, the Research Team focused on the following selection criteria: i) primary NACE code: 23.13; and ii) primary line of business: manufacturing. This was important to reduce the risk of sampling companies involved only in design, decoration or retail activities. It is worth remarking **that the 'reserve list' for the hollow glass sector included some 120 plants across the EU**. In the same way as for the flat glass industry, this left ample room to randomly select interviewees from such a list. Finally, available data did not allow for identifying *ex ante* plants producing packaging glass and plants

producing tableware. In this respect, a preliminary question was asked to potential interviewees during the scoping phase of the data collection exercise (see below) in order to ensure compliance with the sampling criteria discussed above.

In fact, as some information relevant to the sampling strategy was not public available, e.g. company size, product manufactured by a certain company or plant, etc., the Research Team performed the data collection exercise in three steps:

- **Step #1: scoping.** Companies included in the 'main list', 'mirror list' and 'reserve list' received a short questionnaire including a limited set of scoping questions aiming to:
 - ascertain that selected companies were willing to participate in the data collection for the CCA;
 - identify a contact person for the Study within the company;
 - univocally identify the company (via the VAT number);
 - gather missing data to complete the selection of the sample, e.g. number of employees, products manufactured by the plant, years in which the plant has operated, features of the plant value chain;
 - assessing the relevance of specific pieces of legislation to the plant in order to tailor the 'full questionnaire' (see Step #2);
 - ascertain that selected companies were willing to share documentary evidence for data validation purposes and/or to provide some basic data for plants based in third countries.
- **Step #2: interview preparation.** Based on the results of Step #1, the Research Team completed the sample selection in compliance with the sampling criteria detailed above. Sampled plants received a written questionnaire covering all the relevant areas of legislation as well as key performance indicators. They were given enough time to retrieve data and information required to respond. During Step #2, a selected member of the Research Team for each plant was always available to provide guidance and clarification regarding the questionnaire and all the information required to fill in the questionnaire. This was key to maximise the response rate and ascertain that questions were not misinterpreted and responses were consistent across the sample.
- **Step #3: semi-structured interviews.** Semi-structured interviews were organised with all sampled plants accepting to participate in the Study in order to complete the questionnaire and gather any additional evidence or comments relevant to the CCA.⁶² Interviews were carried out either face-to-face or via telephone. Interviewees were free to share a pre-filled questionnaire before performing the interviews; while this was not required, it proved to be the most effective approach to increase the quality of collected data.

Against this background, the Research Team drafted a '**scoping questionnaire**' for Step #1 for each sector in the scope of the CCA as well as a '**full questionnaire**' for Steps #2 and #3 to collect primary data from sampled companies. The 'full questionnaire' underwent a '**pilot experiment**' to test its content before launching the full-scale data collection and reflected the methodology detailed in Chapter 2. It is divided into different parts covering selected legislation areas and the most relevant pieces of legislation within each area. In this respect, it is worth remarking that some parts or sections of the

⁶² This is generally the most suitable approach to gathering a set of comparable data while still leaving space for a more in-depth analysis of the specificities of cases and exploring differences between interviewees' experiences.

questionnaire applied only to a sub-set of the sectors and subsectors in the scope of the CCA; this aspect will be further discussed in Part B of this Study.

3.4 Sample

Some **50 EU glass manufacturers were involved in Step 1** (see above) of the Data Collection strategy. More specifically, 30 plants producing glass packaging, five plants producing glass tableware and 15 plants producing flat glass were requested to fill in the 'scoping questionnaire'. Interestingly, **all contacted plants returned the 'scoping questionnaire'** (Table 4).

All respondents to Step 1 were requested to complete the 'full questionnaire'. The response rate was very high and the samples on which this CCA relies are composed as follows (Table 5; see Box 8 for key statistics on glass sectors and subsectors covered by the CCA):

- **Flat glass.** The sample comprises **15 plants**, i.e. more than 35% of the total value of production sold by EU producers of float glass (Table 6).
- **Packaging glass.** The sample includes 26 plants, as four plants manufacturing flacons decided to withdraw from the CCA. Nonetheless, only **21 questionnaires can be used to assess regulatory costs** generated by EU rules on packaging glass. In fact, five questionnaires were compiled by plants manufacturing flacons belonging to two companies. In this respect, while compliance with confidentiality rules does not allow for showing regulatory costs borne by EU producers of flacons, such plants cannot be considered 'typical plants' and their data cannot be averaged with those provided by other producers of packaging glass. At any rate, data and information provided by these plants were used for data validation purposes. The sample used for cost assessment represents more than 15% of the total value of production sold by EU producers of packaging glass (Table 6).
- **Glass tableware.** The sample is composed of **five plants**. The sample covers more than 40% of the total value of production sold by EU producers of glass tableware (Table 6). No plant producing glassware of lead crystal replied to the 'full questionnaire'.

It is worth stressing that, as not all pieces/areas of legislation are relevant to all plants, **the assessment of regulatory costs generated by specific pieces/areas of legislation may be based on a number of observations lower than the total number of plants** included in the sample. In this context, each Chapter covering specific regulatory costs includes a section presenting the number of observations on which the cost assessment relies (see Part B of this Study).

Table 4. Scoping questionnaires

	Flat glass		Packaging glass		Glass tableware	
	Requested	Collected	Requested	Collected	Requested	Collected
SE	5	5	10	10		
CEE	5	5	6	6	5	5
NWE	5	5	14	14		
Total	15	15	30	30	5	5

Source: Authors' own elaboration.

Table 5. Full questionnaires

	Flat Glass		Packaging glass		Glass tableware	
	Requested	Collected	Requested	Collected	Requested	Collected
SE	5	5	10	10	5	5
CEE	5	5	6	6		
NWE	5	5	14	10		
Total	15	15	30*	26 (21)**	5	5

*Note: *Four plants withdrew from the Study; **Five respondents manufacture special products and cannot be considered 'typical plants', hence, their data have not been used to assess regulatory costs.*

Source: Authors' own elaboration.

Table 6. Turnover of sampled plants out of total value of production sold by EU glass producers (%)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Float glass	23.7*	32.9*	31.9*	35.2*	34.7*	35.1*	33.1*	33.2*	34.2*	36.6*
Packaging glass***	12.9* *	14.0* *	13.4* *	14.4* *	14.7* *	15.2* *	15.8* *	15.2* *	15.2* *	15.7* *
Glass tableware	70.6* ***	36.5	38.0	37.7	38.3	39.9	56.5	36.4	38.3	41.7

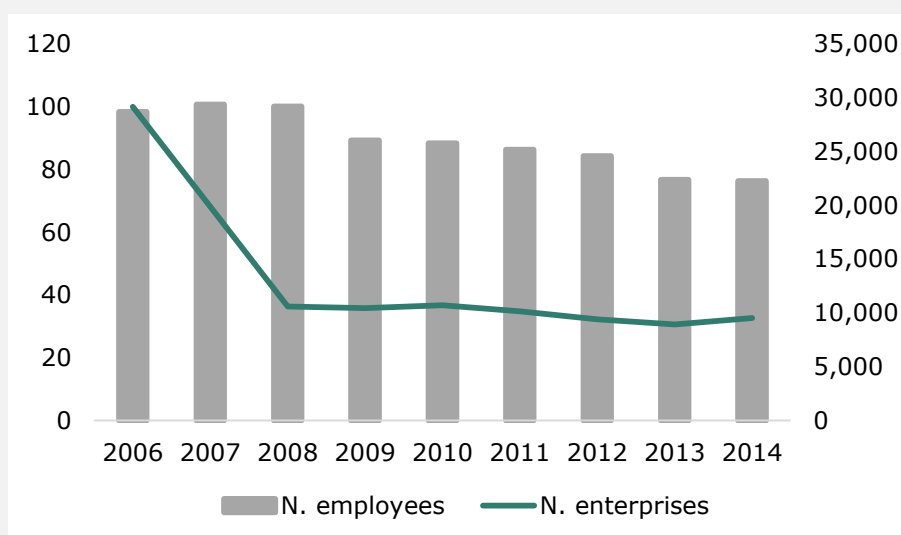
*Notes: *Missing data for two plants over the entire period and for a third plant over the period 2006-11. **Missing data for one plant over the period 2006-11 and for another plant over the period 2006-2009. ***Turnover based on a sample of 21 plants used to assess regulatory costs. ****For 2006, the high value is due to lack of data from PRODCOM for the product 'Other drinking glasses' (23131290); float glass includes the NACE Rev. 2 category 23.11.12; hollow glass packaging includes the NACE Rev. 2 categories 23.13.11.10/20/30/40/50/60/80; hollow glass tableware includes the NACE Rev. 2 categories 23.13.12.20/40/60 and 23.13.13.50/90.*

Source: Authors' own elaboration based on PRODCOM and plant level data.

Box 8. Flat glass and hollow glass: sectoral statistics**Flat glass**

In recent years, **the EU flat glass sector has experienced a gradual, yet constant decline** in terms of number of persons employed as well as number of enterprises (Figure 3).⁶³

Figure 3. Number of employees (right axis, absolute value) and enterprises (left axis side, index number 2006=100) in the EU flat glass sector

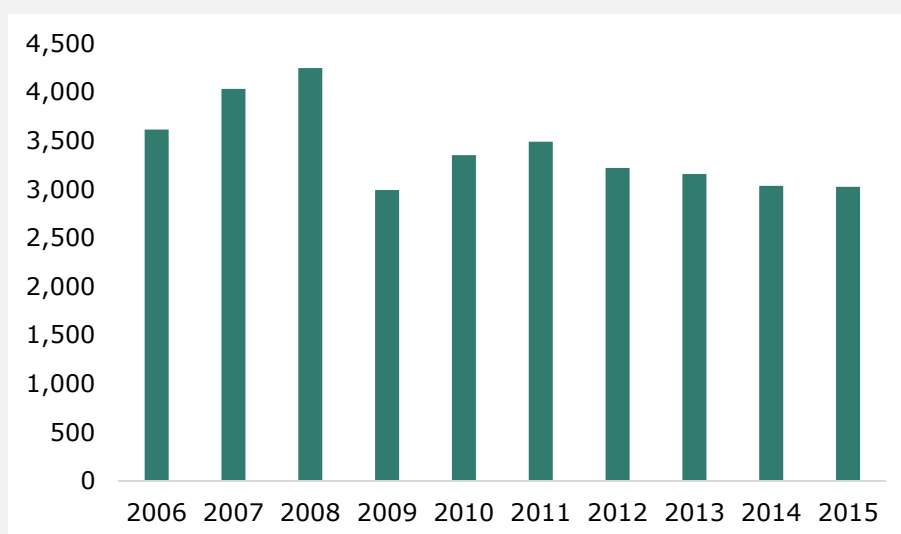


Source: Authors' own elaboration based on Eurostat Structural Business Statistics.

The trend registered by total value of production sold by EU flat glass producers reflects the decline in the number of enterprises and persons employed. In fact, **after 2009, the production value was significantly below pre-crisis levels**; between 2011 and 2015, this indicator went down from some €3.5 billion to about €3 billion (Figure 4).

⁶³ According to Glass for Europe data, there are no more than six companies producing float glass in the EU; in the same vein, EU companies producing rolled glass are in the area of five to six.

Figure 4. Value of production sold by EU flat glass producers (€ millions)



Source: Authors' own elaboration based on PRODCOM.

The distribution of flat glass production across the EU appears to be quite concentrated, with eight Member States accounting for almost 90% of the total sectoral turnover (Table 7).

Table 7. Share of turnover by major Member States for flat glass (average 2006-14)

Member State	% of total turnover
Germany	19.1%
Belgium	15.6%
Spain	13.2%
Italy	11.4%
France	10.4%
Czech Republic	7.5%
United Kingdom	5.6%
Poland	5.0%
Total	87.80%

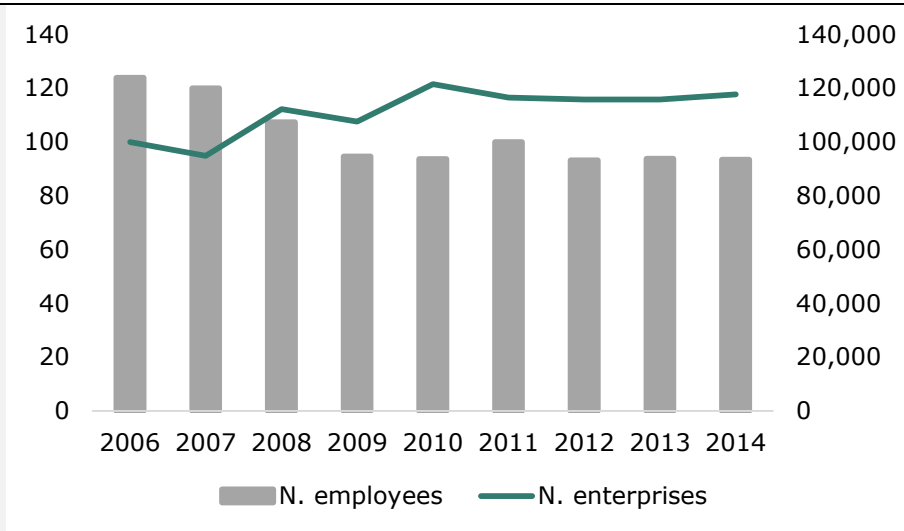
Note: Missing values for specific countries in Eurostat were estimated via Amadeus.
Source: Authors' own elaboration based on Eurostat Structural Business Statistics and Amadeus.

Hollow glass

The EU hollow glass sector registered a **constant decrease in terms of employment**; by contrast the number of enterprises grew up to 2010 and then levelled out (Figure 5).⁶⁴

Figure 5. Number of employees (right axis, absolute value) and enterprises (left axis side, index number 2006=100) in the EU hollow glass sector

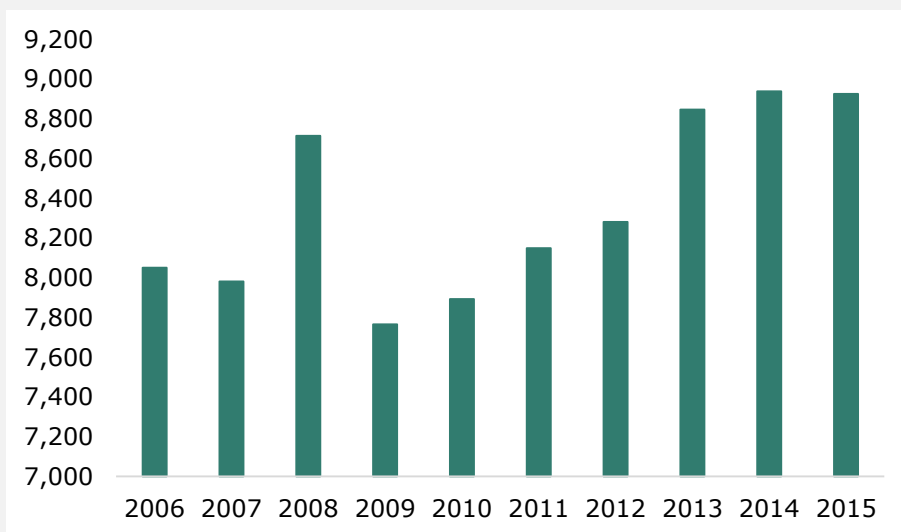
⁶⁴ It is worth remarking that FEVE (The European Container Glass Federation) statistics are substantially different from Eurostat data. Direct employment is estimated in the region of 65,000:



Source: Authors' own elaboration based on Eurostat Structural Business Statistics.

After decreasing by about €1 billion between 2008 and 2009, **the value of production sold by EU packaging glass producers constantly increased** and went **above the pre-crisis level** during the last three years under examination. In fact, since 2013, the value of production sold for packaging glass remained steadily above €8.8 billion (Figure 6).⁶⁵

Figure 6. Value of production sold by EU packaging glass producers (€ millions)



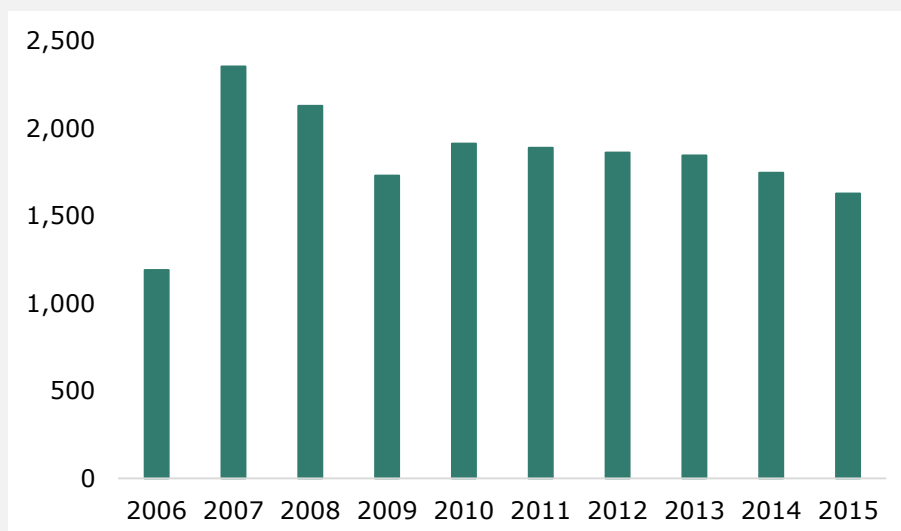
Source: Authors' own elaboration based on PRODCOM.

glass packaging accounts for 44,000 direct employees (FEVE statistics) and glass tableware for 21,000 (EDG/FEVE statistics). In addition, the number of companies has not increased as Eurostat indicates.

⁶⁵ Once again, it is worth emphasizing that FEVE statistics are not aligned with Eurostat data. For instance, according to FEVE, 2007 was an exceptional year for glass packaging in terms of production output, well above 2008.

Conversely, **in the EU glass tableware subsector, figures are still far from pre-crisis levels.** Moreover, in this subsector, the value of production sold by EU producers decreased beginning in 2010. More specifically, between 2013 and 2015, the sector registered an 11.8% contraction (-€218 million).

Figure 7. Value of production sold by EU glass tableware producers (€ millions)



Note: The low value for 2006 is due to missing information for the NACE line 23.13.12.90 "Other drinking glasses".

Source: Authors' own elaboration based on PRODCOM.

France is the leading country in the hollow glass sector, with an average share of total turnover of 25.2% over the period 2006-14. Germany and Italy follow with 17.2% and 15.9% respectively (Table 8). Interestingly, these three countries together account for almost 60% of the total EU turnover. Similarly to flat glass, some 90% of the EU production (in value) is concentrated in nine Member States.

Table 8. Share of turnover per major Member States for hollow glass (average 2006-14)

Member State	% of total turnover
France	25.2%
Germany	17.2%
Italy	15.9%
Spain	8.0%
United Kingdom	6.6%
Poland	5.3%
Portugal	4.3%
Czech Republic	2.8%
Netherlands	2.8%
Total	88.2%

Note: Missing values for specific countries in Eurostat were estimated via Amadeus.

Source: Authors' own elaboration based on Eurostat Structural Business Statistics and Amadeus.

Source: Authors' own elaboration.

Part B. Assessment of regulatory costs

4 **Legislation covered by the Cumulative Cost Assessment**

This Part of the Study presents a detailed assessment of regulatory costs generated by the following area of legislation on EU glass producers:

- **Internal Market legislation**
- **Energy**
- **Climate**
- **Environmental legislation (industrial emissions)**
- **Environmental legislation (waste)**
- **Consumers and health legislation**
- **Workers' and workplace safety**

In addition, it includes three Chapters providing a more qualitative discussion of the role played by **EU trade, competition and transport legislation** in the EU glass industry.

As discussed in Chapters 1 and 2, **the CCA focuses on the most burdensome legislation for the EU glass industry**. The pieces of legislation covered by this Study were selected during its Inception Phase:

- The starting point for this selection was the 'indicative list' of **relevant legislation and regulatory measures provided in Annex 4 of the Technical Specifications**.
- Based on legal research (screening of EU legislation, including through EUR-Lex), literature review (including the references provided in the Tender Specifications) and review of the websites of stakeholder associations, this '**indicative list**' of **EU rules has been extended** to cover all the pieces of legislation that potentially affected the glass industry. Only binding legal acts were included in the 'extended list'; non-binding acts were selected insofar as they were expected to generate specific costs for the industry, e.g. EC Guidance on undertaking new non-energy extractive activities in accordance with Natura 2000 requirements.⁶⁶ At any rate, more general EU policies, e.g. innovation policy, tax policy, labour policy, were left out of the scope of the CCA, and trade policy was included insofar as trade defence instruments are concerned.
- **Pieces of legislation included in the 'extended list' were shortlisted** via desk research activities and several interviews with relevant stakeholder associations and industry experts in order to single out the most burdensome legislation for the sectors covered by the CCA (packaging glass, glass tableware and flat glass).
- Finally, **the 'final list' of legislation underwent a mapping exercise aimed to screen each piece of legislation and identify those regulatory obligations** that were expected to engender costs for EU manufacturers of glass. The results of the mapping served as a basis to prepare the questionnaires to collect costs data at plant level.

An overview of the pieces of legislation encompassed by the present CCA is provided in Table 9. Importantly, the Research Team also assessed impacts of prior legislation that was still in force in some of the years covered by this Study and was then repealed by the acts listed below.

⁶⁶ European Union (2011), Guidance Document, "Non-energy mineral extraction and Natura 2000" (http://ec.europa.eu/environment/nature/natura2000/management/docs/nee_i_n2000_guidance.pdf).

Table 9. List of EU legislation covered by the CCA

1. Internal Market legislation
Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products (CPR)
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP)
Measuring Instrument Directive: Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments (MID)
2. Energy legislation
Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the Internal Market in electricity and repealing Directive 2003/54/EC
Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003
Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the Internal Market in natural gas and repealing Directive 2003/55/EC
Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005
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 Energy Efficiency Directive (Directive 2012/27/EC)
Guidelines on State Aid for environmental protection and energy 2014-2020 are 'soft' legislation and relevant to assess the cost impact of the Renewable Energy Directive Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity
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 Text with EEA relevance
3. Climate legislation
Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance (also known as the EU ETS Directive)
Commission Regulation No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council
Commission Regulation No 601/2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council
Commission Decision determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (2011/278/EU)
4. Competition legislation
Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty

Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty

Council Regulation (EC) No 659/1999 of 22 March 1999 laying down detailed rules for the application of Article 93 of the EC Treaty

Commission Regulation (EC) No 794/2004 of 21 April 2004 implementing Council Regulation (EC) No 659/1999 laying down detailed rules for the application of Article 93 of the EC Treaty

Council Regulation (EU) No 734/2013 of 22 July 2013 amending Regulation (EC) No 659/1999 laying down detailed rules for the application of Article 93 of the EC Treaty

Community guidelines on state aid for environmental protection (2008/C 82/01)

Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01)

Guidelines on certain state aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04)

5. Environmental legislation (industrial emissions)

Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (Industrial Emissions Directive, IED)

6. Environmental legislation (waste)

Waste Framework Directive: Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste

Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

Packaging and packaging waste Directive: European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste

7. Trade legislation

Council Regulation (EC) No 1225/2009 of 30 November 2009 on protection against dumped imports from countries not members of the European Community

Council Regulation (EC) No 597/2009 of 11 June 2009 on protection against subsidised imports from countries not members of the European Community

Council Regulation (EC) No 260/2009 of 26 February 2009 on the common rules for imports

Council Regulation (EC) No 625/2009 of 7 July 2009 on common rules for imports from certain third countries

8. Consumer and Health legislation

Commission Regulation 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food

Framework Regulation EC 1935/2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC

Directive 2001/95/EC on general product safety

9. Workers' and workplace safety legislation

Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (89/391/EEC)

Directive of 30 November 1989 concerning the minimum safety and health requirements for the workplace

Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work

Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (Noise Directive)

Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC

Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation)

10. Transport legislation

Directive 2002/15/EC of the European Parliament and of the Council of 11 March 2002 on the organisation of the working time of persons performing mobile road transport activities

Regulation (EC) No 561/2006 of the European Parliament and of the Council of 15 March 2006 on the harmonisation of certain social legislation relating to road transport and amending Council Regulations (EEC) No 3821/85 and (EC) No 2135/98 and repealing Council Regulation (EEC) No 3820/8

Directive 2006/22/EC of the European Parliament and of the Council of 15 March 2006 on minimum conditions for the implementation of Council Regulations (EEC) No 3820/85 and (EEC) No 3821/85 concerning social legislation relating to road transport activities and repealing Council Directive 88/599/EEC

Note: The CCA covers also predecessors of the pieces of legislation listed above that were in force between 2006 and 2015.

Source: Author's own elaboration.

5 Internal Market legislation

5.1 Construction Products Regulation and Directive

5.1.1 Description of the Act

The Construction Product Regulation (CPR)⁶⁷ sets out rules for **the measurement and declaration of performance of construction products** placed on the Single Market, including those made of glass or ceramics. The CPR aims at ensuring the **free circulation of construction products within the Internal Market**. The above-mentioned objective is achieved by: (i) mandating manufacturers to express the performance characteristics of their products using only the harmonised technical language set by the CPR framework (including the applicable standards);⁶⁸ and (ii) prohibiting Member States from impeding the making available on the market or the use of construction products compliant with the CPR framework.⁶⁹

The CPR came fully into force in July 2013, replacing the Construction Product Directive (CPD).⁷⁰ While the CPR introduced some changes and simplifications compared to the previous framework, the two acts share the same logical framework.

The CPR is based on the **'New Approach'** to Single Market regulation. Therein, the basic act sets the general objectives, while the detailed specifications applicable to every single product are left to standardisation, in the remit of the European Committee for Standardisations. That way, the system remains flexible, as technical details are left to co-regulation via harmonised standards (hEN), while the fulfilment of the overarching objectives is ensured by setting them through binding rules.

The CPR is a *sui generis* Regulation within the New Approach paradigm, because it does not set performance targets, but introduces a **uniform measurement methodology for product performance**. While a New Approach Directive on, e.g. the safety of certain products would state the minimum safety level that a manufacturer has to guarantee to place a product on the Single Market, the CPR 'only' sets a common methodology for measuring the performance of construction products based on their essential characteristics (as defined in Art. 2.4 CPR), which then relate to the Basic Requirements of a construction work.⁷¹

The CPR and CPD are relevant for the glass subsector producing construction products, which is flat glass, to the extent to which plants are not exclusively producing for the automotive sector. However, these acts are not relevant for the hollow glass sector, which does not manufacture construction products.

5.1.2 Categories of regulatory costs

To abide by the CPR provisions, companies do not have to incur substantive costs to modify their products or production processes to meet any performance requirement. Rather, the

⁶⁷ Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products (Construction Product Regulation, CPR).

⁶⁸ See Art. 4-6 CPR.

⁶⁹ See Art. 8.4 CPR.

⁷⁰ Council Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.

⁷¹ The Basic Requirements of a construction work are listed in Annex I to the CPR as follows: (i) mechanical resistance and stability; (ii) safety in case of fire; (iii) hygiene, health and the environment; (iv) safety and accessibility in use; (v) protection against noise; (vi) energy economy and heat retention; and (vii) sustainable use of natural resources. The last requirement was not included in the CPD.

CPR generates costs to measure, certify and communicate to the customers the performance of the products according to the applicable hEN.

Measurement, certification and information provisions generate direct costs,⁷² such as:

- **administrative burdens**, i.e. those related to the drafting and submission of the product declaration of performance, and to the CE marking process (including access to applicable hENs);⁷³ and
- **substantive compliance costs**, namely the costs for the testing of products and production control.⁷⁴

Five regulatory obligations were identified in the CPR. Four of them are information obligations concerning the draft, supply and storage of the Declaration of Performance (DoP) and the labelling of products with the CE marking. One of them is a substantive obligation concerning the Assessment and Verification of Constancy of Performance (AVCP), which is the duty to carry out the Initial Type Testing (ITT) and the Factory Production Control (FPC).

As far as the attribution of costs is concerned, **CPR provisions are directly applicable to companies** and largely rely on EU-wide hENs. National actors have a role, e.g. for compliance checks, but the costs can be attributed to the EU level.

5.1.3 Methodological aspects

To measure regulatory costs associated to the CPR, and the changes brought about by the CPD, companies were presented with three sets of questions:

- Questions on the **administrative burdens due to the draft, supply, and storage of the DoP and the CE marking**. These obligations were bundled together, for two reasons. First and foremost, the same company activities provide information and data for both the DoP and CE marking, and usually the same personnel is in charge of both instruments. Secondly, bundling the questions eased respondents' efforts, as they did not need to allocate costs to more granular tasks.
- Questions on the **substantive costs due to AVCP**, including both ITT and FPC.
- Questions on the **changes between CPR costs and those incurred under the CPD**.

The measurement of regulatory costs will be done on **two typical years**, which are 2015 for CPR costs and 2012 for CPD costs. This is done because CPR and CPD costs mostly depend on the number of product series manufactured by each plant and on the number of new series put into the market. As these variables may change from year to year without a clear pattern, it was considered more appropriate to require information on the typical amount of personnel and other resources spent by companies to comply with this framework. Importantly, CPR activities, once the system up and running, remain fairly

⁷² With regard to indirect compliance costs, in principle CPR costs may be passed on to the glass industry by construction companies when purchasing other construction products, e.g. when building or renovating plants. In fact, however, the share of construction products over total input is negligible, thus impacts are likely to be close to zero in practical terms. As for other indirect costs, the CPR may contribute in certain cases to raising market access barriers for newcomers or foreign operators, by increasing the entry costs linked to product testing and certification. However, such impact on the glass sector is estimated to be limited. Finally, there is no evidence of significant litigation costs.

⁷³ Costs for access to standards were classified as direct charges in the inception report. However, since most companies have access to standards by means of subscription to standardisation bodies, this can be best be considered an out-of-pocket expenditure linked to an information obligation. This change has no impact on the quantification provided below.

⁷⁴ According to Tool #54, "testing costs are not considered as administrative burdens". See European Commission (2015), Better Regulation Toolbox.

consistent across time, as indicated during interviews, which again supports the appropriateness of the 'typical year' approach. At the same time, one-off costs linked to the passage between CPR and CPD, which took place in 2013, are also surveyed, and then included in the quantification. While absolute amounts in euros will be calculated for two typical years, costs per tonne may vary depending on the yearly output. This is considered appropriate because CPR and CPD costs are for most part fixed and need to be borne even when production declines.

Concerning the measurement of the **administrative burdens due to the DoP and CE marking**, the following methodology was adopted:

- First, plants are asked whether DoP and CE marking are managed at local or centralised level, or a combination of both. Indeed, several companies, especially large and multinational, do manage centrally some of these obligations, in particular the preparation and storage of the DoP, while plants are responsible for printing, labelling and supplying DoP and CE marking. When this is the case, follow-up questionnaires are submitted to company's headquarters to retrieve information on these costs. Whenever relevant, headquarters are also surveyed on the best method for allocating costs to plants, which may either be on an output base, i.e. larger plants 'bear' a larger share of costs depending on the yearly production, or equally across all plants.
- Plants are asked information on the following cost and resource items:
 - Amount of personnel (in FTE) working on 'DoPs and CE marking, including drafting, supplying and storing and in the creation/maintenance of items in the catalogue and company databases'.
 - Costs of access to hEN (including subscription to standardised bodies).
 - IT investment and operational costs for storing and supplying the DoP, annualised over a five-year amortisation period and including financial costs.
 - Printing investment and operational costs for DoP (when provided on paper) and CE marking, annualised for IT costs and including financial costs.
 - Translation and other costs (annualised over the same five-year period when one-off).

The rate of reply and the quality of information for this set of questions was good.

With respect to personnel costs, in certain cases it was not immediately possible for companies to disentangle personnel time allocated precisely to these activities, and data were refined by means of follow-up contacts with interviewees and information retrieved from other plants. The data gaps were larger for investment costs for IT systems and printing. These costs usually have less salience to companies compared to personnel costs, also because, in the context of CPR, they are generally limited, as they do not comprise large investments. However, compliance with the CPR framework requires IT and printing operations; for this reason, data gaps were filled, using the median value for each subsector. Obviously, for plants that do not resort to the electronic provision of DoP, no IT costs were inputted. Using a zero value for non-respondents would have led to the underestimation of these costs.

Based on these cost parameters, total administrative costs due to the DoP and CE marking were quantified for each plant in the sample. To obtain administrative burdens, plants' costs were discounted by the BAU factor.

With respect to the measurement of the **substantive costs due to AVCP**, plants were preliminarily asked to clarify whether ITT and FCP activities were part of their normal business practice. This was done because in the cumulated cost and benefit assessment of the construction sector, a survey showed that *'most or all costs incurred for the AVCP, including initial testing, ongoing testing, and other FPC measures, would be incurred in*

any case because of quality management and to provide information on product performance to customers'.⁷⁵ In line with this early result, only one company in the flat glass sector reported that these activities are not part of their normal business practice. Accordingly, no regulatory burdens are attributed to this obligation.

Finally, as for the **changes between CPR costs and those incurred under the CPD**, companies are requested to provide an estimated percentage change with respect to various cost parameters, such as personnel's time for DoP and CE marking, other one-off administrative costs, personnel's time for ITT and FPC, testing costs, notified bodies costs. In addition to change reported during interviews, CPD costs do not include any expense linked to the provision of the DoP, as, under the previous framework, there was no duty to provide such documents to customers. The main changes, relevant for the cost quantification, from CPD to CPR are summarised in Box 9 below.

Box 9. Changes between the CPD and the CPR

DOP. Under the CPD, the manufacturer had to draw the Attestation of Conformity for the product that it intended to CE-mark; under the CPR, the manufacturer needs to draw the DoP for all products covered by hEN or EAD. Both the CPD Attestation of Conformity and the CPR DoP include similar information. The main difference between the CPD and the CPR is the duty of the manufacturer to provide the DoP to customers; under the current framework, companies can opt for supplying their DoP via paper or via electronic means. Derogations from the duty to draw a DOP were introduced in the following cases: (i) products individually manufactured or custom-made in a non-series process, and installed in a single identified construction work; (ii) construction products manufactured on the construction site; and (iii) construction products manufactured in a traditional way or for heritage conservation. Under the CPD, there was no derogation from the duty to draw the Attestation of Conformity, though a simplified declaration of conformity could be drafted for individual and non-series production.

CE marking. Under the CPR, all products covered by a DOP or EAD need to be CE-marked. Under the CPD, CE marking was not mandatory in four Member States: Finland, Ireland, Sweden, and the United Kingdom. However, many industrial sectors CE-marked their products even in Member States in which this was not required, especially when products were also designed for exports. In addition, the meaning of the CE marking in the context of the CPR was clarified.

AVCP. AVCP systems were simplified, by removing System 2, foreseen under the CPD. Art. 37 allows micro-enterprises to use different methods for products covered by Systems 3 and 4, where so provided for in the hEN, and to resort to System 4 for products for which System 3 would be required. Art. 38 allows manufacturers to replace AVCP with Specific Technical Documentation for individually manufactured or custom-made products in a non-series process.

Source: Supporting study for the Fitness Check on the construction sector: EU Internal Market and energy efficiency legislation.

⁷⁵ Cf. Economisti Associati, CEPS, Milieu et al., Supporting study for the Fitness Check on the construction sector: EU Internal Market and energy efficiency legislation. Volume 1 – Main Report, p. 45.

5.1.4 Cost assessment – Flat Glass

Sample

Regulatory costs triggered by CPR/CPD can be assessed by relying on 14 questionnaires. For the remaining plant, its production line was targeted to the automotive sector. Sufficient data across the three sub-regions are available, which allow regional estimates to be presented.

Administrative Costs

The estimated parameters for administrative costs generated by DoP and CE marking are presented below. When possible, comparisons to the estimates from the Cumulated Costs and Benefits Assessment of the Construction Sector (in short, the 'Construction report') are given.

- **Amount of personnel:** the median and average values are 0.18 FTEs. FTEs range from less than 0.01 FTE to 0.5. These values are significantly lower than those from the Construction report, in which one FTE was estimated for a typical small company, and two FTEs were estimated for medium-sized and large companies.
- **Annual costs of access to hEN** (including subscription to standardised bodies): the median value is €145, while the average value is €563, which is significantly lower than the Construction report's estimate of €1,000.
- **IT investments and operational costs:** the median IT CAPEX is €7,000, while the median operational costs are €5,015 per year.
- **Printing investment and operational costs:** the average value is €1,852. Combined median values for IT and printing (€12,015) are significantly higher than those in the Construction report (€6,000), which may be explained by the larger average size of flat glass plants compared to other construction product suppliers.
- **Annual other costs:** negligible.

The median value of total administrative costs due to DoP and CE marking per plant is about €9,800, while the sample average value is around €10,100. The sample weighted average is only slightly higher with €10,900, indicating that larger plants face higher costs, but only marginally. The BAU factor analysis shows a modal and median assessment corresponding to a BAU factor of 40%, which is in line with the Construction report (36%). The median and sample average typical administrative burdens therefore come to about €4,400 and €4,000, and a sample weighted average of €4,000.

Cumulative regulatory costs

In Table 10 and Table 11 the regulatory costs per tonne of flat glass generated by the CPR and CPD are presented. The costs are shown for the EU and the three sub-regions and are measured in the typical years 2015 and 2012. **Regulatory costs are in the area of a few euro cents per tonne of product.** Regional differences remain small, with SE facing marginally higher costs than NWE and CEE. The cost analysis over the 10-year period can be found in Figure 8 to Figure 11 below, for the EU and the three sub-regions.

CPR and CPD costs show a slight increase over this period, increasing from less than €0.01 to about €0.02/tonne. Regional differences are again minimal with CEE and NWE showing an almost identical development, reaching €0.01/tonne, and SE presenting a slightly higher increase from €0.01 to €0.03/tonne. Overall, costs remained widely constant from

2006 to 2012 and then again from 2013 to 2015. Between 2012 and 2013, there is a slight increase following the introduction of the new CPR obligations.

Table 10. Regulatory costs generated by the CPR on the flat glass sector (€/tonne – Typical year: 2015 – averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.01	0.01	0.03	0.02
	Substantive compliance costs	0	0	0	0
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		0.01	0.01	0.03	0.02

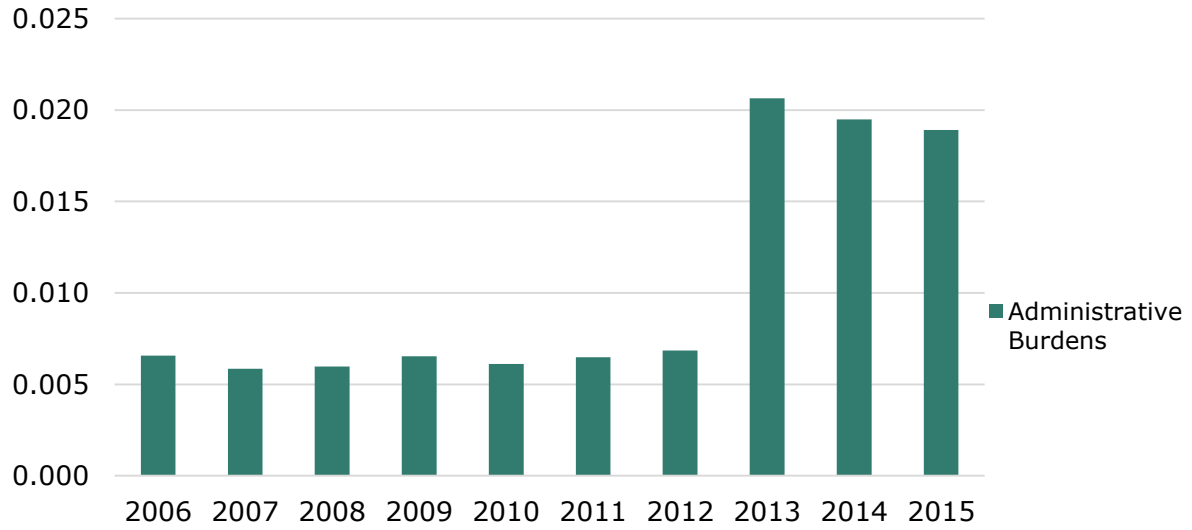
Source: Authors' own elaboration.

Table 11. Regulatory costs generated by the CPD on the flat glass sector (€/tonne – Typical year: 2012 – averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.00	0.00	0.01	0.01
	Substantive compliance costs	0	0	0	0
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		0.00	0.01	0.01	0.01

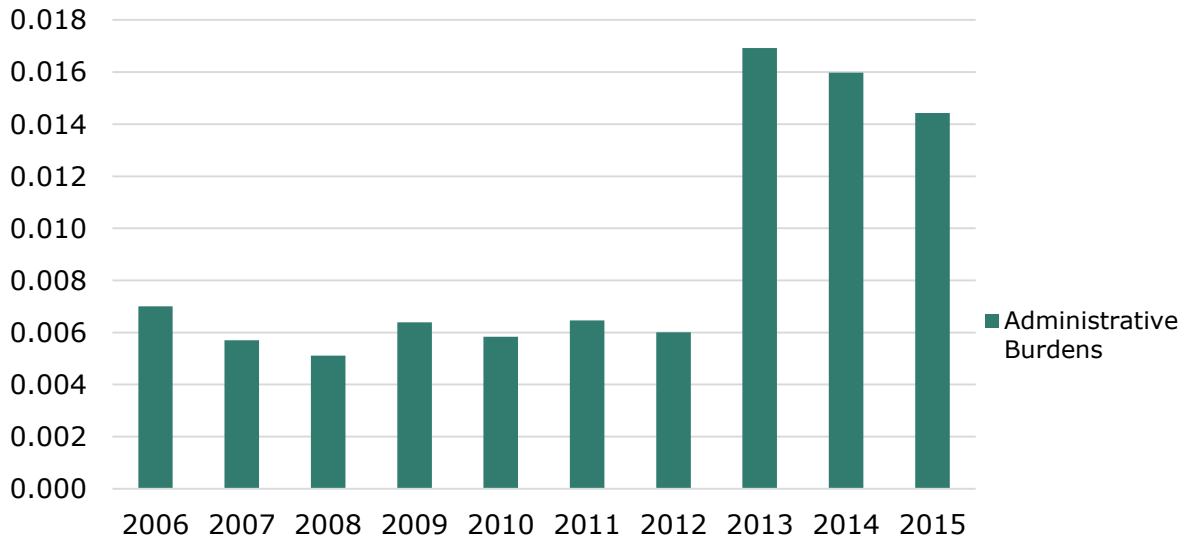
Source: Authors' own elaboration.

Figure 8. Regulatory costs generated by the CPD/CPR on the flat glass sector at the EU level (€/tonne – average costs)



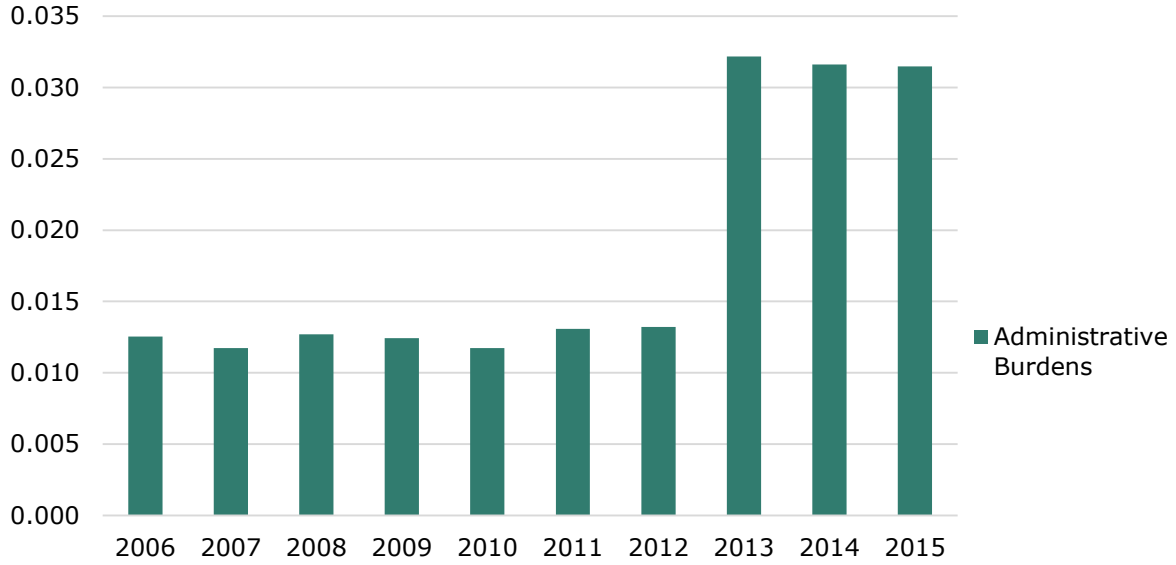
Source: Authors' own elaboration.

Figure 9. Regulatory costs generated by the CPD/CPR on the flat glass sector in the Central Eastern European Region (€/tonne – average costs)



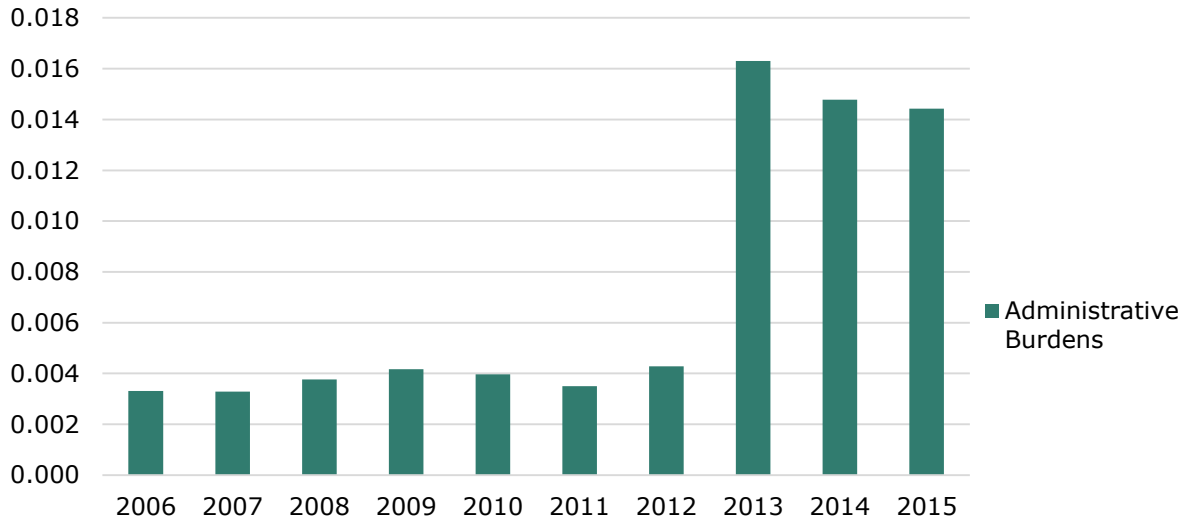
Source: Authors' own elaboration.

Figure 10. Regulatory costs generated by the CPD/CPR on the flat glass sector in the Southern European Region (€/tonne – average costs)



Source: Authors' own elaboration.

Figure 11. Regulatory costs generated by the CPD/CPR on the flat glass sector in the Northern-Western European Region (€/tonne – average costs)



Source: Authors' own elaboration.

5.2 Internal Market for chemicals

5.2.1 Description of the Acts (REACH and CLP)

The **Regulation No 1907/2006/EC** (REACH) is the European Union's regulatory framework on chemicals and their safe use that entered into force on 1 June 2007. **REACH makes the industry responsible for assessing and managing the risks posed by chemicals and for providing appropriate safety information** to their users. At the same time, the European Union has the possibility to take additional measures on highly dangerous substances, where there is a need for complementary action at EU level.⁷⁶

Regulation No 1272/2008 (CLP Regulation) lays down EU-wide criteria that are applied to determine **whether a substance or mixture**, which is manufactured or imported into the European market, **has properties that could damage human health or the environment**.⁷⁷

According to the **REACH Regulation**, the producer has to demonstrate with conclusive scientific data that substances used in its production process fulfil the criteria specified in the Regulation.⁷⁸ The REACH Regulation includes also several obligations for downstream users, who have to identify, apply and, where suitable, recommend appropriate measures to adequately control risks; they are obliged to communicate information down the supply chain, as well as to prepare Safety Data Sheets or a chemical safety report (which includes exposure scenario for the identified use(s)); and in some cases they have to notify the European Chemicals Agency (ECHA).⁷⁹

Glass is exempted from certain provisions, if it fulfils the criteria reported in Annex V of REACH (Box 10). According to point 11 of this Annex, articles made of glass, which are not intended to release any substances, are exempted from certain provisions (Title II registration of the substances, Title V downstream users and Title VI evaluation) and can also be considered exempted from the obligation of registration and notification.⁸⁰

Box 10. Explanation for glass exemption from certain provisions of REACH

Certain boron substances included in the Candidate List, such as diboron trioxide, boric acid and disodium tetraborate, are involved in processes leading to the production of articles containing "borosilicate glass". In these processes, the boron substances are usually first chemically transformed into a manufactured glass substance. The glass substance is subsequently processed into articles. In this circumstance, the boron substances are completely transformed and not present as such in the final glass article. Consequently, there is no obligation to notify under Art. 7(2) of REACH, nor to communicate information down the supply chain under Art. 33 of REACH.

Source: Interview with a REACH expert from the European Commission.

⁷⁶ Glass Alliance Europe (www.glassallianceeurope.eu/en/reach).

⁷⁷ ECHA, Questions and answers on Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, 2009 (https://echa.europa.eu/documents/10162/13643/questions_and_answers_clp_20090526_en.pdf).

⁷⁸ For further details, see Glass Alliance Europe (www.glassallianceeurope.eu/en/reach).

⁷⁹ REACH Regulation, Art. 66: If you are a downstream user that uses a substance that is on the Authorisation List (Annex XIV) based on an authorisation granted to an applicant up your supply chain, you have to notify your use to ECHA.

⁸⁰ Interview with a REACH expert from the European Commission.

The **Classification, Labelling and Packaging (CLP) Regulation** obliges manufacturers and importers of substances, downstream users, including formulators of mixtures and re-importers of substances or mixtures benefiting from an exemption from Article 2 REACH, to classify, label and package substances and mixtures.⁸¹ The most common tool for hazardous communication is the labelling on the packaged substance or mixture, but also the Safety Data Sheet that is provided to other companies in the supply chain. Manufacturers and importers placing a hazardous substance on the market also have to notify certain information to ECHA, in particular the substance identity and its classification and labelling, unless this information has already been submitted as part of a registration under REACH.⁸²

5.2.2 Methodological aspects

Regulatory costs generated by this area of legislation are difficult to estimate, due to a very limited number of cost data provided by respondents to the questionnaire. In fact, for most companies interviewed, no costs occur for both hollow glass and flat glass.

The Research Team investigated whether firms submitted and updated registration dossiers to ECHA between 2006 and 2015, and requested a quantification of costs related to these activities, in the form of personnel time, out of pocket expenses or fees. The Research Team similarly collected data on costs, if any, generated by the notification of substances of very high concern (SVHC) or substances used in process-oriented research and development (PPORD). Feedback on these two areas was limited to isolated responses.

Most of the replies provided were related to the costs of information to downstream users, e.g. additional information on safe use and disposal placed on the packaging, and to workers, e.g. warning signs at work.

Almost all the cost items listed can be classified as **administrative burdens**, generated by the implementation of administrative procedures, e.g. the provision of information to users on safe use and disposal placed on the packaging. The fees to be paid to ECHA were accounted as **direct charges**.⁸³ However, a very limited number of companies reported costs of this nature. This part of the questionnaire was the same across all the sectors considered, as the legislation similarly applies to firms operating in the flat glass sector as well as in the hollow glass sector (packaging glass and glass tableware).

Regarding the costs generated by the CLP Regulation, we inquired whether companies reported costs of various nature (labour, investment, operational costs) as related to the provision of information to downstream users as well as to comply with the requirements imposed. All costs reported in this section were considered **administrative burdens**.

Data collected for glass tableware cannot be presented, due to confidentiality reasons.

5.2.3 General findings relevant to all glass subsectors

According to a study done by DG GROW,⁸⁴ manufacturers and formulators tend to allocate more resources to comply with the Regulations than downstream users, even though some article suppliers and end users also allocate significant resources. In fact, according to our findings, both the REACH and the CLP Regulations have proven to generate **only**

⁸¹ ECHA, Questions and answers on Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, 2009 (https://echa.europa.eu/documents/10162/13643/questions_and_answers_clp_20090526_en.pdf)

⁸² Ibid.

⁸³ Note: Direct fees to ECHA are usually not paid by downstream users such as the ceramics or glass industry.

⁸⁴ DG GROW (2015), Monitoring the Impacts of REACH on Innovation, Competitiveness and SMEs.

administrative burdens, and only in terms of becoming familiar with information obligations and preparation of documentation. After all, the glass industry is largely exempted from the majority of obligations set out by REACH; in addition, this industry is hardly producing any substances/mixtures falling under the scope of CLP Regulation. The vast majority of interviewed companies did not have to substitute any of the substances used in the glass production process due to the REACH Regulation. As a result, **both Regulations are of limited relevance for the glass industry**. Against this background, due to the limited number of responses and related confidentiality issues, the cost assessment for the CLP Regulation cannot be presented.

5.2.4 Cost assessment – Packaging glass

Sample

The sample used for cost estimates in this area of legislation comprises the following number of plants, divided across the three defined regions.

Table 12. Packaging glass: Sample size by geographic region

Packaging glass/ REACH	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	2	5	10

Source: Authors' own elaboration.

Ten plants provided costs data. However, the breakdown of replies at a regional level does not present a sufficient number to disclose data for NWE and CEE: only Southern Europe fulfils the requirements of confidentiality and reaches the target of five responses.

Direct regulatory costs

The direct regulatory costs generated by REACH on the EU packaging glass subsector consist only of administrative burdens, which are estimated at **€0.01/tonne of production output in a typical year; similar values are registered in the SE region**. The cost estimate confirms the assumption that EU legislation on REACH generates only very limited costs on hollow glass producers, given that glass is exempted from the majority of obligations set out by REACH. Company responses on the amount of costs across the EU show little variance. The total of costs generated by the REACH legislation are due to the obligations generated by the duty to communicate information to downstream users and to workers. Some plants also mentioned the implementation of training activities and the set-up of a system of warning signs. The BAU factor is about 55% which indicates that some of the obligations, even if classified as administrative burdens, are expected to also be required, e.g. by downstream clients in absence of REACH. Individual responses concerning the BAU factor tend to polarise along two extreme interpretations: a subgroup of plants states that none of the costs would have been paid in the absence of the legislation, while another subgroup claims that costs would have been paid anyway. Plants belonging to the same company tend to provide a uniform interpretation. This underlines that individual policies of companies, their specific type of

business function and organisation as well as the location of their business appear to impact significantly on the perception of the effects of the legislation.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for packaging glass in the area of the REACH Regulation.

Table 13. Packaging glass: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	<i>Confidential</i>	<i>Confidential</i>	0.01	0.01
	Substantive compliance costs	<i>Confidential</i>	<i>Confidential</i>	0	0
	Direct charges	<i>Confidential</i>	<i>Confidential</i>	0	0
Indirect regulatory costs		<i>Confidential</i>	<i>Confidential</i>	NA	NA
Total regulatory costs		<i>Confidential</i>	<i>Confidential</i>	0.01	0.01

Source: Authors' own elaboration.

5.2.5 Cost assessment – Flat glass

Sample

The sample used to estimate costs in this area of legislation consists of the following number of plants, split across the three defined regions (Table 14).

Table 14. Flat glass: Sample size by geographic region

Flat glass /REACH	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	3	3	9

Source: Authors' own elaboration.

Similarly to the case of packaging glass plants, nine plants serve as a basis to investigate the costs faced by a typical plant. Data for the NWE and the SE regions cannot be presented due to confidentiality reasons (data were provided only by two independent companies). In CEE numbers can be shown, but need to be discussed with special care as they are based on three observations.

Direct regulatory costs

Direct regulatory costs of the REACH Regulation for the EU flat glass producers are estimated at **€0.02/tonne of production output in a typical year**. These costs consist entirely of **administrative burdens** due to the obligations generated by the duty to inform (a) downstream users and (b) workers. The overall BAU for the sector is about 60%, and responses by company and across regions appear generally uniform. A possible explanation for this rather uniform BAU is that some activities conducted due to REACH legislation would potentially still be demanded by downstream clients in absence of legislation. To illustrate this point, those companies which only experience costs related to providing information to workers report a lower BAU than those companies which also face costs in providing information to downstream users.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for the flat glass sector generated by the REACH Regulation.

Table 15. Flat glass: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	<i>Confidential</i>	0.017*	<i>Confidential</i>	0.019
	Substantive compliance costs	<i>Confidential</i>	0*	<i>Confidential</i>	0
	Direct charges	<i>Confidential</i>	0*	<i>Confidential</i>	0
Indirect regulatory costs		<i>Confidential</i>	NA	<i>Confidential</i>	NA
Total regulatory costs		<i>Confidential</i>	0.017*	<i>Confidential</i>	0.019

Note: *Number below sample target, but can be presented as being above confidentiality threshold.

Source: Authors' own elaboration.

5.3 Measuring Instruments Directive

5.3.1 Description of the Act

Directive 2004/22/EC on Measuring Instruments (MID) was adopted by the European Parliament and Council on 31 March 2004, for application by EU Member States from 30 October 2006. The Measuring Instruments Directive **harmonises the requirements of 10 different types of devices and systems with a measuring function**, including capacity serving measures made of glass. This Directive established that measuring instruments **must meet essential requirements, satisfy specific conformity assessment procedures and have MID markings**.

The main challenge for the industry posed by the MID is the inconsistent approach of notified bodies in interpreting essential requirements. Consequently, the legislation can cause **administrative burdens** in dealing with notified bodies and conducting tests, especially due to international differences.

During the Inception Phase, sectoral associations have confirmed that, in the context of this Study, the MID is relevant only to producers involved in the production of glass tableware.⁸⁵

5.3.2 Methodological aspects

Plants were asked to assess the costs of complying with conformity assessments and technical documentation, conformity marking and the provision of additional information. Given that costs are either investment costs (longer-term investments) or ongoing staff or operational costs, costs were estimated for a typical year.

It is also worth noting that for glass tableware, costs expressed in €/tonne tend to be higher than in other sectors, as glass tableware items are generally high-cost high-margin products. Consequently, €/tonne estimates are quite high, but shares out of, e.g. total production costs and EBITDA, are comparable to other sectors.

5.3.3 Cost assessment – Glass tableware

Sample

The sample used for cost estimates for this area of legislation includes five plants across the EU.

Table 16. Glass tableware: Sample size by geographic region

Glass tableware/ MID	EU
Number of plants in the sample	5

Source: Authors' own elaboration.

⁸⁵ Consultation with glass and ceramics associations.

Direct regulatory costs

The direct regulatory costs generated by the MID on EU glass tableware producers include only administrative burdens, which derive from: (a) the procedure of conformity assessment and producing the technical documentation related to measuring instruments (in terms of workers involved or outsourced expenses); and (b) application of conformity marking ('CE') and 'supplementary metrology marking' on measuring instruments (in terms of acquisition of special machines, software or similar investment as well as associated operational costs). These costs are estimated at **€2.29/tonne of production output in a typical year**. This estimate is obtained after deducting an estimated 80% BAU factor. Given that all costs are classified as administrative burden, this BAU factor can be considered surprisingly high. A reason might be that companies attach costs related to similar activities under the same cost provisions as the requirements to comply with EU legislation. Variance between plants is somewhat higher than for other regulatory cost items.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for glass tableware in the area of MID.

Table 17. Glass tableware: Regulatory costs generated by MID (€/tonne – Typical year – averages)

		EU
Direct regulatory costs	Administrative burdens	2.29
	Substantive compliance costs	0
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		2.29

Source: Authors' own elaboration.

6 Energy legislation

This Chapter is structured as follows:

- In the beginning of the Chapter, the overview of global developments impacting energy prices and a description of the EU legislation and their expected impact are presented.
- Section 6.2 presents details on methodological choices specific to energy legislation as well as data collection and validation.
- Section 6.3 provides an overview of the impact of energy costs, including electricity and gas costs, on production costs.
- Section 6.4 provides a cost assessment of energy legislation in relation to use of electricity by the EU glass sector. Cost assessments for i) packaging glass, ii) glass tableware and iii) flat glass sectors are presented. Each cost assessment first sets the scene with analysis of electricity intensity and electricity costs, then turns to the impact of regulation on electricity price components, then provides the regulatory cost assessment for glass producers.
- Section 6.5 provides a cost assessment of energy legislation in relation to use of natural by the glass sector. Cost assessment for i) packaging glass, ii) glass tableware and iii) flat glass sectors is presented. Each cost assessment first sets the scene with analysis of natural gas intensity and natural gas costs, then discusses the impact of regulation on natural gas price components, then provides the regulatory cost assessment for glass producers.
- Section 6.6 provides a cost assessment of the Energy Efficiency Directive for i) packaging glass, ii) glass tableware and iii) flat glass sectors.

6.1 Overview and relevance of energy policy for the EU glass sector

In the last two decades, energy legislation in the EU has mainly pursued the objective of unbundling energy suppliers from network operators, privatising parts of the value chain and creating an Internal Market subject to cross-border competition. In parallel, energy legislation was introduced to move away from fossil fuels, fully restructure the sector and moderate energy demand. In addition to EU and national legislation, global developments drive the costs of energy. As the international trends impacting costs of energy for industry influence the cost of energy for the glass sector, the recent trends in energy prices are here discussed.

Energy bill of the industry typically consists of four parts:

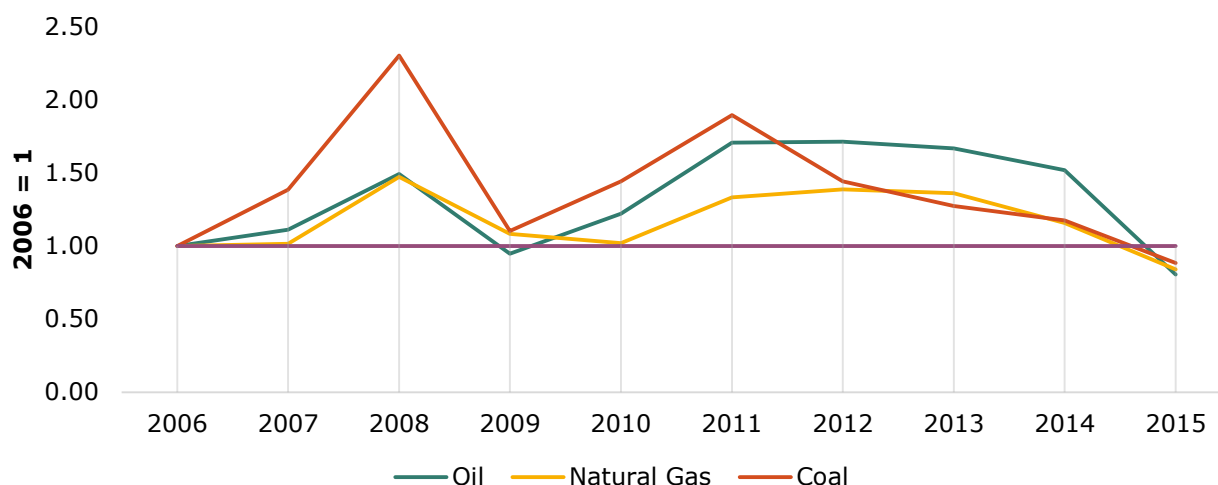
- energy component;
- network costs;
- renewable energy support levies for electricity;
- other taxes, levies and fees and charges.

The costs of the energy component are usually affected by the prices of the energy commodities. Network costs, renewable energy scheme (RES) levies and other taxes are the result of the EU and national legislation. This section will present price trends of the energy commodities in the EU.

6.1.1 Global developments in energy prices

Oil, natural gas and coal are the three most consumed fuels in the EU⁸⁶ and their interconnected price trends have significant impact on electricity prices in the EU. Figure 12 shows the normalised price trends for oil, natural gas and coal in the EU, showing that the three fuels follow similar price trends.

Figure 12. Normalised price trends of oil, natural gas and coal, 2006-15; 2006=1



Source: BP (2016).⁸⁷

Oil price developments 2006-15

Oil is by far the most consumed fuel in the EU⁸⁸ and although it is not typically used to generate electricity, its price affects the price of other fossil fuels, such as natural gas and coal.

In the period between 2006 and 2015 there were several oil price developments:⁸⁹

- **2006-08:** the price of oil increased from about \$60 to \$100 per barrel. The main reason was growing energy consumption in developing countries, mainly China and India.
- **2008-09:** due to the global economic crisis, oil consumption decreased, which led to a drop in oil prices to below \$60 per barrel.

⁸⁶ Gross inland consumption, EU-28, 1990–2014 (% of total consumption) ([http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross inland consumption, EU-28, 1990%E2%80%932014 \(%25 of total consumption\) YB16.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_(%25_of_total_consumption)_YB16.png)).

⁸⁷ BP Statistical Review of World Energy 2016 (www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf).

⁸⁸ Gross inland consumption, EU-28, 1990–2014 (% of total consumption) ([http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross inland consumption, EU-28, 1990%E2%80%932014 \(%25 of total consumption\) YB16.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_(%25_of_total_consumption)_YB16.png)).

⁸⁹ BP Statistical Review of World Energy 2016 (www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf).

- **2009-13:** the recovery from the global economic crises led to the growing demand for oil and prices rose to around \$100 per barrel.
- **Since 2013:** in 2013 the prices moderately went down and since 2014 there was a constant and sharp decline in oil prices to around \$50 per barrel. The main reasons were the decrease of demand in China (due to slowing economic growth), and the shale gas and oil revolution in the US.

Natural Gas market developments, 2006-15

Natural gas, a fuel consumed mostly by industry and the residential, commercial and, more recently, electricity sectors, is the second-most consumed fuel in the EU⁹⁰ and has followed a similar trend to that of oil.

Traditionally, natural gas markets were regional markets where natural gas was delivered mainly via pipelines under oil-price-linked long-term contracts. However, gas markets have significantly evolved over the last 15 years, mainly due to the following developments:

- Sophistication of liquefaction technologies and development of Liquefied Natural Gas (LNG) infrastructures helped globalise natural gas markets.
- Shale gas revolution in North America increased the natural gas supply, consequently reducing natural gas prices.
- Spot pricing partly replaced traditional oil-price-linked long-term contracts.
- The price of oil significantly dropped in 2015-16, affecting gas markets, yet important volumes of gas are still being delivered under long-term contracts destined for identified buyers.

These developments have significantly lowered the natural gas prices in the (import dependent) EU.⁹¹

Coal market developments, 2006-15

Coal is used mostly to generate electricity and represents the third most consumed fuel in the EU⁹². It followed the similar price trend to that of oil and gas, dropping from its peak in 2008 of around \$150 per tonne to around \$70 per tonne in 2009 due to the global economic crisis, followed by a recovery and subsequent drop to even lower levels in 2015 (below \$60 per tonne).

6.1.2 Summary of the legislation covered

The EU objectives of unbundling energy suppliers from network operators and creating an Internal Market with cross-border competition are present in several pieces of EU legislation. These legislative acts have an impact on the manufacturing industry, such as

⁹⁰ Gross inland consumption, EU-28, 1990–2014 (% of total consumption) ([http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_\(%25_of_total_consumption\)_YB16.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_(%25_of_total_consumption)_YB16.png)).

⁹¹ BP Statistical Review of World Energy 2016 (www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf).

⁹² Gross inland consumption, EU-28, 1990–2014 (% of total consumption) ([http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_\(%25_of_total_consumption\)_YB16.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_inland_consumption,_EU-28,_1990%E2%80%932014_(%25_of_total_consumption)_YB16.png)).

the glass sector. The following legislative acts were identified as having potential to generate a cost impact on the glass industry:

- **Internal Energy Market:**
 - Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the Internal Market in electricity and repealing Directive 2003/54/EC;
 - Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003;
 - Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the Internal Market in natural gas and repealing Directive 2003/55/EC;
 - Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.
- **Renewable Energy:**
 - 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 Energy Efficiency Directive (Directive 2012/27/EC);
 - Guidelines on State Aid for environmental protection and energy 2014-2020 are 'soft' legislation and relevant to assess the cost impact of the Renewable Energy Directive.
- **Energy Taxation:**
 - Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity.
- **Energy Efficiency Directive:**
 - 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 Text with EEA relevance.

The impacts of these acts are described in more detail in sections 6.4, 6.5 and 6.6.

6.2 Methodological aspects

This section explains the methodological choices specific to the analysis of regulatory costs generated by energy legislation for the glass sector.

6.2.1 General aspects

Data on costs of EU energy legislation was collected via interviews with industry players. The questionnaire surveyed energy consumption and energy prices paid by the plant (both in terms of electricity and natural gas prices and consumption), the components of energy bills, i.e. 1) energy component, 2) network costs, 3) RES levies and 4) other taxes, fees and levies, costs of passing energy audits and carrying out a cost-benefit analysis to assess the option of introducing co-generation in heating. In addition, data on the annual production output of the plant was used for the analysis on the energy intensity of production.

Table 18 shows the total number of questionnaires including data on costs generated by EU energy legislation per subsector and those used in this Chapter. As the data collected

at plant level needs also to be validated, the Research Team complemented the bottom-up data collection with data validation via follow-up interviews. When gaps in data provided by the respondents were detected, plant managers were approached with follow-up questions to ensure the quality of the data. The Research Team also used triangulation for data validation: secondary sources such as Eurostat data and previously conducted studies were used to assess the validity of the data.

Table 18. Total number of questionnaires received and used in the Chapter

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Packaging glass	21	7	6	8	21 (electricity), 21 (natural gas)
Glass tableware	5	-	-	-	5 (electricity), 5 (natural gas)
Flat glass	15	5	5	5	15 (electricity), 15 (natural gas)

Source: Authors' own elaboration.

Missing data points

For a number of plants, data for some years was not provided. Where data was missing for particular years, the Research Team relied on methods of extrapolation based on data from other plants in the sample and secondary sources. The following provides a more detailed description of the methodology:

- *Consumption missing (MWh)*: The average energy intensity (MWh/tonne) was calculated for the plant from the closest two available years to the missing data point. The average energy intensity value along with the annual plant production value for that year allowed the missing data point to be calculated. This method was only used if one to four consecutive years were missing.
- *Total energy cost missing (€)*: If a plant in the sample has a similar production value and is in the same Member State, then the trend in annual energy prices was used and applied to the plant with missing energy cost data, using the available data points. If a plant in the sample does not have a similar production value and is in the same Member State then energy price trend data for that Member State from a previous study was used.⁹³ This method was only used if one to four consecutive years were missing.
- *Component costs missing (€)*: If one to two consecutive years were missing, the average of the share of components from the same plant in the two closest years to the missing year were used. If more than two years were missing, the average share of components from sampled plants in the same Member State were used. In the rare case where data was not available from our sample, component shares from a previous study were used.⁹⁴

⁹³ Marcu, A. et al. (2016), "Composition and Drives of energy prices and costs for energy intensive industries", CEPS.

⁹⁴ Ibid.

Data presentation

The Chapter uses box plots so as to display cost ranges and consumption ranges in the sectors. An exemplary box plot is presented in Figure 13. Graphs were prepared both to present values for electricity and natural gas.

The grey box is divided into two parts with a horizontal line, which indicates the median of the sample. The upper and lower boundary line of the grey box represent the first and third quartile of the data set meaning that box contains 50% of the sample. The lower border of the box represents the first (lower) quartile of the sample. It separates the lowest 25% of the data sample from the highest 75%. Correspondingly, the upper border of the box indicates the third (upper) quartile of the sample, thus separating the highest 25% of data from the lowest 75%.

The vertical lines below and above the box represent the minimum and maximum value of the sample. The green, blue and red figures present weighted regional averages.

Figure 13. Example plot



Source: Authors' own elaboration.

6.2.2 Electricity specific aspects

The **electricity intensity of production** was measured by summing i) electricity purchased from the grid; and ii) electricity self-generated; then subtracting iii) electricity sold to the grid; and iv) dividing by production.

When calculating **net electricity costs**, the 'electricity costs' section takes into consideration: i) interruptibility schemes; ii) self-produced electricity; iii) electricity sold to the grid; and iv) reimbursements from RES levies and other taxes, fees and levies. The 'electricity cost components section' takes into account reimbursements from RES levies and taxes but not i) interruptibility schemes; ii) self-produced electricity; iii) electricity sold to the grid.

When calculating **direct costs from energy taxation legislation**, the Study takes into account i) the minimum rate presented in legislation ii) multiplied by consumption. Self-generated electricity is not taken into account.

When calculating **indirect costs for electricity**, the impact of EU legislation on i) network costs and ii) RES levies needs to be considered. The impact of EU legislation on both cost components is considered separately.

Both Internal Market legislation and the Renewable Energy Directive generate costs present in network costs:

- **Internal Market legislation** has a cost impact due to cross-border interconnector projects. This is particularly true for projects taking place in areas with the weakest links to the EU market (Italy, the Iberian Peninsula, Ireland and the UK and Baltic states). **The Renewable Energy Directive** can generate costs as part of transmission fees due to the need for new infrastructure required to integrate renewable energy into the grid. Costs generated by this Directive are also included in distribution fees as connecting increasing variable renewable electricity generation to the grid requires significant upgrades to existing infrastructure.
- The delivery of new grid investments took place after the entry into force of Internal Market legislation and the Renewable Energy Directive. The cost of new investment is demonstrated in the network cost developments present in the primary data: network costs remained quite stable with a slight increase in the beginning of the study period but increased more significantly in absolute terms from 2010 onwards. The primary data collection from glass manufacturers shows that, for example, in the glass tableware sector costs increased from €7.7/MWh (2006) to €8.9/MWh (2015).
- Since the Internal Market legislation (714/2009) and the Renewable Energy Directive (2009/28/EC) became effective, the Research Team suggests that **50% of networks can be attributable to EU legislation** in the years 2010-15. It is estimated that 50% of network costs would have been incurred in the absence of EU legislation.
- The Research Team estimates that **30% of networks can be attributable to EU legislation** in the years 2006-09 for repealed legislation and Directives, namely the Internal Market legislation (1228/2003) and the Renewable Energy Directive (2001/77/EC).
- These estimates are based on combined studies by ENTSO-E⁹⁵ and IEA,⁹⁶ the share of variable renewables in the electricity mix for each time period and data collected from plants.

The Renewable Energy Directive generates costs present in the RES support component:

- Since the introduction of the Renewable Energy Directive (2001/77/EC) that was replaced by the Renewable Energy Directive (2009/28/EC), Member States have implemented support schemes to subsidise less mature low-carbon technologies. Many of these support schemes are funded through levies on consumer energy bills.

⁹⁵ The CCA is a retrospective analysis, whereas the ENTSO-E TYNDP looks forward to 2012-30. However, the estimations from ENTSO-E are particularly for the time period 2012-15 and can also provide information on past developments. The study estimates that the investment in transmission costs would correspond to €1.50-2/MWh in 2012-20 (www.entsoe.eu/publications/market-reports/Documents/ENTSO-E%20Overview%20of%20Transmission%20tariffs%202015_FINAL.pdf).

⁹⁶ The results from this study show that distribution grid infrastructure costs associated with upgrading the grid can be estimated in the range of €0.50-3/MWh for a 20-30% renewable share in annual electricity generation within a system. System operating costs incurred in the conventional part of the power system range from €2-4/MWh for below a 10% share of variable renewable generation in total generation and €5-6/MWh for a share of variable renewable generation above 20% in total generation. Applying this to the share of variable renewable generation in Europe, it is possible to approximate the cost of renewables on distribution costs (http://iea-etsap.org/E-TechDS/PDF/E15_Ren_integr_FINAL_Dec2013_GSOK.pdf).

- The more recent Renewable Energy Directive (2009/28/EC) sets aggressive renewable energy targets for Member States and it can therefore be assumed that since it became effective, most of the **RES levies on electricity bills are due to obligations set by EU legislation**. This is supported by evidence gathered from glass manufacturers, as RES levies have increased dramatically over the study period. For example, in the flat glass sector, RES levies increased from €5.40/MWh (2006) to €18.90/MWh (2015), representing approximately a 72% increase in the RES levy over 2006-15. Based on the data collected and the Directive, it is estimated that **85% of the RES support can be attributed to EU legislation** in the period 2010-15, since the more recent Directive became effective.
- RES levies were reported by plants on electricity bills since the start of the study period in 2006, though they were considerably lower in the years prior to 2010. When considering RES levy costs attributable to EU legislation prior to 2010, a share of these costs is due to the Directive 2001/77/EC that sets non-legally binding targets for renewable generation in Europe. However, this Directive sets much less aggressive targets than its succeeding Directive, hence, the Research Team deems **50% of the RES support can be attributable to EU legislation** in the period 2006-09. It is estimated that 50% of these costs would have been incurred in the absence of EU legislation as a result of national initiatives.

6.2.3 Natural gas specific aspects

The **natural gas intensity** of production was measured by summing i) natural gas purchased from the grid ii) divided by production.

When presenting **net natural gas costs**, the Study takes into account reimbursements from taxes and levies in the 'gas costs' and in the 'gas components' sections.

When calculating **direct costs from energy taxation legislation**, the Study takes into account i) the minimum rate presented in legislation ii) multiplied by consumption.

When calculating **indirect costs for natural gas**, the cost of EU legislation on network costs needs to be considered:

- The Internal Energy Market legislation aims to promote the cross-border flow of natural gas and thus advance the building of cross-border infrastructure. **The costs of new infrastructure, present in network costs, can be passed on to natural gas bills creating costs for industrial consumers.**
- The delivery of investment needed for new gas infrastructure slowed due to the economic crisis and uncertainty of gas demand. Network costs have, however, stayed quite stable before and after the entry into force of the Third Energy Package. For example, in the flat glass sector, network costs represented €0.85/MWh of the total bill in (2006). By 2015, network costs have increased to €1.10/MWh (2015).
- Therefore, we estimate the cost of Internal Market legislation present in network costs to be modest as most network costs would anyway occur in the absence of EU legislation. This Study uses an estimate that **15% of natural gas network costs are generated due to EU Internal Market legislation** for the entire study period 2006-15.

6.2.4 Energy efficiency specific aspects

When calculating **direct costs from the Energy Efficiency Directive**, the Study takes into account i) total costs of the audit in 2012-2015 (payments to auditors and labour costs) and dividing them by ii) total production in 2012-2015.

Some plants reported costs related to employees preparing the energy audit and accompanying the auditors in the plant. These employees are assumed to be technicians and associate professionals. The hourly earnings of technicians and associate professionals are therefore applied.

As a small amount of plants reports having carried out an energy efficiency audit prior to the entry into force of the obligation in 2012, not all costs generated by 2012-15 audits can be attributed to the Energy Efficiency Directive. Therefore, we attribute **85% of the costs of the audits to the Energy Efficiency Directive**, assuming that when plants report having carried out energy efficiency audits, it is likely that some of the activities would have taken place in the absence of EU legislation.

6.3 Overview of the impact of energy costs on production costs

This section includes information from responding glass plants concerning the impact of energy costs – for both natural gas and electricity – over production costs.⁹⁷ As the glass sector is an energy-intensive sector, the impact of energy costs on production costs sheds light on the role energy costs play on the sectors' competitiveness.

Packaging glass

What follows below is an analysis on the impact of energy costs on production costs in the packaging glass subsector.

Table 19. Packaging glass: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Packaging glass	21	7	6	8	21

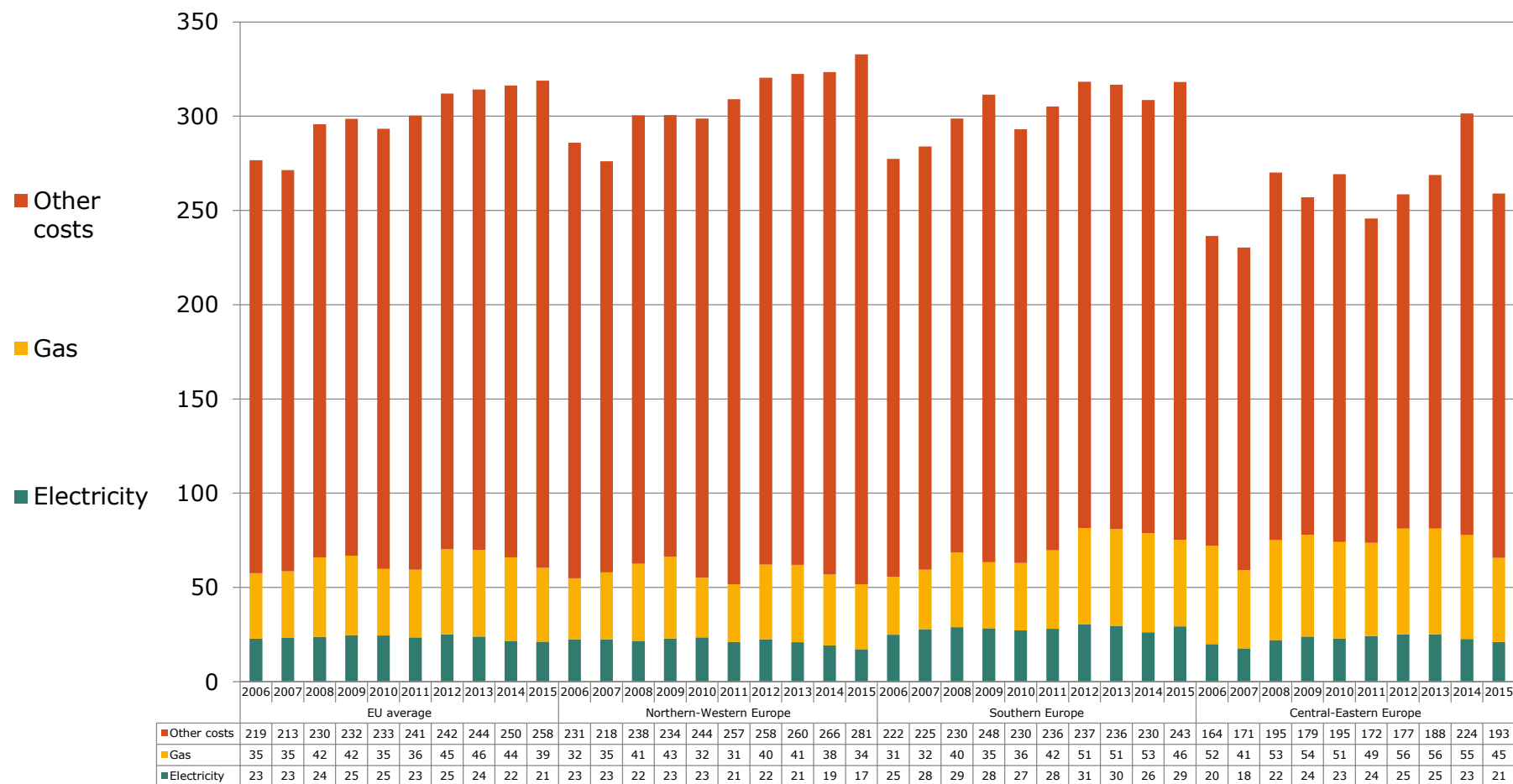
Source: Authors' own elaboration.

The impact of electricity and gas costs on production costs in the packaging glass subsector fluctuated somewhat over the study period. The share of electricity costs on total production costs decreased: in 2006 electricity costs represented 8.3% of production costs, while in 2015 they represented a share of 6.7% of total production costs. The share of natural gas costs on production costs fluctuated over time. In 2006, natural gas costs were responsible for a share of 12.5%, increasing to 14.6% in 2013 and going down to 12.3% in 2015.

Some regional differences were present. While in the SE and CEE region energy costs (both electricity and natural gas costs) represented similar shares of production costs, in the NWE region, the role of energy costs was less significant. In 2015, energy costs were at 23.6% of production costs in the SE region and at 25.4% in the CEE while in the NWE region they stood at 15.5%.

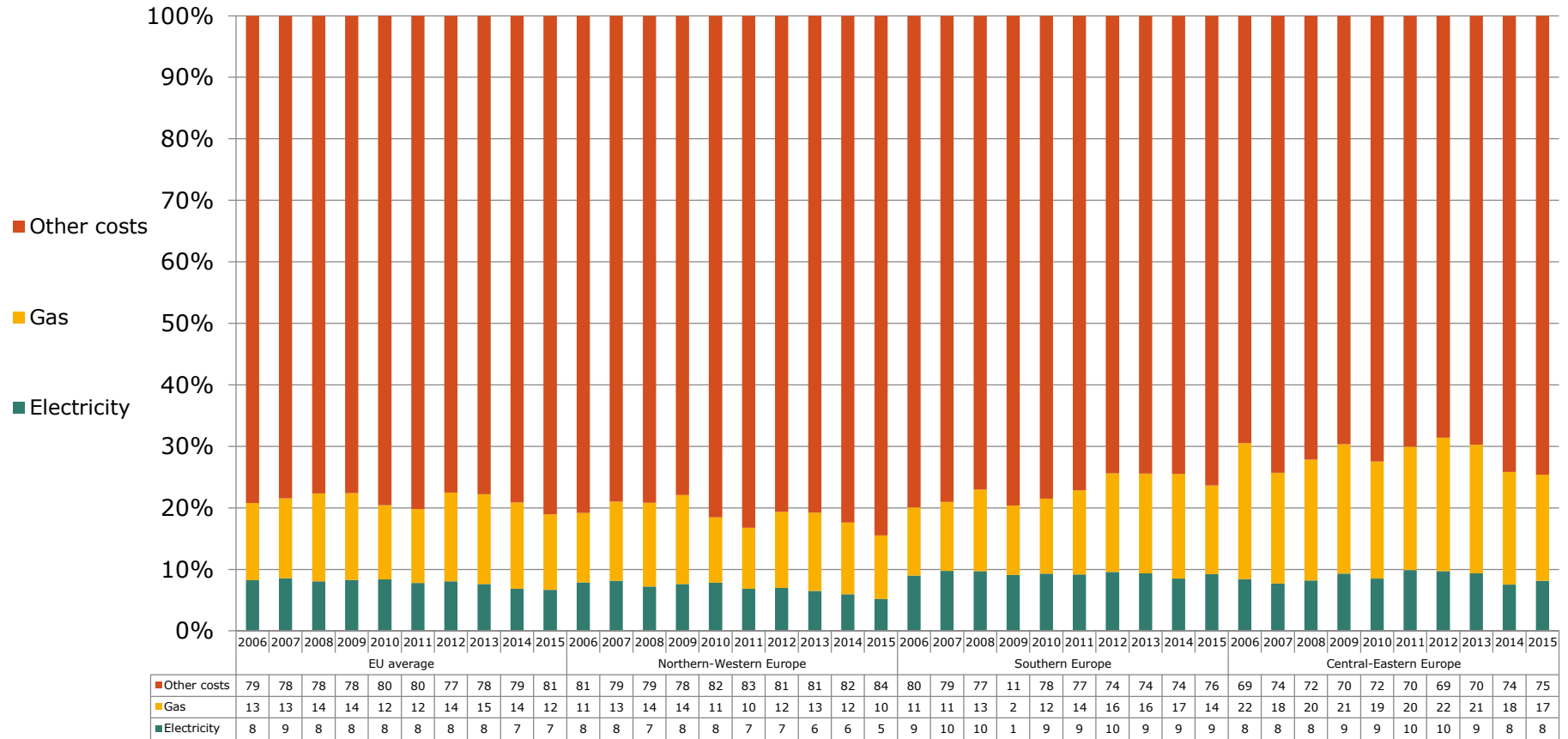
⁹⁷ Production costs include all costs, both OPEX, CAPEX and other expenses, borne by the plant and directly relating to the manufacturing process.

Figure 14. Packaging glass: Impact of energy costs on production costs €/tonne of production (2006-15)



Source: Authors' own elaboration.

Figure 15. Packaging glass: Impact of energy costs on production costs % (2006-15)



Source: Authors' own elaboration.

Glass tableware

What follows is an analysis on the impact of energy costs on production costs in the glass tableware subsector.

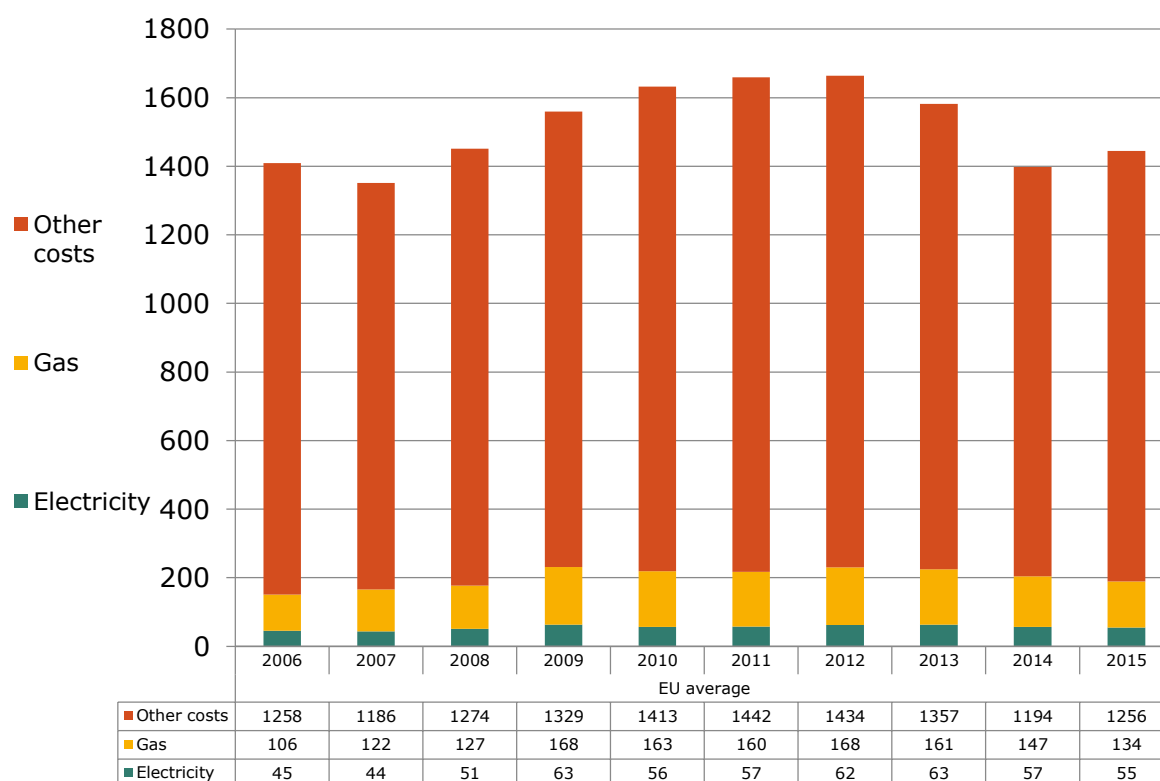
Table 20. Glass tableware: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Glass tableware	5	5

Source: Authors' own elaboration.

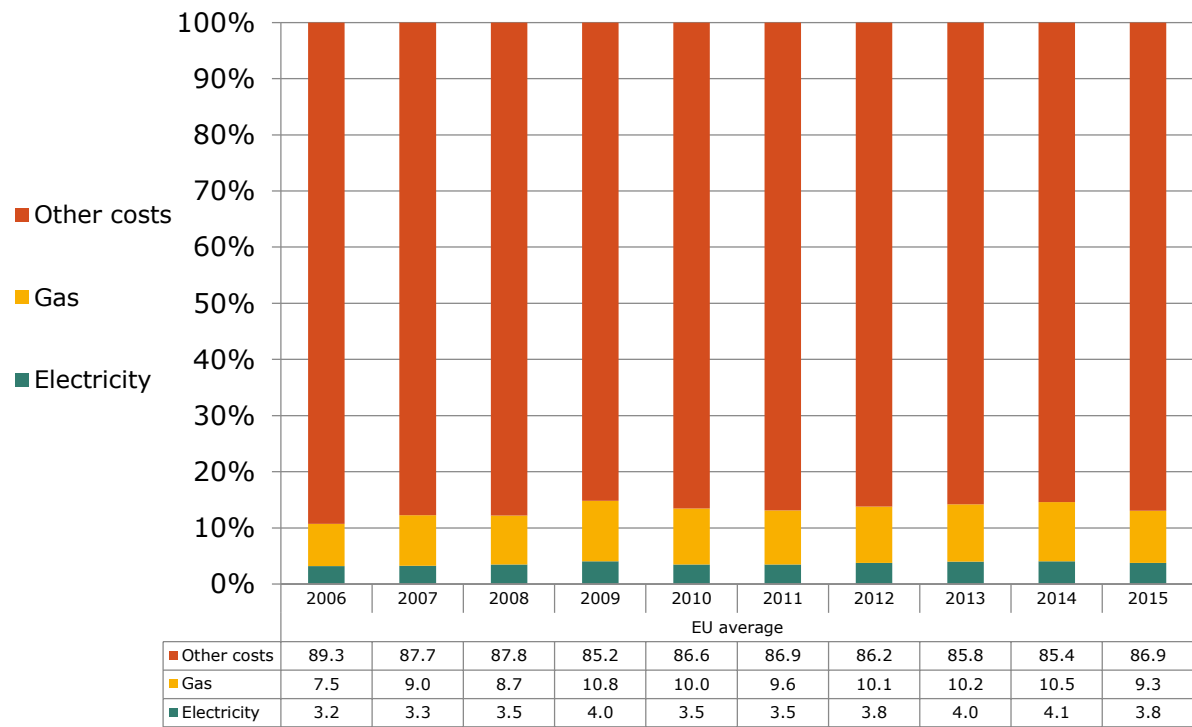
The share of gas costs fluctuated over the study period. An increase in the share of gas costs over production costs can be observed from 2006 to 2015. While in 2006 gas costs represented a share of 7.5% on total production costs, by 2015, the share increased up to 9.3%. The share of electricity costs remained more stable throughout the study period. In 2006, the costs represented a share of 3.2% of total costs and in 2015 the share was at 3.8%. Both natural gas costs and electricity costs as a share of production costs increased in absolute value over the period 2006-15.

Figure 16. Glass tableware: Impact of energy costs on production costs €/tonne of production (2006-15)



Source: Authors' own elaboration.

Figure 17. Glass tableware: Impact of energy costs on production costs % (2006-15)



Source: Authors' own elaboration.

Flat glass

What follows below is an analysis on the impact of energy costs on production costs in the flat glass sector.

Table 21. Flat glass: Total number of questionnaires received and used in the Chapter

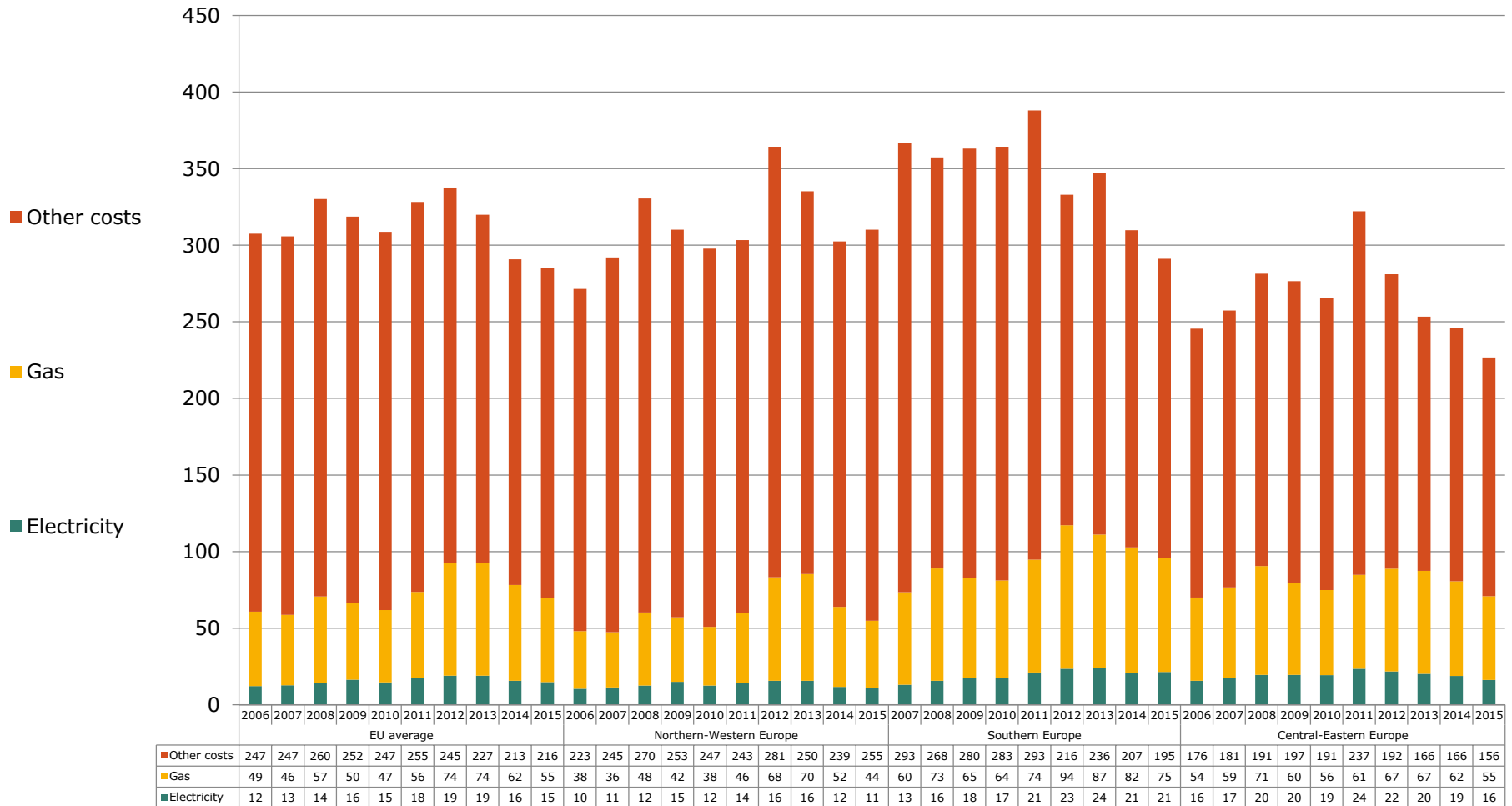
Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Flat glass	15	5	5	5	15

Source: Authors' own elaboration.

In 2006, energy costs represented a share of 19.8% of total costs, while in 2015 their share was 24.4%. Energy costs per tonne of output were at their highest level in 2012: €92.70/tonne. From 2012 to 2015, the costs decreased to €69.40/tonne. Electricity costs as a share of production costs stayed relatively stable over the 10-year study period: in 2006, electricity costs were 4% of production while in 2015 their share was 5.2%. Gas costs as a share of production costs were at a higher level in 2015 than in 2006: in 2006, gas costs were responsible for 15.8% of production costs while in 2015 their share was 19.2%.

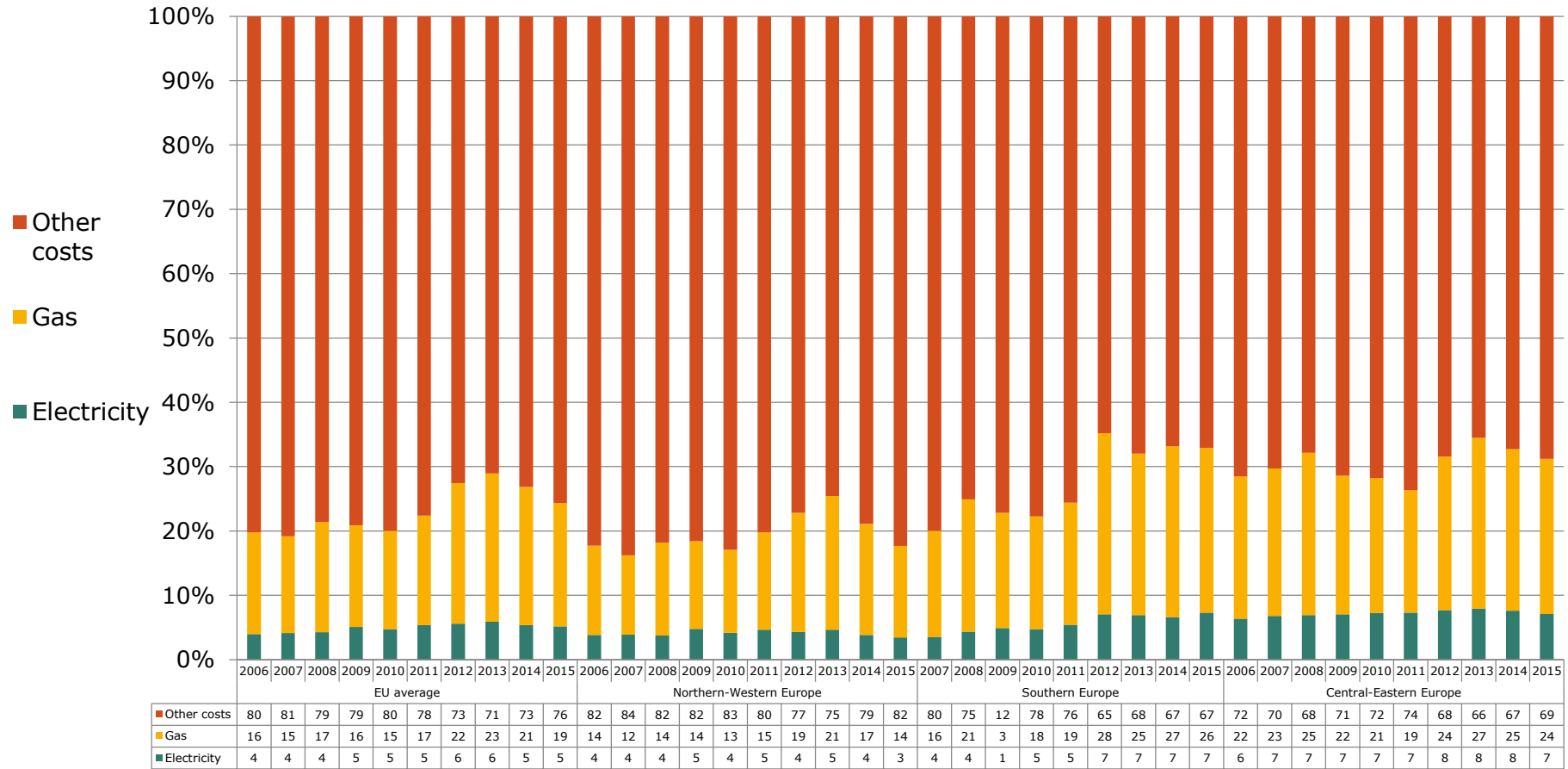
Some regional differences were present. Energy costs as a share of production costs were the highest in the CEE and SE regions, where energy costs were 31.2% (CEE) and 32.9% (SE) of production costs in 2015. The share was less significant in the NWE region in 2015, accounting for 17.7% of production costs. In the SE region, gas costs were responsible for an increasing share of production costs: while in 2006 gas costs represented 15.1% of total costs, their share increased to 25.6% in 2015. Note, however, that total production costs in the SE region decreased over the period 2006-15.

Figure 18. Flat glass: Impact of energy costs on production costs €/tonne of production (2006-15)



Source: Authors' own elaboration.

Figure 19. Flat glass: Impact of energy costs on production costs % (2006-2015)



Source: Authors' own elaboration.

6.4 Electricity

Glass manufacturing is an energy-intensive industry. While natural gas is the main energy source in the sector, glass manufacturers also consume electricity.⁹⁸ A cost assessment of EU legislation on electricity for packaging glass, glass tableware and flat glass producers is presented in this section.

The price of electricity is split into four components, of which the last three can be partly caused by the regulatory framework (regulated components):

- energy supply;
- network costs;
- renewable support;
- other taxes, fees, levies and charges (excluding recoverable taxes, such as VAT).

Data on components of the electricity bill shed light on the trends of regulatory components, which are set by both the EU and national regulators. **While not all regulated components are a result of EU Regulation, an EU driven component is present in network costs, renewable support as well as other taxes, fees, levies and charges.**

Note that there are differences between the electricity costs and electricity cost components presented under each cost assessment. These differences are caused by i) the revenues respondents gained from selling self-generated electricity to the grid and ii) by remunerations for those plants that have taken part in an interruptibility scheme. Both revenues from self-generation and interruptibility scheme remuneration are taken into account in net electricity costs section whereas these revenues are not accounted for in electricity bill component analysis. Note that reimbursement from RES and for taxes, fees and levies (excluding VAT) are taken into account both in net electricity costs and in electricity bill components section.

In this section, the analysis of electricity legislation is described via box plots. Where box plots have not been used due to confidentiality reasons, line graphs are provided instead.

6.4.1 Description of the Acts

What follows is a description of electricity related legislation with an expected cost impact on the glass sector.

Internal Energy Market. Directives and Regulations setting rules for the Internal Energy Market constitute the so-called '**Third Energy Package**' (hereinafter Third Package). Completing the Internal Market requires both 'software', i.e. common rules for trading electricity, as well as 'hardware', i.e. cross-border infrastructure. This package replaced the 'Second Energy Package', which enabled new gas and electricity suppliers entering national markets and customers choosing their own gas and electricity suppliers.

The Directive (whose transposition was required by 2011) included in the 'Third Package' envisages interventions in both the 'software' and 'hardware' dimensions. Directive 2009/72/EC concerning common rules for the Internal Market in electricity defines rules along which the EU market in electricity is established. This Directive replaced the repealed Directive 2003/54/EC that had the objective of creating conditions more conducive to genuine, fair competition and putting in place a true single market, advancing common rules for the Internal Market in electricity. The legislation established rules, *inter alia*, related to access to the market, and that distribution and transmission systems are

⁹⁸ Ecorys et al. (2008), FWC Sector Competitiveness Studies - Competitiveness of the Glass Sector, p 111 (<http://ec.europa.eu/DocsRoom/documents/1989/attachments/1/translations/en/renditions/pdf>).

operated through legally separate entities. Both **Directives aim at creating common rules for the generation, transmission and distribution of electricity** and for the organisation and functioning of the electricity sector in the EU. In order to mainly achieve the objective of the security of supply, the Directive requires Member States to develop necessary network infrastructure, including interconnection capacity.

In addition, **the Directive 2009/72/EC requires a phase-out of regulated energy prices**. Interestingly, in 2014, electricity prices for non-household consumers were still regulated in 10 EU Member States. The Regulation completing the 'Third Package' entered into force in 2009 and mainly concerns the 'software' part of the Internal Energy Market. **Regulation (EC) No 714/2009 sets fair rules for cross-border exchanges in electricity** in order to enhance competition within the Internal Market in electricity, taking into account the particular characteristics of national and regional markets. This involves *inter alia*: i) the establishment of a compensation mechanism for cross-border flows of electricity; ii) the setting of harmonised principles on cross-border transmission charges; and iii) the allocation of available capacities of interconnections between national transmission systems. This Regulation replaced Regulation (EC) No 1228/2003 that entered into force in 2003 and was in place with the purpose of intensifying trade in electricity by means of **putting in place conditions for access to the network for cross-border exchanges in electricity**. Both Regulations aim at facilitating the emergence of a well-functioning and transparent wholesale market in the EU with a high level of security of supply in electricity.

Renewable Energy Directive. The Renewable Energy Directive, whose transposition was due by 2010, **establishes a common framework for the promotion of energy from renewable sources**. In particular, this Directive sets mandatory targets for renewables at national level, consistent with a target of at least a 20% share of energy from renewable sources in the EU's gross final consumption of energy in 2020. Member States shall ensure that the share of energy from renewables in gross final consumption of energy reaches the national overall targets. To ensure this, EU countries have set up dedicated support policies for renewables. Measures of cooperation between Member States and with third countries for achieving the national overall target can also be introduced. This Directive replaced Directive 2001/77/EC that was in place to **promote electricity produced from renewable energy sources in the internal electricity market**. The repealed legislation included national renewable energy targets for EU Member States to meet an EU wide target of 12% gross inland energy consumption from renewables by 2010. These targets were, however, indicative and were not enforced by the EU.

The application of the Renewable Energy Directive is affected by the "**Guidelines on State Aid for environmental protection and energy 2014-2020**" providing criteria on how Member States can exempt energy intensive companies that are particularly exposed to international competition from charges levied for the support of renewables. Annex III of the guidelines lists the sectors covered in this Study among those industries where exemptions may be granted. Such exemptions existed before the adoption of the guidelines but were subject to national legislation. Moreover, the guidelines address the market distortions that may result from subsidies granted to renewable energy sources. For this reason, the guidelines prescribe a gradual move to market-based support for renewable energy. Both sets of rules have an impact on the actual costs of implementing the Renewables Energy Directive and will therefore be assessed in this Study. Nonetheless, as these new guidelines are applicable from 1 July 2014, their impact on the timeframe covered by this Study is expected to be limited.

Energy Taxation Directive. The current Energy Taxation Directive came into force in 2003, setting a minimum level of taxation for energy products (Art. 4). It is the **basis for an EU-wide harmonised minimum taxation of electricity and energy products, including natural gas**.

The Directive sets minimum rates for EU-wide harmonised taxation for electricity. For electricity, the minimum tax rate amounts to €0.5/MWh. This rate can be used to estimate the potential cost of the Energy Taxation Directive.

Note that according to Article 17, Member States may apply tax reductions in favour of energy-intensive businesses, if “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 case exemptions are in place, the above-mentioned direct costs might not occur or they might be due to national legislation.

6.4.2 Categories of regulatory costs

Internal Market legislation. With regard to the ‘hardware’ dimension of the Internal Market, the deployment of cross-border infrastructure requires significant investment. The associated costs may be passed on to consumers and charged in their electricity bill, thus causing **indirect compliance costs** borne by industry players in both sectors. The ‘software’ part is mainly driven by network codes, which are a set of rules to facilitate the harmonisation, integration and efficiency of EU energy markets.

Minor **indirect costs** could arise when adopting these new market rules. However, these are considered to be negligible in absolute terms. For instance, liquid markets are an important prerequisite for entering into long-term contracts, which are used to hedge the price risk of short-term markets. The impact of phasing out regulated energy prices can be ambiguous. While the deregulation of energy prices is important to ensure the functioning of liberalised energy markets, in those countries where energy intensive industries used to benefit from favourable ‘industrial tariffs’, deregulation may have led to higher energy prices, thus generating other **indirect compliance costs** that might weigh on glass industry players.

Renewable Energy Directive. Support schemes for renewable sources are typically funded by imposing surcharges on end-consumers in their electricity bill, thus generating **indirect compliance costs**. However, energy intensive industries may be entitled to exemptions, thus shouldering only a reduced burden of these costs in some EU Member States. The main share falls on other consumers such as on households and industries not entitled to exemptions. Further costs may also arise due to the need to **reinforce networks** for the system integration of renewables, insofar as such costs are passed on to end-consumers (**indirect compliance costs**).

Energy Taxation Directive. This Directive may generate **direct charges** depending on taxation set by EU Member States.

6.4.3 Cost assessment – Packaging glass

Sample

A short overview of the number of questionnaires received can be found below in Table 22. In total, the sample covers 21 respondents from the packaging glass subsector. **More than three plants from each geographical region provided data** enabling the Research Team to present regional cost assessments in the packaging glass subsector.

Table 22. Packaging glass: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Packaging glass	21	7	6	8	21

Source: Authors' own elaboration.

Electricity prices and costs

All electricity costs reported in this section, and used throughout the analysis are net costs: reimbursements from interruptibility schemes, renewable support reimbursements and self-generated electricity sold to the grid have been taken into account.

Electricity intensity

What follows here is an analysis of electricity intensity of production as reported by responding plants. An assessment of the industry's electricity intensity helps to understand what role costs generated by consumption of electricity play for the sector.

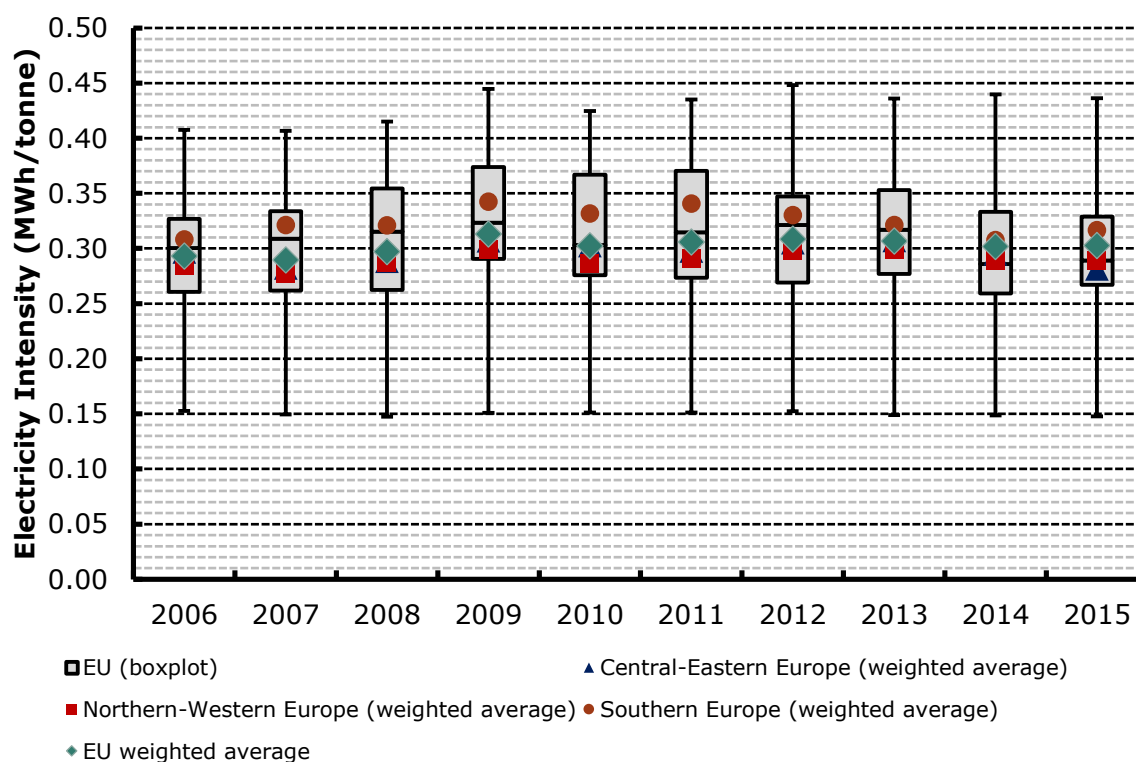
All plants in the sample provided the relevant information allowing the Research Team to assess the electricity intensity based on 21 plants. Note that none of the respondents uses self-generation of electricity.

The respondents' electricity intensity remained relatively stable over the period 2006-15, with an EU weighted average ranging between 0.29-0.31 MWh/tonne of production over the study period. In 2015, the EU weighted average of electricity intensity was at 0.30 MWh/tonne of production. The years between 2006 and 2015 only show minor fluctuations. The EU weighted average was lower than the median in most years. Cross-checked with previous research, these results are in line with literature on electricity intensity of production in the packaging glass subsector.⁹⁹

Plants reported heterogeneous electricity intensities. The minimum intensity (0.15 MWh/tonne of production) reported by a plant in 2015 was half of the electricity intensity reported by the most electricity-intensive plant (0.44 MWh/tonne of production). Dispersion was greater in the beginning of the study period and then decreased.

Some **regional differences were present**, demonstrated by lower values for the NWE region and highest electricity intensity for the SE region. Intensity in the NWE region was below the median in all years. Respondents from the NWE region reported stable electricity intensities for all years (0.29 MWh/ tonne of production both in 2006 and in 2015). The trend was equally stable in the CEE region while more fluctuations took place in the SE region, where electricity intensity went from 0.31 MWh/ tonne of production in 2006 to 0.34 MWh/tonne of production in 2009 and finally to 0.32 MWh/tonne of production in 2015.

⁹⁹ Ecofys (2009), "Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the glass Industry" (www.ecofys.com/files/files/091102_glass.pdf).

Figure 20. Packaging glass: Electricity intensity per tonne of production (2006-15)

Source: Authors' own elaboration.

Electricity costs

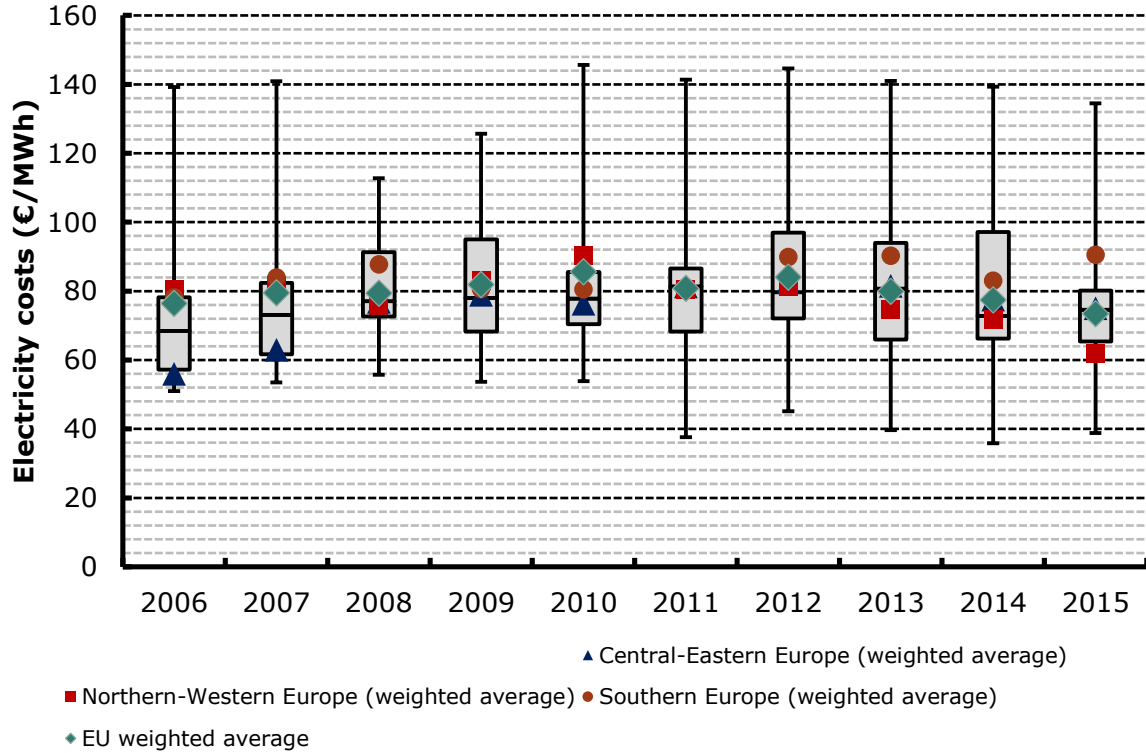
All plants in the sample provided their electricity costs allowing the Research Team to assess the net electricity costs based on a sample of 21 plants. Five plants out of the sample of 21 reported that they received reimbursements from taking part in an interruptibility scheme, six respondents reported reimbursements from RES levies while five respondents showed reimbursements from other taxes, fees and levies. No plants in the sample reported use of self-generated electricity.

Net electricity costs fluctuated over the period 2006-15. Costs show an upward trend for weighted EU averages from 2006 (€76.50/MWh) to 2010 (€85.60/MWh). With the exception of 2012 (€84/MWh), data shows decreasing net electricity costs from 2011 onward with respondents paying €73.50/MWh for electricity in 2015. The period 2011-15 shows a downward trend, bringing the costs below the 2006 level in 2015. This finding is in line with the global energy price developments in 2006-15 presented in Figure 12. Note, however, that otherwise the electricity cost developments do not show trends as stark as Figure 12 presents.

Regional comparison shows great price dispersion, possibly due to the higher weight of regulated components and higher fragmentation of national policies. The regional differences are characterised by the differences in costs SE producers faced in relation to producers in the NWE and CEE regions. Price dispersion was great in particular between NWE and SE producers. SE producers reported costs higher than the EU-weighted average in all years except 2009 and 2010. While the recent trend of decreasing costs was true for

the NWE and CEE regions, the development did not manifest itself in the SE region in 2011-15, when costs fluctuated from €81.10/MWh in 2011 to €91.50/MWh in 2015. In the NWE region, costs decreased from €80.50/MWh (2011) to €61.80/MWh (2015) and in the CEE region from €81.30/MWh (2012) to €75.05 (2015).

Figure 21. Packaging glass: Costs of electricity paid by respondents (2006-15)



Source: Authors' own elaboration.

Components of the electricity bill

In this section, the components of the price paid by respondents for electricity are discussed. **The energy component is the largest component present in the electricity bill.** In 2006, the energy component accounted for €61.50/MWh whereas in 2015 the amount was at €59.30/MWh.

The regulatory component has a large impact on the electricity price paid by respondents: **in 2015, 41% of the EU-weighted average electricity price was due to the regulatory component.** The share of the regulatory component has been on the rise. As a comparison, the impact of the regulatory component was in 2006 at around 28% and increased in the following years.

While the share of taxes and levies and network costs on average EU costs stayed relatively stable between 2006 and 2015, the share of renewable support increased. Though RES costs were present in 2006-09, they show a steep increase in the post-2009 period. The average RES support paid by manufacturers was €6.20/MWh in 2006, which increased to €12.50/MWh in 2011 and further to €20.40/MWh in 2015. Network costs show a slight increase: the EU average of network costs present in the electricity bill was €12/MWh in 2006 and increased to €13/MWh in 2015. These trends were behind indirect costs of electricity legislation faced by plants and described in more detail in the section entitled 'Indirect regulatory costs' below.

The impact of the different regulated components varies across regions. In 2015, the regulatory components made for some 54% of the electricity bill for manufactures in the SE region while for respondents in the NWE region, the non-energy component represented around 29% of the energy bill. In the CEE region, non-energy components made up for 46% of the total electricity bill in 2015.

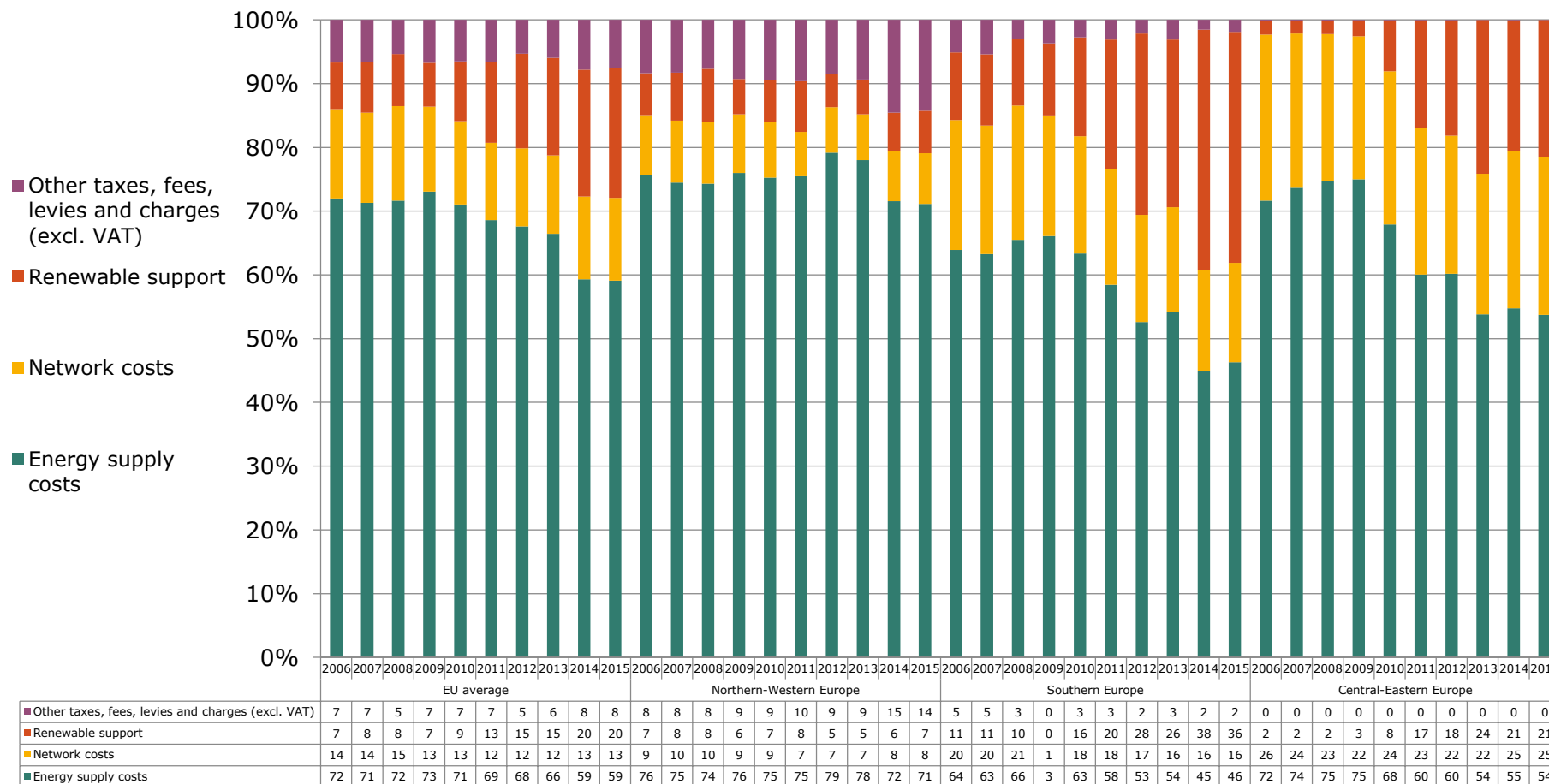
RES levies, network costs, and taxes and other levies differ in importance across regions. **In both the CEE and SE regions, the increase of the regulatory share was driven by the growing role of renewable energy support.** In the CEE region, the renewable energy support component steadily increased from 2.2% (2006) to 21.5% (2015), while in the SE region the share increased from 10.6% (2006) to 36.2% (2015). A share of the increase in RES levy can be attributed to EU legislation.

In the NWE region, the share of regulatory components remained quite steady over the study period, going up from 2006 (24.4%) to 2015 (28.9%). **Taxes, fees and levies represented a larger share of the electricity bill in the NWE region than in the two other regions.** In 2015, taxes, fees and levies covered €11.60/MWh of the electricity bill in the NWE region, while for SE manufactures the cost was at €2.60/MWh and in the CEE region at €0.04/MWh. A low level of taxes, fees and levies in the CEE region might imply that some plants in the sample were exempted from the tax set out in the Energy Taxation Directive with a minimum level of €0.50/MWh.

Network costs increased in the CEE and SE regions while in the NWE region they decreased. In the CEE region, manufacturers paid on average €14.80/MWh in 2006 while by 2015 the costs had gone up to €21.30/MWh. In the SE region, network costs increased from €17.70/MWh (2006) to €21.30/MWh (2015). Network costs show a more stable trend in the NWE region and in 2015 (€6.50/MWh) were actually below 2006 level (€8.60/MWh).

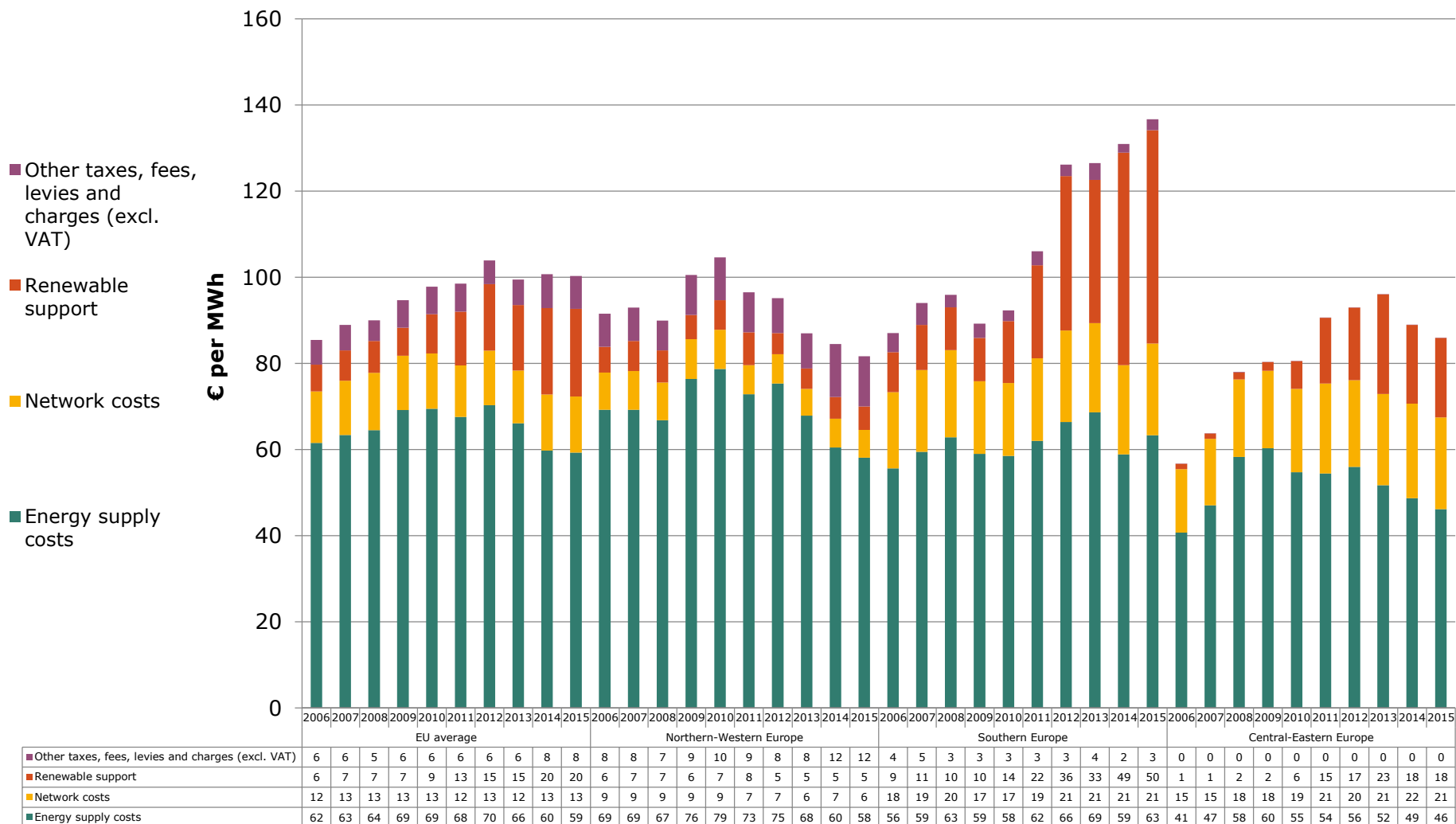
The data on electricity bill components shows that the share of regulatory costs increased. However, the overall electricity price decreased beginning in 2011 due to falling energy supply costs, which outweighed the increase in regulatory costs.

Figure 22. Packaging glass: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 23. Packaging glass: Absolute costs of components of the electricity bills paid by respondents (weighted averages, 2006-15, €/MWh)



Source: Authors' own elaboration.

Direct regulatory costs

This section addresses direct charges generated by Energy Taxation legislation.

Direct charges

The figures below present the direct costs generated by the Energy Taxation Directive. Costs generated by EU legislation, linked to electricity consumption of plants, remained stable over the study period 2006-15. This is to be expected as EU legislation sets a minimum level of tax per MWh, which stayed the same throughout the study period. Note that Member States might have put in place Energy tax schemes, which generated more costs to the sector than the EU minimum.

In 2015, the average costs generated by the Energy Taxation Directive were at €0.16/tonne of production in NWE region, €0.14/tonne of production in CEE region and €0.16/tonne of production in the SE region. Note that in case exemptions were in place, the above-mentioned direct costs might not have occurred. A low level of taxes, fees and levies in the CEE region might imply that some plants in the sample were exempted from the tax.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the sector. Following the analysis on the relevance of EU energy legislation, this section looks at indirect compliance costs generated by the three following legislative acts and their repealed acts:

- Directive 2009/72/EC which aims at creating common rules for the generation, transmission and distribution of electricity, repealing Directive 2003/54/EC;
- Regulation (EC) No 714/2009 which aims at setting fair rules for cross-border exchanges in electricity, repealing Regulation (EC) No 1228/2003;
- Renewable Energy Directive 2009/28/EC which sets a common framework for the promotion of energy from renewable sources, repealing Directives 2001/77/EC and 2003/30/EC.

Internal Market legislation generates costs via the investment put in place due to Internal Market legislation.

The Renewable Energy Directive can generate indirect regulatory costs in a two-fold manner:

- By specific renewable energy support levies added to electricity bills.
- By the need to reinforce networks for the system of integration on renewable energy. These costs are also passed on to the electricity bills and added to the network cost component.

The graphs below show indirect costs generated by the Internal Market legislation and the Renewable Energy Directive. Indirect costs present more than 90% of the cost generated by electricity related legislation.

At the EU level, the costs increased through the period 2006-15 and peaked at €3.40/tonne of production in 2012. **Indirect costs were highest in the SE region, ranging from €2.20/tonne (2006) to €6.30/tonne (2015).** Costs in the CEE region

peaked in 2012 (€5/tonne) and decreased to €4.90/tonne in 2015. **Costs of electricity legislation were considerably lower in the NWE region compared to the CEE and SE regions, ranging between €1-2/tonne in 2006-15.**

The reasons behind regional differences and particularly in the lower costs incurred by electricity legislation in the NWE region can be explained by the differing importance in regulatory components in the three geographic regions. In 2015, the regulatory components were some 54% of the electricity bill for manufactures in the SE region, while for respondents in the NWE region the regulatory component represented around 29% of the energy bill. In the CEE region, regulatory components made up 46% of the total electricity bill in 2015.

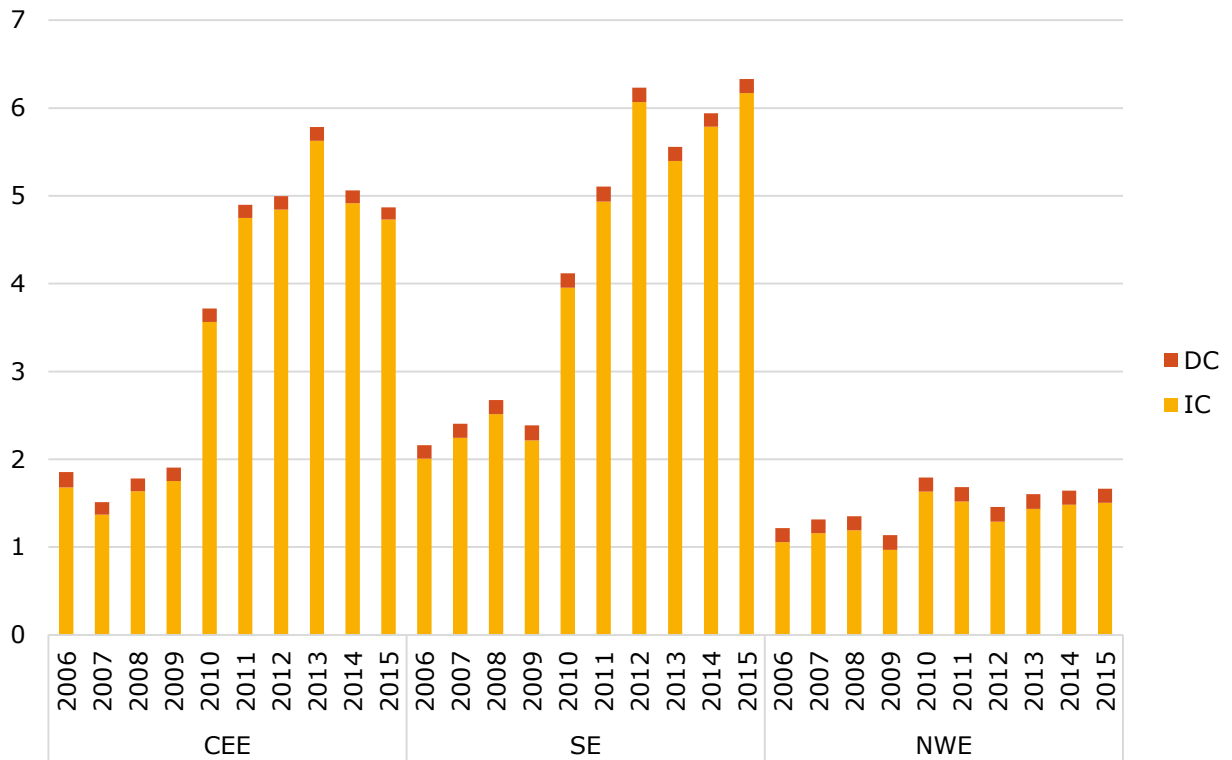
Furthermore, while in both the CEE and SE regions the increase of the regulatory share were driven by the growing role of renewable energy support, in the NWE region, taxes, fees and levies represented a larger share of the electricity bill. **The prominence of RES support in the SE and CEE regions therefore mostly explains the difference in the regulatory costs present in the SE and CEE regions compared to the NWE region.**

Table 23 presents the direct and indirect costs of the most recent year (2015), which also has the most available data; 2015 can be considered a typical year for the sector, as production has recovered following the economic crisis.

The 2014-20 Guidelines on State Aid for Environmental Protection and Energy prescribe a gradual move to market-based support for renewable energy and thus can bring down renewable support exemptions, generating a cost impact on the sector. These new guidelines are applicable from 1 July 2014 and therefore their impact can only be assessed for years 2014-15. The State Aid Guidelines may lead to a decrease in renewable support levy exemptions, which could translate to higher renewable support costs.

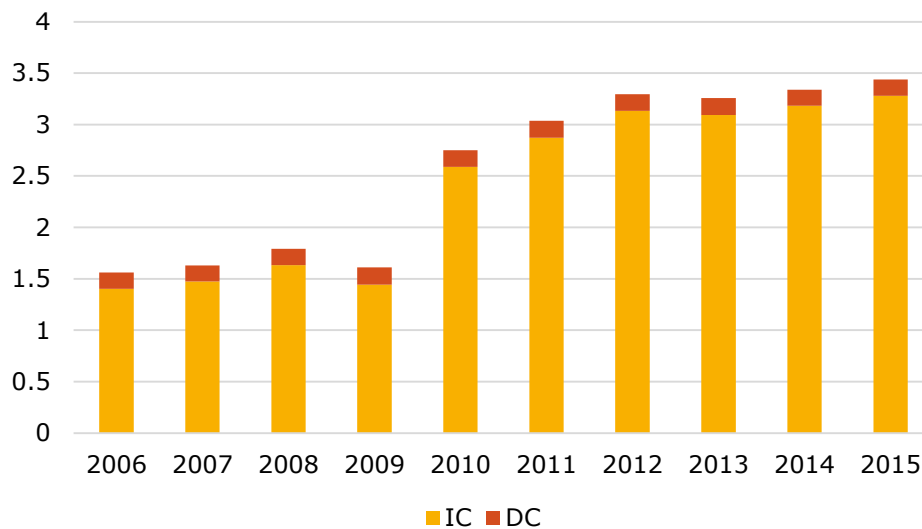
As shown in Figure 23, the RES component increased in 2014-15, up from €20/MWh to €20.40/MWh. In the absence of data on the evolution on national exemption schemes, the cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no strong conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

Figure 24. Packaging glass: Cumulative regulatory costs of electricity legislation 2006-15 for the CEE, NWE and SE regions (€/tonne of production)



Source: Authors' own elaboration.

Figure 25. Packaging glass: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 23. Packaging glass: Cumulative regulatory costs of electricity legislation 2015 (€/tonne of production)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0	0	0	0
	Direct charges	0.16	0.14	0.16	0.16
Indirect regulatory costs		1.50	4.73	6.17	3.28
Total regulatory costs		1.66	4.87	6.33	3.44

Source: Authors' own elaboration.

6.4.4 Cost assessment – Glass tableware

Sample

A brief overview of the number of questionnaires received can be found below in Table 24. The sample covers five respondents from the glass tableware subsector.

Table 24. Glass tableware: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Glass tableware	5	5

Source: Authors' own elaboration.

Electricity prices and costs

All electricity costs reported in this section, and used throughout the analysis are net costs: reimbursements from interruptibility schemes, renewable support reimbursements and self-generated electricity sold to the grid have been taken into account.

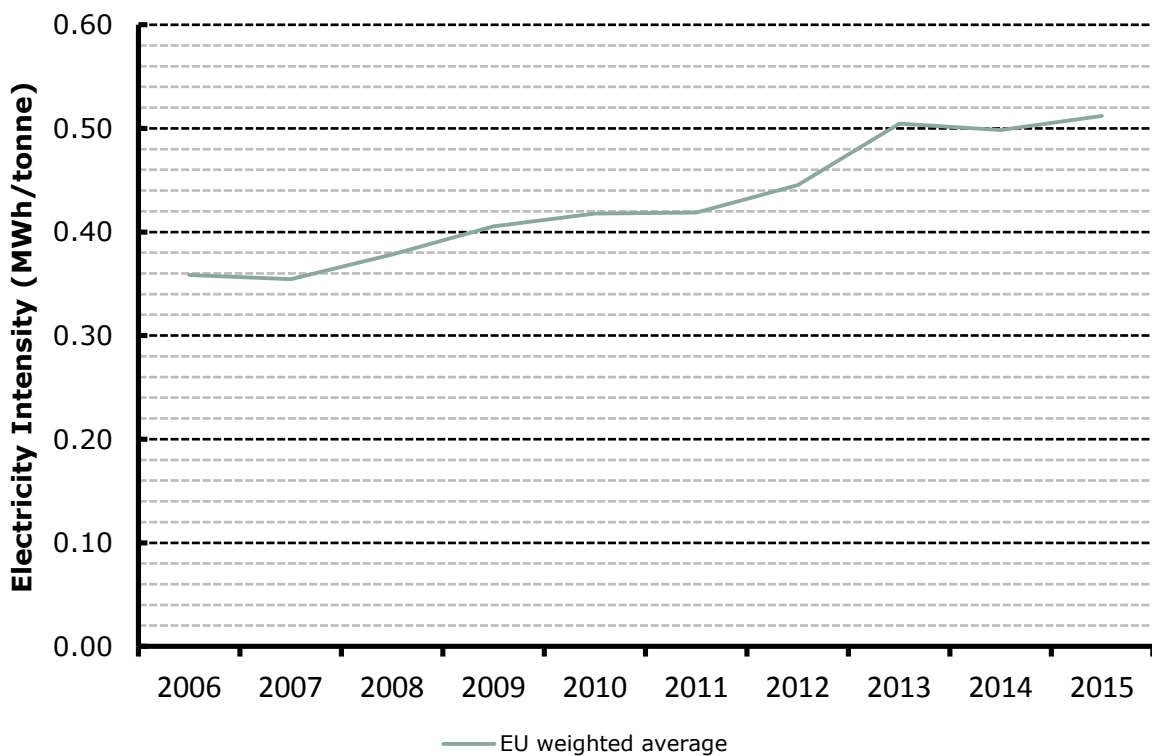
Electricity intensity

What follows is an analysis of electricity intensity of production as reported by responding plants. An assessment of the industry’s electricity intensity helps us to understand what role costs generated by consumption of electricity play for the sector.

Due to the limited number of respondents from glass tableware manufacturers, data cannot be displayed via a box plot. Instead, a line graph is used. All plants in the sample provided the relevant information allowing the Research Team to assess the electricity intensity based on the sample of five plants. Note that none of the respondents uses self-generation of electricity.

Compared to packaging glass and flat glass producers, glass tableware producers are more electricity-intensive. The respondents’ electricity intensity shows an increasing trend over the period 2006-15. While the EU-weighted average of electricity intensity was at 0.36 MWh/tonne of production in 2006, in 2015 the figure stood at 0.51 MWh/tonne of production.

Figure 26. Glass tableware: Electricity intensity per tonne of production (2006-15)



Source: Authors’ own elaboration.

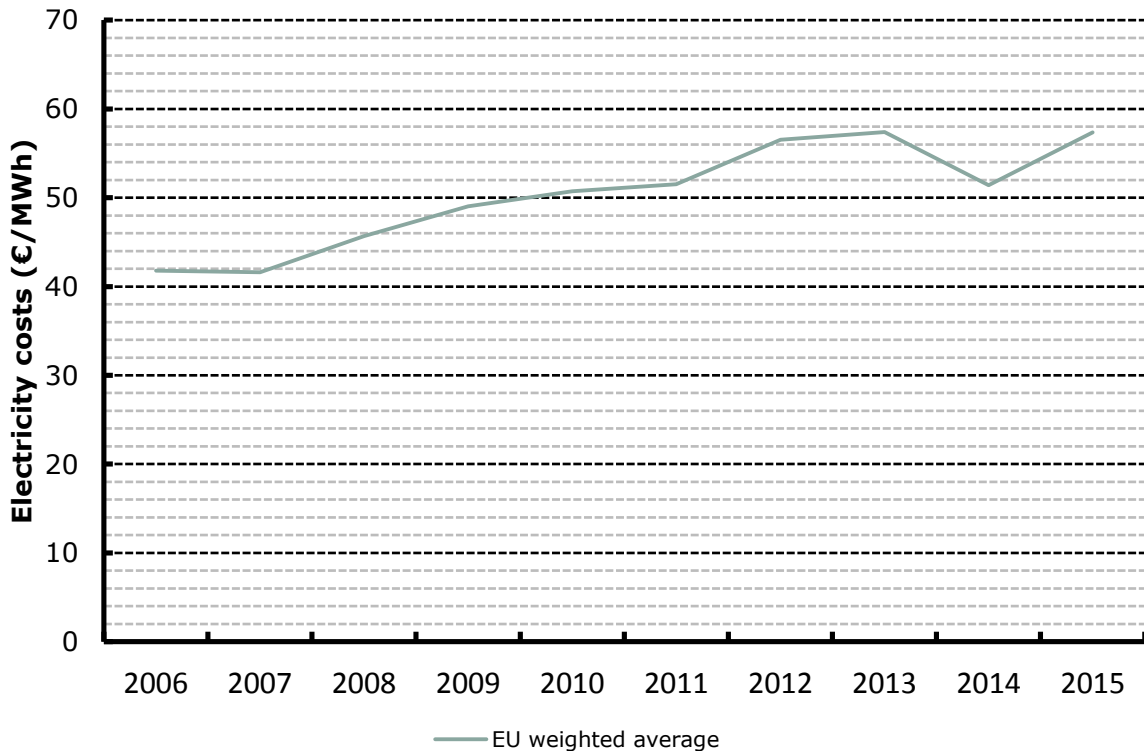
Electricity costs

All plants in the sample provided their electricity costs allowing the Research Team to assess the net electricity costs based on a sample of five plants. Two plants out of five reported reimbursement from taxes, fees or levies. No plant reported RES reimbursements. One plant reported to have received interruptibility scheme reimbursements.

Net electricity costs for glass tableware producers are lower than for flat glass and packaging glass producers. This observation is in line with results from previous studies that indicate lower electricity costs for more electricity-intensive plants. Net electricity costs increased over the period 2006-15. **Costs show an upward trend for EU weighted average from 2006 (€41.80/MWh) to 2015 (€57.30/MWh).**

The trends presented here do not follow the global coal and oil price developments shown in Figure 12. Due to the small sample size, no solid conclusion can be drawn from this sample.

Figure 27. Glass tableware: Costs of electricity paid by respondents (2006-15)



Source: Authors' own elaboration.

Components of the electricity bill

In this section, the components of the price paid by respondents for electricity are discussed.

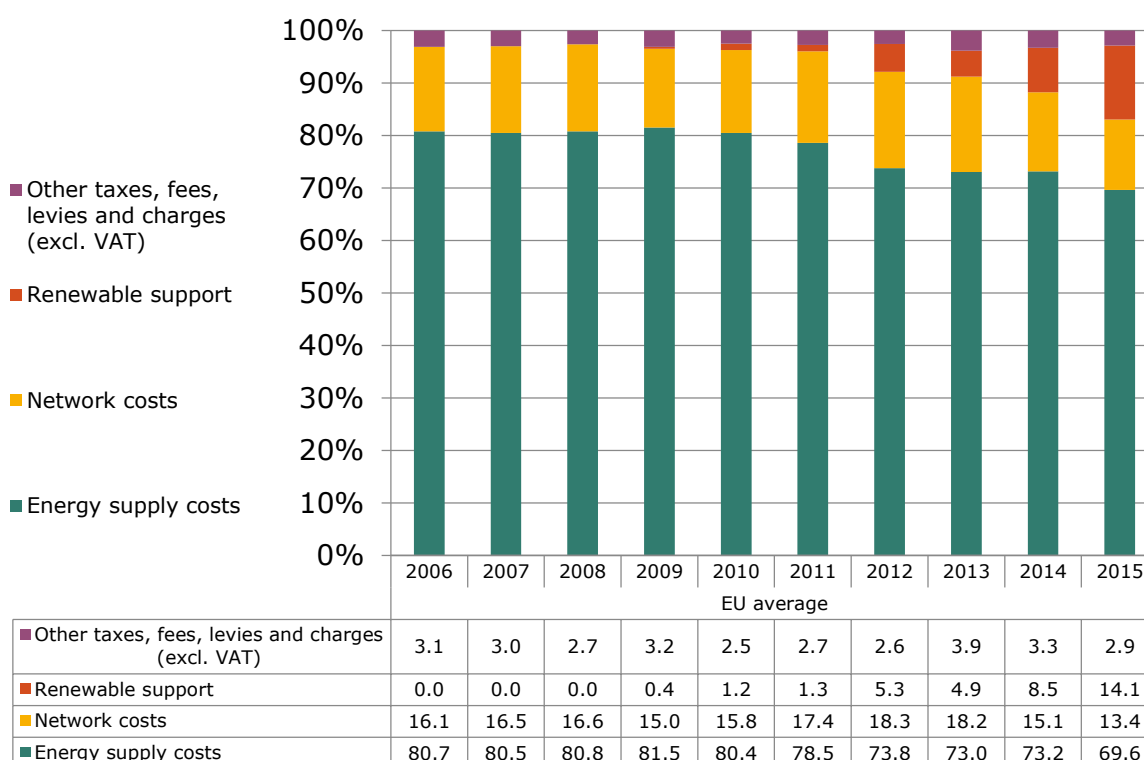
The energy component represents the largest component in the electricity bill. It increased from €38.80/MWh in 2006 to €45.90/MWh in 2015. Both the energy component and the regulatory component seem to have **driven the increase in the EU weighted average electricity costs.**

The regulatory component had a large impact on the electricity price paid by respondents: in 2015, 30% of the EU weighted average electricity price was due to the regulatory component. The regulatory component was on the rise. As a comparison, the regulatory component was around €9.30/MWh in 2006 and, with some fluctuations, increased to €20.10/MWh in 2015.

Network costs show an upward trend during the period 2006-13, as they increased from €7.70/MWh to €11.50/MWh (2012), then decreased to €8.90/MWh in 2015. **The share of renewable energy support of the electricity bill grew the most, from 0% (2006) to 14.1% (2015)**, in absolute values, meaning an increase from €0/MWh to €9.30/MWh. Other taxes and levies on average EU costs stayed relatively stable during 2006-15, with a share of €1.50/MWh in 2006 to €1.90/MWh in 2015.

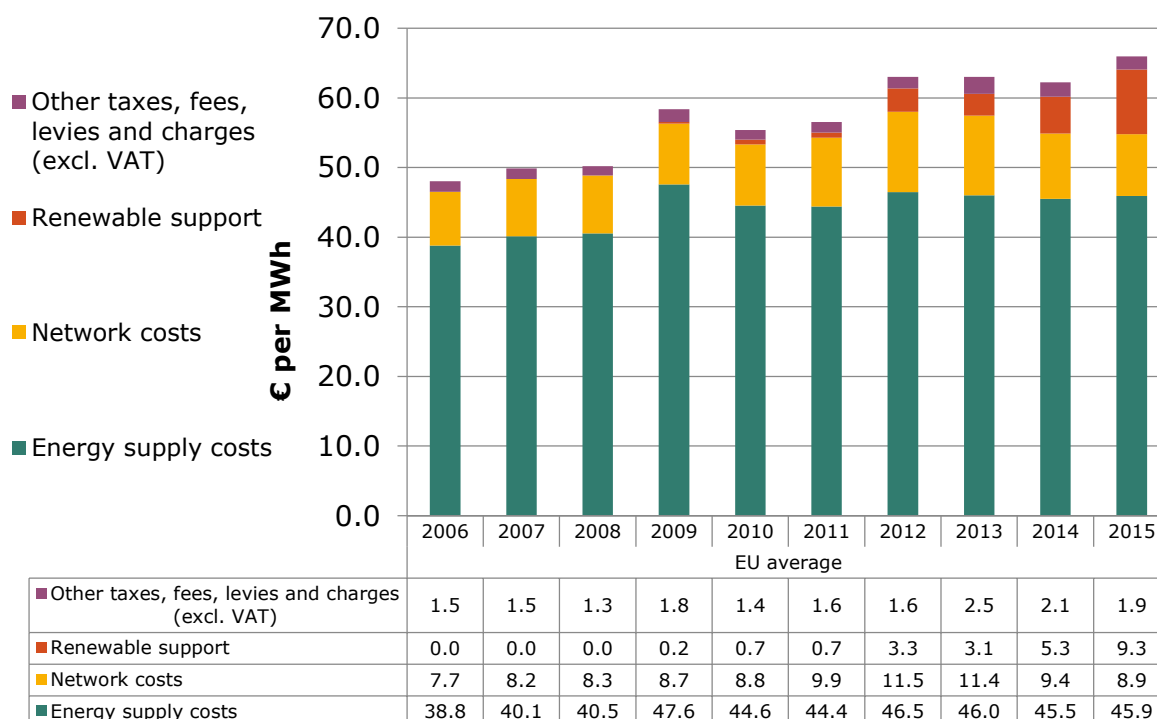
The data on electricity bill components shows that all four components increased across the 2006-15 period. Due to the limited size of the sample, no solid conclusions on the component trends can be drawn.

Figure 28. Glass tableware: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 29. Glass tableware: Absolute costs of components of the electricity bills paid by respondents (weighted averages, 2006-15, €/MWh)



Source: Authors' own elaboration.

Direct regulatory costs

This section address direct charges generated by energy taxation legislation.

Direct charges

The figures below present the direct costs generated by the Energy Taxation Directive. Costs generated by EU legislation, linked to electricity consumption of plants, remained stable over the study period 2006-15. This is to be expected as EU legislation sets a minimum level of tax per MWh which stayed the same throughout the study period. Note that Member States might have put in place Energy tax schemes that generated more costs for the sector than the EU minimum. **In 2015, the average costs generated by the Energy Taxation Directive were €0.52/tonne of production in the EU level.** Note that in case exemptions are in place, the above-mentioned direct costs might not occur.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the sector. Following the analysis on the relevance of EU energy legislation, this section looks at indirect compliance costs generated by the three following legislative acts and their repealed acts:

- Directive 2009/72/EC which aims at creating common rules for the generation, transmission and distribution of electricity, repealing Directive 2003/54/EC;

- Regulation (EC) No 714/2009 which aims at setting fair rules for cross-border exchanges in electricity, repealing Regulation (EC) No 1228/2003;
- Renewable Energy Directive 2009/28/EC, which sets a common framework for the promotion of energy from renewable sources, repealing Directives 2001/77/EC and 2003/30/EC.

Internal Market legislation generates costs via the investment put in place due to Internal Market legislation.

The Renewable Energy Directive can generate indirect regulatory costs in a twofold manner:

- By specific renewable energy support levies added to electricity bills.
- By the need to reinforce networks for the system of integration on renewable energy. These costs are also pass on the electricity bills and added to the network cost component.

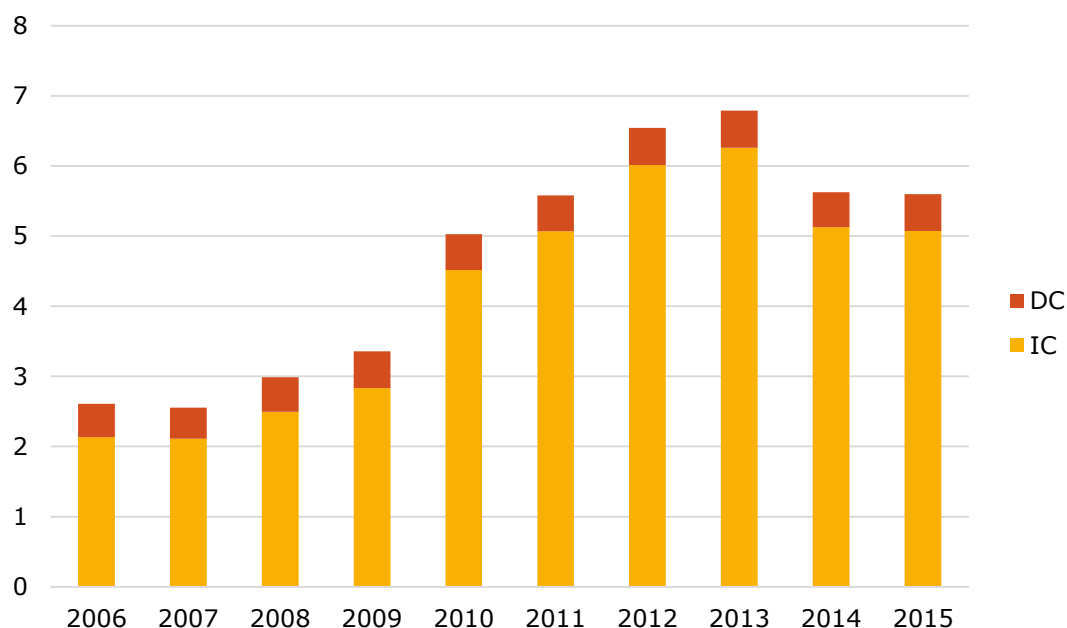
The graphs below show indirect costs generated by the Internal Market legislation and the Renewable Energy Directive. Indirect costs present approximately 90% of the cost incurred by electricity related legislation.

At the EU level, the costs increased from 2006 onwards and peaked at €6.80/tonne of production in 2013. Table 25 presents the direct and indirect costs of the most recent year (2015), which also has the most data available; 2015 can be considered a typical year for the sector, as production has recovered following the economic crisis.

The 2014-20 Guidelines on State Aid for Environmental Protection and Energy prescribe a gradual move to market-based support for renewable energy and thus can bring down renewable support exemptions generating a cost impact on the sector. These new guidelines are applicable from 1 July 2014 and therefore their impact can only be assessed for 2014-15. The State Aid Guidelines may lead to a decrease in renewable support levy exemptions, which could translate into higher renewable support costs.

As shown in Figure 29, the RES component increased between 2014-15, from €5.30/MWh to €9.30/MWh. In the absence of data on the evolution of national exemption schemes, the cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no solid conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

Figure 30. Glass tableware: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 25. Glass tableware: Cumulative regulatory costs of electricity legislation for 2015 (€/tonne of production)

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	0
	Direct charges	0.52
Indirect regulatory costs		5.08
Total regulatory costs		5.60

Source: Authors' own elaboration.

6.4.5 Cost assessment – Flat glass

Sample

A short overview of the number of questionnaires received can be found below in Table 26. In total, the sample covers 15 respondents from the flat glass sector. More than three plants from each geographical region provided data enabling the Research Team to present regional cost assessments in the flat glass sector.

Table 26. Flat glass: Total number of questionnaires received and used in the Chapter

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Flat glass	15	5	5	5	15

Source: Authors' own elaboration.

Electricity prices and costs

All electricity costs reported in this section, and used throughout the analysis are net costs: reimbursements from interruptibility schemes, renewable support reimbursements and self-generated electricity sold to the grid have been taken into account.

Electricity intensity

What follows is an analysis of electricity intensity of production as reported by responding plants. An assessment of the industry's electricity intensity helps us to understand what role costs generated by EU legislation on electricity play for the sector.

Assessment of electricity intensity is based on 15 responding plants. Note that none of the respondents uses self-generation of electricity.

Compared to the packaging glass and glass tableware subsector in particular, the data from flat glass respondents shows a somewhat lower electricity intensity per tonne of production. The respondents' **electricity intensity remained relatively stable over the period 2006-15, with an EU weighted average fluctuating between 0.20 MWh/tonne of production (2007) and 0.23 MWh/tonne of production (2012)**. The EU weighted average was 0.22 MWh/tonne of production in the beginning of the study period and 0.21 MWh/tonne of production in 2015. As observations fluctuate between years, no clear trend can be identified. Crossed-checked with previous research, these results are in line with literature on electricity intensity of production in the hollow glass sector.¹⁰⁰

Contrary to trends in other subsectors, the EU weighted average was higher than the median in most years. This is explained by a high electricity intensity of one large plant with large production output.

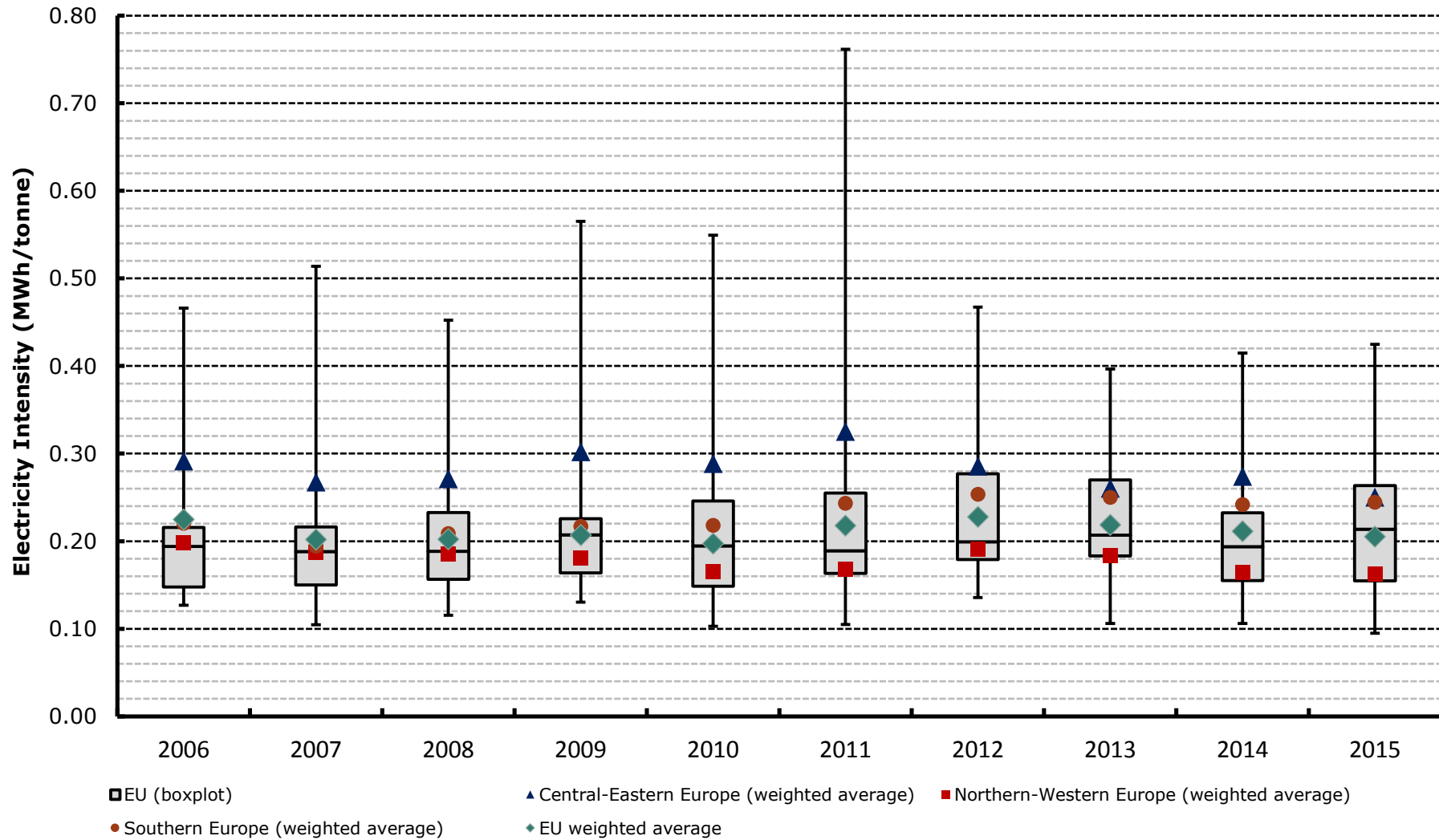
Regional differences are present in the data. **In all years, plants in the NWE region reported lower electricity intensity than their peers in the CEE and SE regions.**

¹⁰⁰ Ibid.

The weighted average for NWE plants was below median in all years, whereas SE and CEE plants were above the 2006-15 median.

The trend in the CEE region is interesting to analyse, in particular during 2012-15. **Plants based in CEE reported higher electricity intensities than those in NWE and SE in 2006-11 but demonstrated a decreasing trend in electricity intensity in 2012-15.** The electricity intensity of CEE plants decreased from 0.33 MWh/tonne of production (2011) to 0.25 MWh/tonne (2015), while manufacturers in SE regions showed stable electricity intensity, 0.24 MWh/tonne both in 2011 and in 2015. While slight changes can be identified, this difference in electricity intensities over this relatively short period cannot be identified as a robust trend.

Figure 31. Flat glass: Electricity intensity per tonne of production (2006-15)



Source: Authors' own elaboration.

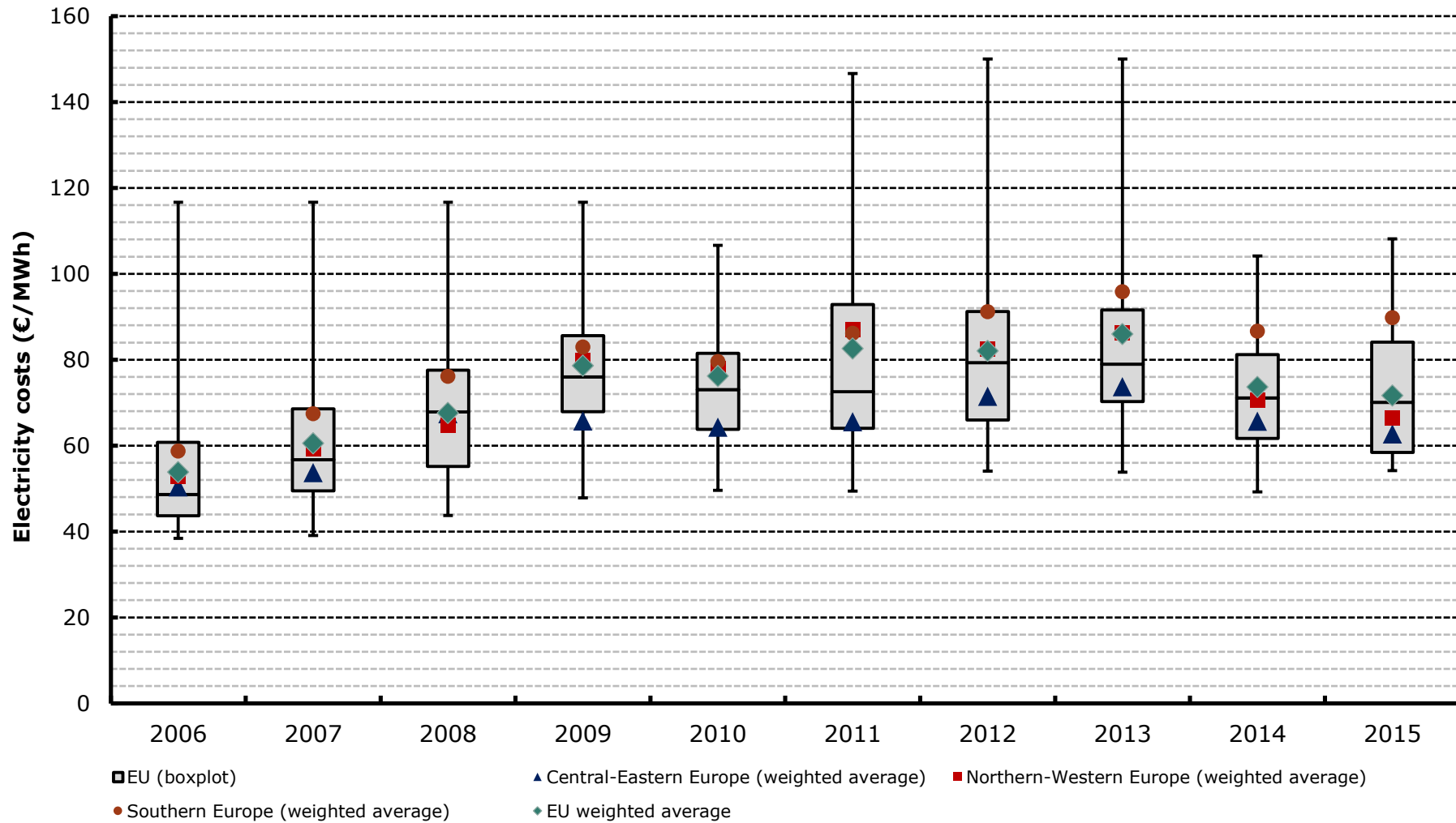
Electricity costs

All plants in the sample provided their electricity costs allowing the Research Team to assess the net electricity costs based on a sample of 15 plants. Three plants out of 15 reported reimbursements from RES levies while three respondents showed reimbursements from other taxes, fees and levies. Two plants indicated the usage of self-generated electricity in their production process. No plants in the sample reported having received reimbursements from taking part in an interruptibility scheme.

The flat glass sector reports **lower electricity costs than those of the glass tableware and packaging glass subsectors**. Net electricity costs fluctuated significantly over the period 2006-15. **There was a clear increasing trend in the EU weighted average electricity costs from 2006 (€53.80/MWh) to 2013 (€86/MWh). The last years of the study period show that costs decreased**, and in 2015 average costs of electricity for EU producers was €73.60/MWh. As shown in next section, the increasing trend, particularly in 2010-13, is explained by higher regulatory cost components.

Regional comparison shows dispersion, possibly due to higher fragmentation of national policies. **Average net costs were lowest in the CEE region**, where producers paid €62.70/MWh in 2015, while in SE region the weighted average was €89.80/MWh and in the NWE region €66.40/MWh. Electricity costs of SE manufactures are between €8.40 to €27.10/MWh higher than those of CEE producers during the study period, and in the NWE region between €2.50/MWh and €14.50/MWh higher than in the CEE region (with the exception of 2008 when the costs were lower in the NWE region). The electricity costs presented here somewhat follow the global energy price trends presented in Figure 12 but with far more moderate fluctuations.

Figure 32. Flat glass: Costs of electricity paid by respondents (2006-15)



Source: Authors' own elaboration.

Components of the electricity bill

In this section, the components of the price paid by respondents for electricity are discussed.

The energy component is the largest component present in the energy bill. It fluctuated during the study period mostly following the electricity cost trends described in the previous section. The energy component increased between 2006 (€41.00/MWh) and 2012 (€64.70/MWh), then decreased.

The regulatory component had a large impact on the electricity price paid by respondents: in 2015, 39% of the EU weighted average electricity price was due to the regulatory component. **The share of the non-energy component increased between 2006 (30%) and 2015 (39%) in absolute terms, from €18/MWh to €32/MWh.**

Network costs, renewable energy support and other taxes and levies increased over the study period with some fluctuations. Network costs fluctuated over the period but on average increased. While in 2006 network costs were €8.80/MWh, in 2015 they stood at €10/MWh. RES support fluctuated the most. RES support increased steeply from 2009 (€7.20/MWh) to 2010 (€11/MWh) and 2011 (€16.30/MWh) and since then increased to €19/MWh in 2015. At the EU level, taxes and levies remained relatively stable, decreasing between 2006 (€3.50/MWh) and 2015 (€3/MWh).

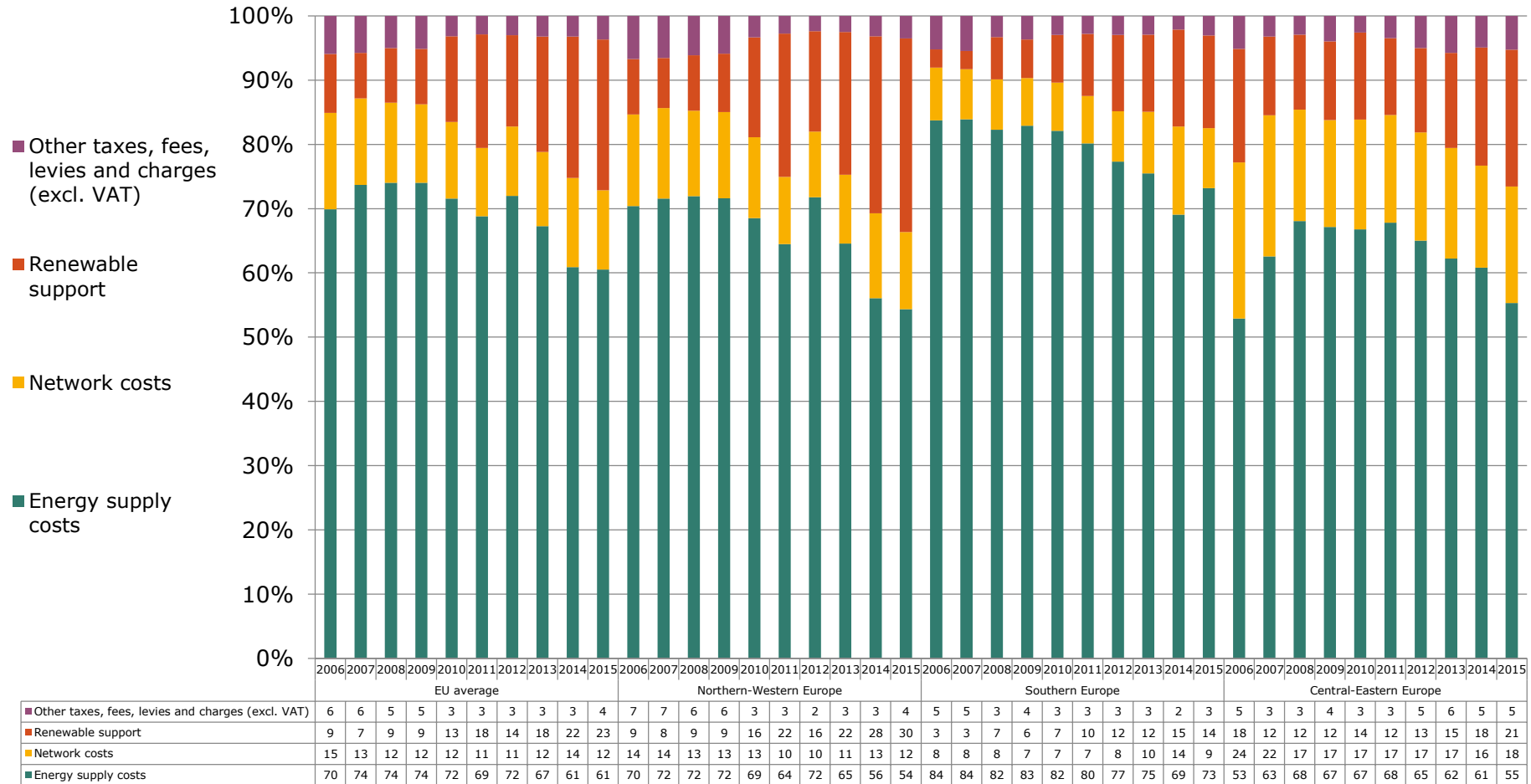
The impact of regulated components also varies across regions. **Data from SE producers show that to some extent the sharp increase in RES support can be attributed to the trends in the SE regions where the RES support increased from €5.10/MWh (2009) to €11.60/MWh (2012).** As under the same time period, variable renewable energy increased in the SE region from 6.9% of production to 10.9% of production;¹⁰¹ the increase in the RES levy can be linked to increase use of renewable energy. In the CEE regions, RES support increased, with some fluctuations between 2006 (€10.80/MWh) and 2015 (€13.70/MWh).

In 2009, average RES support in the NWE region was €7.80/MWh, increased to €22.60/MWh in 2011 and then decreased in 2012 to €14.70/MWh before increasing again, to €24/MWh, in 2015. The rapid cost fluctuations were accompanied by fluctuations in taxes and levies in the NWE region. While in 2006, plants reported paying €3.80/MWh in taxes and levies, in 2015 they reported taxes and levies covered €2.80/MWh of the electricity bill.

The data on electricity bill components shows that the share of regulatory costs increased and, in particular, the introduction of the Renewable Energy Directive seems to be reflected in the increase of RES support schemes. Part of this share can be attributed to EU legislation and therefore the analysis provides a starting point for the regulatory cost assessment shown later in this Chapter. However, the overall electricity price has been decreasing since 2013 due to falling energy supply costs, which outweigh the increase in regulatory costs.

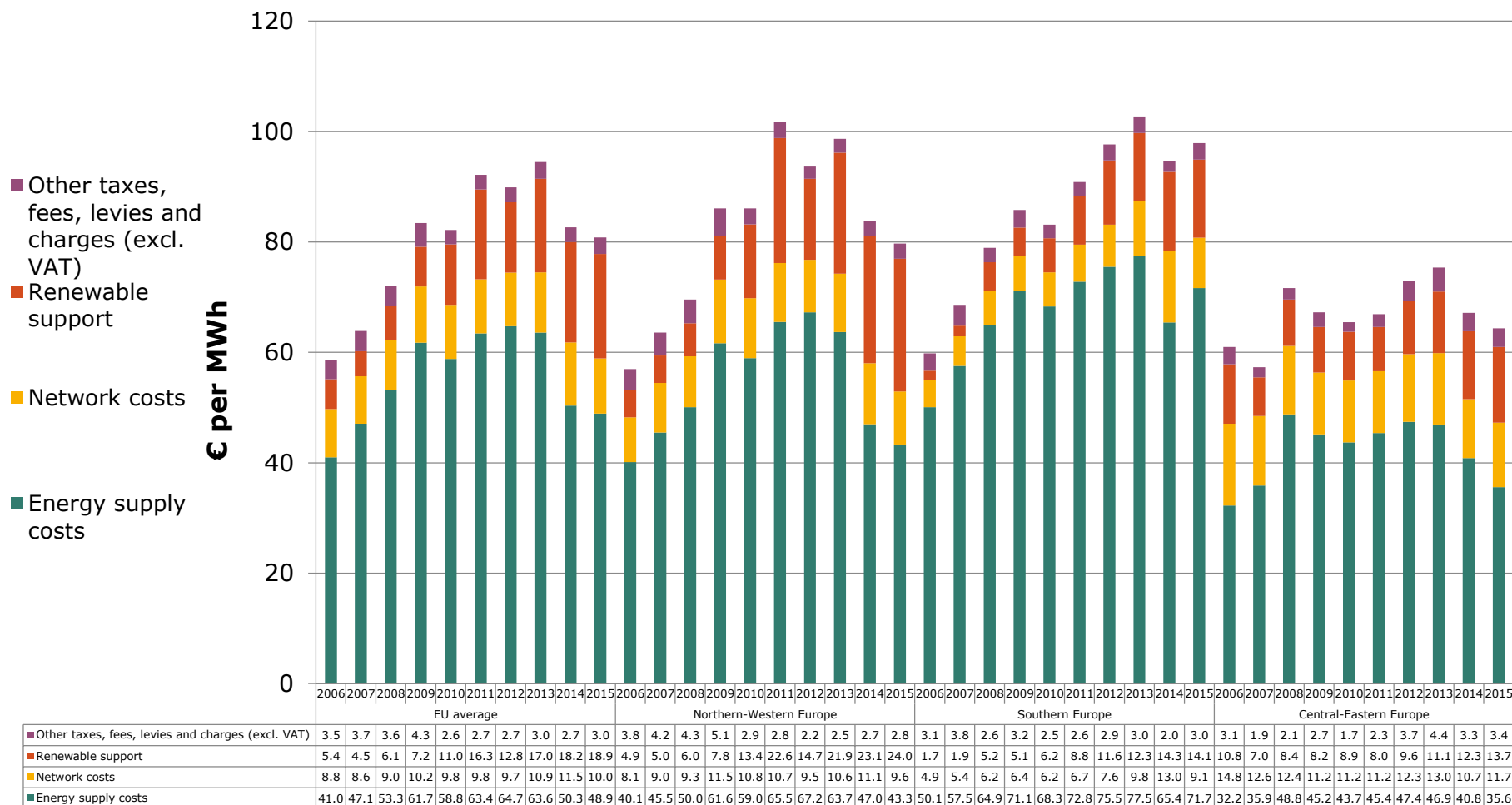
¹⁰¹ Eurostat.

Figure 33. Flat glass: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 34. Flat glass: Absolute costs of components of the electricity bills paid by respondents (weighted averages, 2006-15, €/MWh)



Source: Authors' own elaboration.

Direct regulatory costs

This section addresses direct charges generated by energy taxation legislation.

Direct charges

The figures below present the direct costs generated by the Energy Taxation Directive. Costs generated by EU legislation, linked to electricity consumption of plants, remained stable over the study period 2006-15. This is to be expected as EU legislation sets a minimum level of tax per MWh which stayed the same throughout the study period 2006-15. Note that Member States might have put in place energy tax schemes which would have generated more costs to the sector than the EU minimum.

In 2015, the average costs generated by the Energy Taxation Directive were €0.08/per tonne of production in the NWE region, €0.12/per tonne of production in the CEE region and €0.12/tonne of production in the SE region. Note that in case exemptions are in place, the above-mentioned direct costs might not occur.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the sector. Following the analysis of the relevance of EU energy legislation, this section addresses indirect compliance costs generated by the three following legislative acts and their repealed acts:

- Directive 2009/72/EC which aims at creating common rules for the generation, transmission and distribution of electricity, repealing Directive 2003/54/EC;
- Regulation (EC) No 714/2009 which aims at setting fair rules for cross-border exchanges in electricity, repealing Regulation (EC) No 1228/2003;
- Renewable Energy Directive 2009/28/EC, which sets a common framework for the promotion of energy from renewable sources, repealing Directives 2001/77/EC and 2003/30/EC.

Internal Market legislation generates costs via the investment put in place due to Internal Market legislation.

The Renewable Energy Directive can generate indirect regulatory costs in a twofold manner:

- By specific renewable energy support levies added to electricity bills.
- By the need to reinforce networks for the system of integration on renewable energy. These costs are also pass on the electricity bills and added to the network cost component.

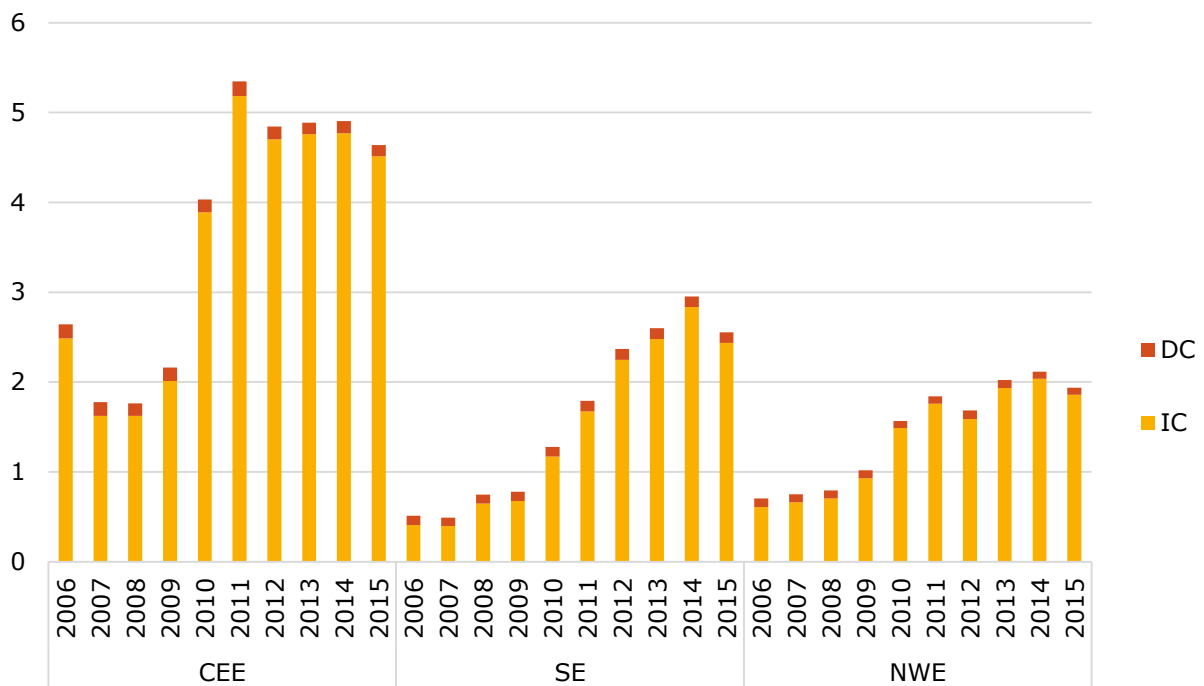
The graphs below show indirect costs generated by the internal market legislation and the Renewable Energy Directive. **The costs are more substantial in the CEE region and less present in the SE and NWE regions where, electricity intensity of production is higher than in other regions.** In the CEE region, costs peaked in 2011 (€5.40/tonne) while both in the SE (€2.90/tonne) and NWE (€2.10/tonne) regions costs were highest in 2014. **At the EU level, the costs peaked at €3/tonne of production in 2014.**

Table 27 presents the direct and indirect costs of the most recent year (2015), which also has the most available data available; 2015 can be considered a typical year for the sector, as production has recovered following the economic crisis.

The 2014-20 Guidelines on State Aid for Environmental Protection and Energy prescribe a gradual move to market-based support for renewable energy and thus can bring down renewable support exemptions generating a cost impact to the sector. These new guidelines are applicable from 1 July 2014 and therefore their impact can only be assessed for 2014-15. The State Aid Guidelines may lead to a decrease in renewable support levy exemptions, which could translate into higher renewable support costs.

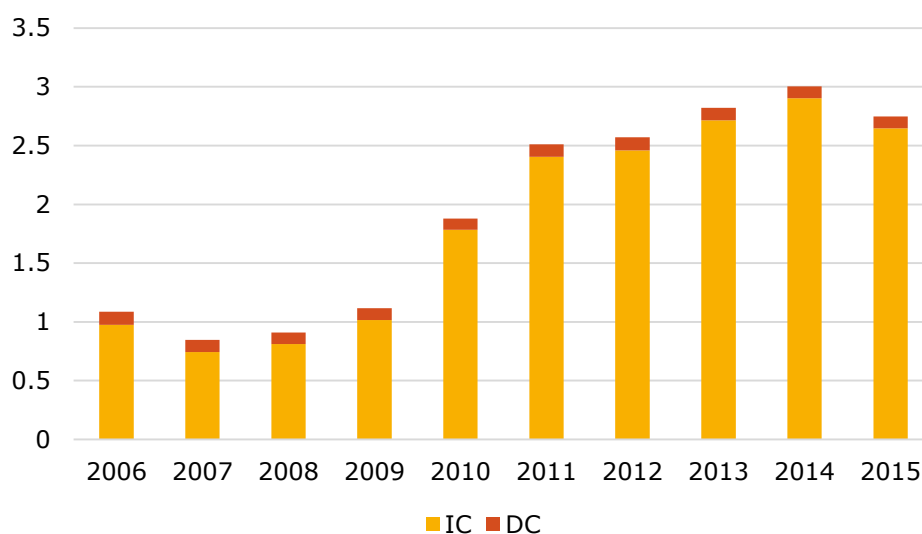
As shown in Figure 34, the RES component slightly increased in 2014-15, from €18.20/MWh to €18.90/MWh. In the absence of data on the evolution on national exemption schemes, a cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no solid conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

Figure 35. Flat glass: Cumulative regulatory costs of electricity legislation 2006-15, CEE, NWE and SE regions (€/tonne of production)



Source: Authors' own elaboration.

Figure 36. Flat glass: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 27. Flat glass: Cumulative regulatory costs of electricity legislation 2015 (€/tonne of production)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0	0	0	0
	Direct charges	0.08	0.12	0.12	0.10
Indirect regulatory costs		1.86	4.51	2.43	2.65
Total regulatory costs		1.94	4.63	2.55	2.75

Source: Authors' own elaboration.

6.5 Gas

Glass manufacturing is an energy-intensive industry and uses natural gas as its main energy source.¹⁰² A cost assessment of EU legislation on gas for packaging glass, glass tableware and flat glass producers is presented in this section.

The price of natural gas is divided into three components, of which the last two can be partly induced by the regulatory framework (regulated components):

- energy supply;
- network costs;
- other taxes, fees, levies and charges (excluding recoverable taxes, such as VAT).

Note that the reimbursement from taxes, fees and levies are taken into account in this section. Data on components of the natural bill shed light on the trends of regulatory components which are set by the EU and national regulators. **While not all regulated components are a result of EU regulation, an EU driven component is present in network costs as well as other taxes, fees, levies and charges (Energy Taxation Directive)**, thus making an analysis of the components relevant for the purpose of assessing cumulative costs. Note that not all plants provided data for the entire period 2006-15. The Research Team used estimates to improve the quality of data (see methodology section of this Chapter).

6.5.1 Description of the Acts

What follows is a description of natural gas related legislation with an expected cost impact on the glass sector.

Internal Energy Market. Directives and regulations setting rules for the Internal Energy Market constitute the so-called '**Third Energy Package**' (hereinafter Third Package). This package repealed the '**Second Energy Package**' (hereinafter Second Package) that entered into force in 2003. Completing the Internal Market requires both '**software**', i.e. common rules for trading gas, as well as '**hardware**', i.e. cross-border infrastructure.

The Directive (whose transposition was required by 2011) included in the '**Third Package**' envisages interventions on both the '**software**' and '**hardware**' dimensions. Directive 2009/73/EC concerning common rules for the Internal Market in natural gas defines rules along which the EU market in natural gas is established. This Directive replaced Directive 2003/55/EC that was part of the Second Package and was put in place to **advance common rules for the Internal Market in natural gas. These Directives aim at establishing common rules for the transmission, distribution, supply and storage of natural gas.** Particularly Directive 2009/73/EC lays down the rules relating to the organisation and functioning of the natural gas sector, access to the market, the criteria and procedures applicable to the granting of authorisations for transmission, distribution, supply and storage of natural gas and the operation of systems. In order to mainly achieve the objective of the security of supply, both Directives require Member States to develop necessary network infrastructure, including interconnection capacity.

Regulation (EC) No 715/2009 provides non-discriminatory rules for access conditions to natural gas transmission systems, liquefaction, re-gasification and storage facilities with a view to ensuring the proper functioning of the Internal Market in gas. In this respect, it also **provides mechanisms to harmonise the network access rules for cross-border exchanges in gas.** This Regulation replaced Regulation (EC) No 1775/2005 that aimed to **provide conditions for non-discriminatory access by third parties to the**

¹⁰² Ecorys et al. (2008), "FWC Sector Competitiveness Studies - Competitiveness of the Glass Sector", p 111 (<http://ec.europa.eu/DocsRoom/documents/1989/attachments/1/translations/en/renditions/pdf>).

gas transmission networks and achieve structural changes in the regulatory framework to tackle barriers to the completion of the Internal Market regarding the trade of gas.

Energy Taxation Directive. The current **Energy Taxation Directive** came into force in 2003, setting a minimum level of taxation for energy products (Art. 4). It is the **basis for an EU-wide harmonised minimum taxation of electricity and energy products, including natural gas.**

The Directive sets minimum rates for EU-wide harmonised taxation for natural gas. The minimum tax rate amounts to €0.15/GJ for natural gas, which converts to a rate of €0.54/MWh. This rate is used to estimate the potential cost of the Energy Taxation Directive.

Note that according to Article 17, Member States may apply tax reductions in favour of energy-intensive businesses, if “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 case exemptions are in place, the above-mentioned direct costs might not occur or they might be due to national legislation.

6.5.2 Categories of regulatory costs

Internal Market legislation. With regard to the ‘hardware’ dimension of the Internal Market, the deployment of cross-border infrastructure requires significant investments. The associated costs may be passed on to consumers and charged in their natural gas bill, thus causing **indirect compliance costs** borne by industry players in both sectors. The ‘software’ part is mainly driven by network codes, which are a set of rules to facilitate the harmonisation, integration and efficiency of EU energy markets. Minor **indirect costs** could arise when adopting these new market rules. However, these are considered to be negligible in absolute terms. For instance, liquid markets are an important prerequisite for entering into long-term contracts, which are used to hedge the price risk of short-term markets. The impact of phasing out regulated energy prices can be ambiguous. While the deregulation of energy prices is important to ensure the functioning of liberalised energy markets, in those countries where energy intensive industries used to benefit from favourable ‘industrial tariffs’, deregulation may have led to higher energy prices, thus generating other **indirect compliance costs** that might weigh on glass industry players.

Energy Taxation Directive. This Directive may generate **direct charges** depending on taxation set by EU Member States.

6.5.3 Cost assessment – Packaging glass

Sample

A short overview of the number of questionnaires received can be found below in Table 28. In total, the sample covers 21 respondents from the packaging glass subsector. More than three plants from each geographical region provided data enabling the Research Team to present regional cost assessments in the packaging glass subsector.

Table 28. Packaging glass: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Packaging glass	21	7	6	8	21

Source: Authors' own elaboration.

Gas prices and costs

Natural gas is the main energy source for the glass sector as it is used in the melting process. Natural gas costs are the key driver of the sector's competitiveness. This section presents information gathered from responding plants on their i) gas intensity ii) net gas costs and ii) components present in the natural gas bills.

Gas intensity

What follows is an analysis of natural gas intensity of production as reported by responding plants.

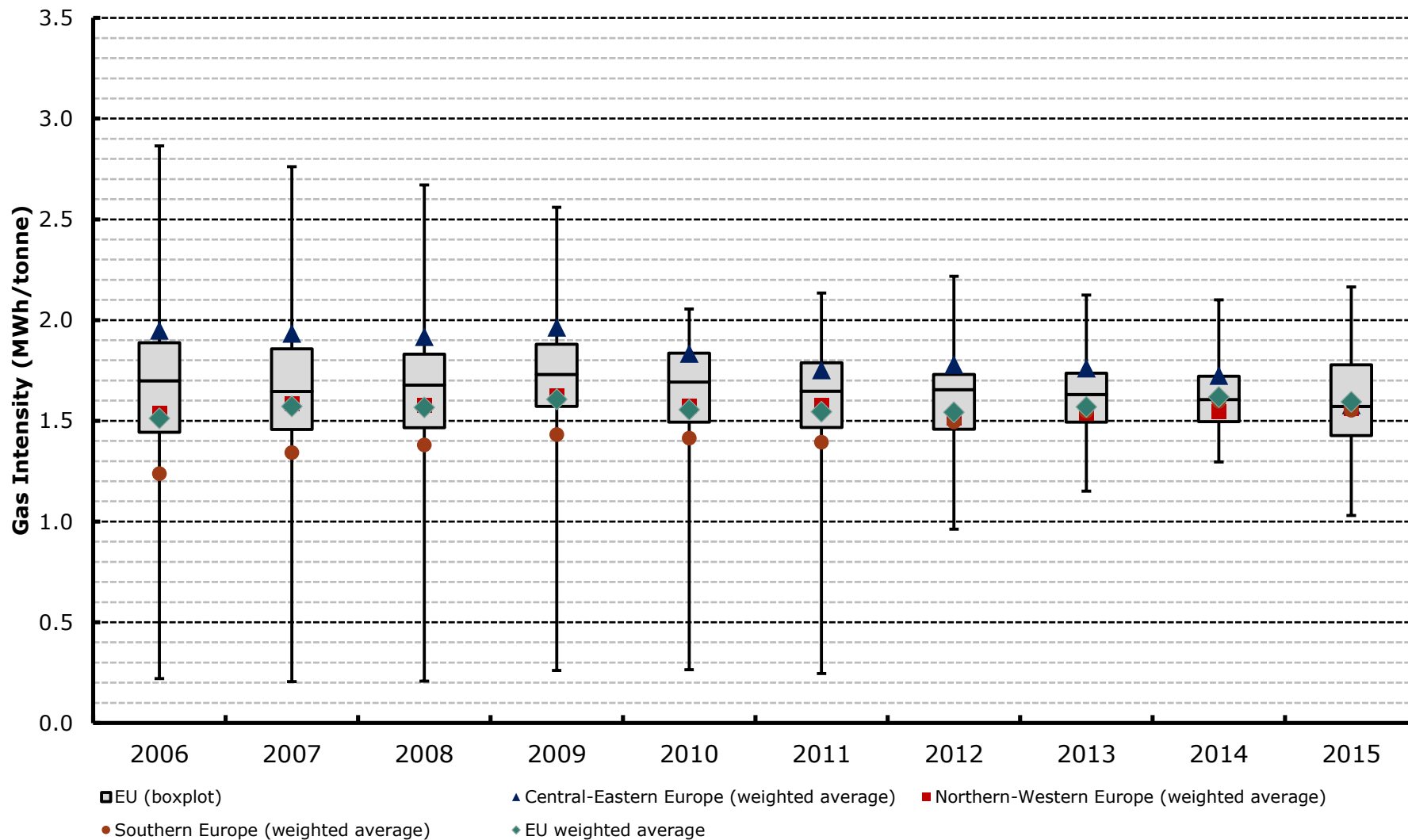
All plants in the sample provided the relevant information allowing the Research Team to assess the electricity intensity based on the sample of 21 plants.

Glass manufacturing has a natural gas-intensive production process. This is manifested by the data received from respondents. **Natural gas intensity remained relatively stable over the period 2006-15, with an EU weighted average between 1.51-1.62 MWh/tonne of production.** While the EU weighted average of electricity intensity was 1.51 MWh/tonne of production in 2006, in 2015 the average stood at 1.59 MWh/tonne of production. In all years, the weighted EU average was below the median.

Plants reported heterogeneous natural gas intensities. The minimum intensity (1 MWh/tonne of production) reported by a plant in 2015 was half of the natural gas intensity reported by the most natural gas intensive plant (2.2 MWh/tonne of production). Dispersion was greater in 2006-09 and since then decreased. While all respondents reported producing packaging glass, the gas intensity of the production process can differ, for example due to diverging shares of recycled glass used in the production process.

Some regional differences are present. **SE respondents show lower natural gas intensities than respondents in other regions in almost all years.** Note, however, that the natural gas intensity in the SE region constantly increased between 2006 (1.24 MWh/tonne of production) and 2015 (1.55 MWh/tonne of production). Data from CEE respondents shows an opposite trend, with decreasing natural gas intensity between 2006 (1.95 MWh/tonne of production) and 2015 (1.58 MWh/tonne of production). Respondents from the NWE region reported stable natural gas intensities for all years (1.54 MWh/tonne of production in 2006 and 1.56 MWh/tonne of production 2015). This is to say that regional differences decreased throughout the 10-year study period.

Figure 37. Packaging glass: Natural gas intensity per tonne of production (2006-15)



Source: Authors' own elaboration.

Gas costs

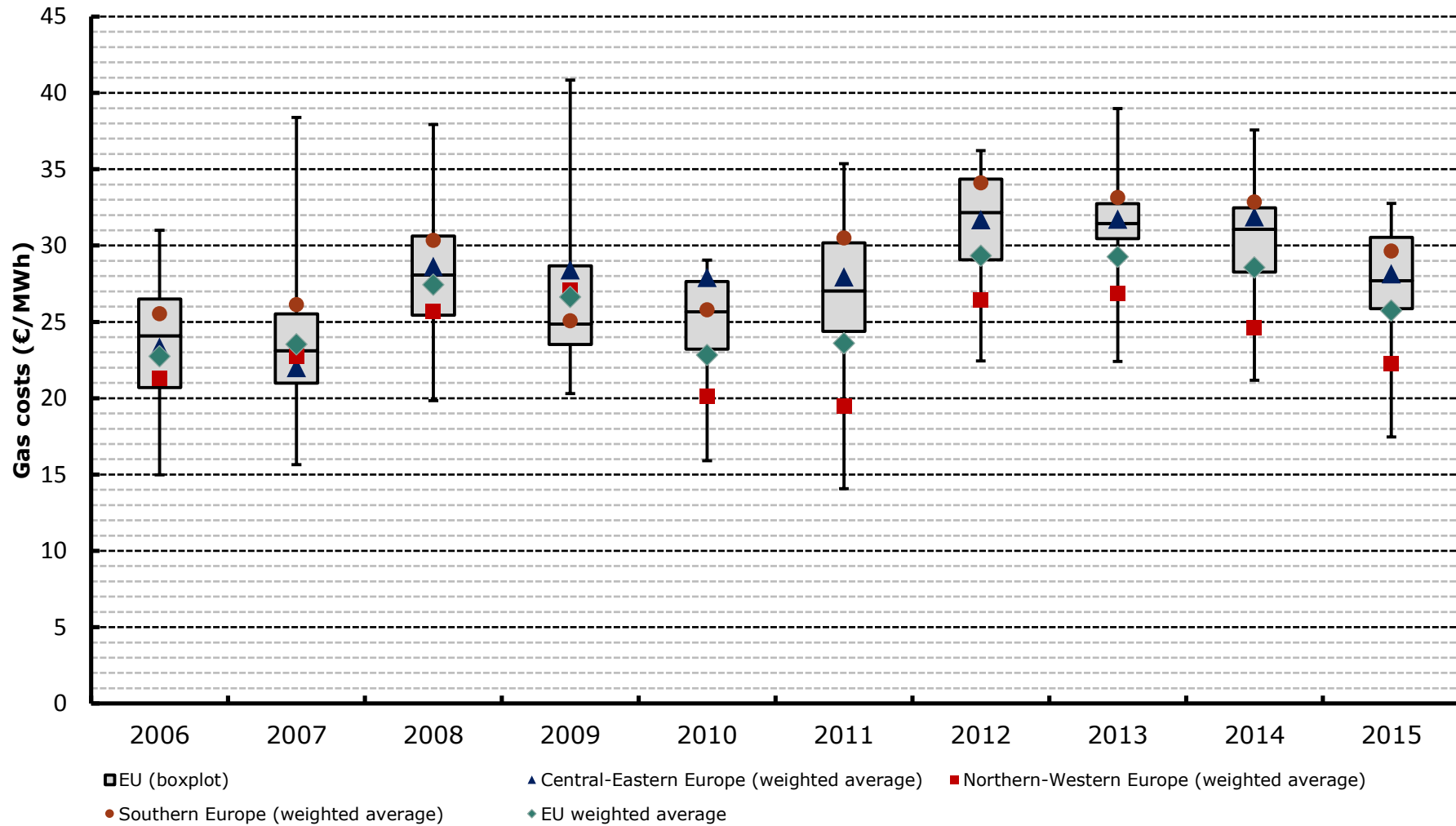
This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Three plants in the NWE region reported reimbursements from taxes.

The weighted average of natural gas cost for EU packaging glass producers fluctuated over the study period (2006-15). **Costs increased till 2008 (€27.40/MWh), decreased thereafter till 2010 (€22.80/MWh), increased again till 2012 (€29.30/MWh), and decreased again till 2015 (€25.80/MWh).** The median costs were higher than the EU weighted average in most years, showing that plants with larger production output have lower natural gas costs.

Data from respondents shows some regional differences. **Plants in the SE region reported higher gas costs in almost all years than plants in CEE and NWE regions,** while plants in the NWE region incurred the lowest costs in almost all years. The declining trend in gas costs held for all three regions in 2012-15, with SE plants paying €29.60/MWh, CEE plants €28.10/MWh and NWE plants €22.30/MWh in 2015.

This data collection from glass manufacturing plants demonstrates the global natural gas price trends presented in Figure 12. This is because the energy supply costs make up a large share of the gas bill, with regulatory components having a much less significant share when compared with electricity bills, as is discussed later in this section. Note, however, that data from manufactures shows that in 2015, costs were below the 2008 level and above the 2006 level.

Figure 38. Packaging glass: Cost of natural gas paid by respondents (2006-15)



Source: Authors' own elaboration.

Components of the gas bill

In this section, the components of the price paid by respondents for natural gas are discussed.

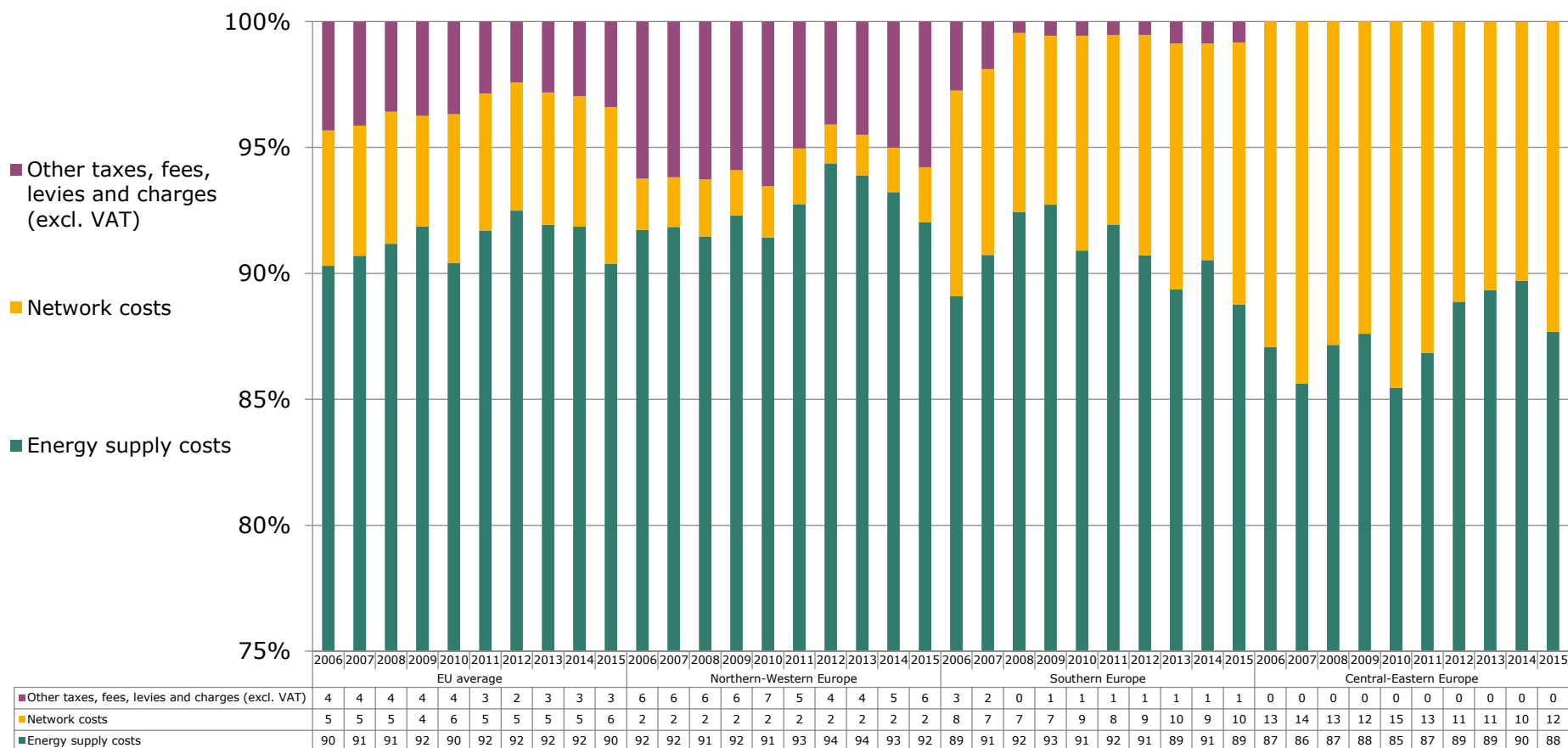
The energy component has the biggest impact on the natural gas bill at EU level, representing approximately 90-92% of gas costs in 2006-15: **while the regulatory components remained relatively stable, the energy components fluctuated over time, following the trends described in the previous section on net natural gas costs.** The energy supply component peaked at €28.80/MWh in 2012, then declined to €24.90/MWh in 2015. Network costs at EU level show an increase from €1.30/MWh in 2006 to €1.70/MWh in 2015. On average, taxes, fees and levies decreased both in absolute and relative terms: while in 2006 taxes and levies represented €1/MWh, in 2015 they stood at €0.9/MWh.

Regional level analysis shows large differences between geographical areas. **In the NWE region, network costs represented only a small share of the natural gas bill (2.2% in 2015), while in the SE network costs accounted for 10.4% of the bill (2015) and in the CEE region 12.3% (2015).**

Taxes and levies however were more substantial in the NWE region, where manufacturers paid €1.46/MWh on taxes and levies in 2015. In the SE region, the cost of taxes and levies amounted to €0.25/MWh while for CEE manufacturers taxes and levies represented less than €0.01 of their natural gas bill. These differences were likely a result of the various national tax schemes in place.

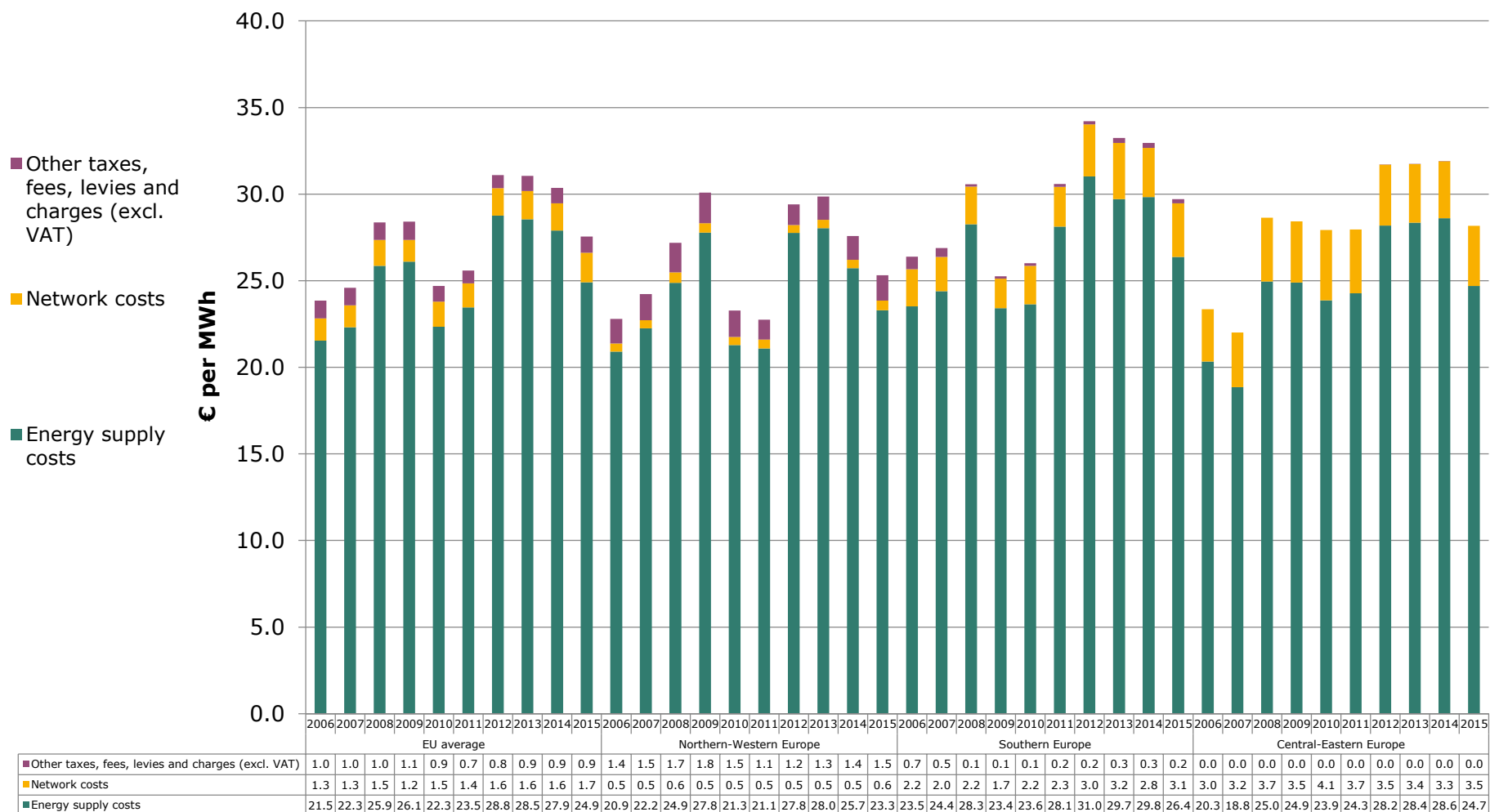
Data received from respondents on their natural gas cost components shows that unlike in the case of electricity cost components, the energy component is the driver of the natural gas costs. **In all regions, regulatory costs present less than 15% of the natural gas cost.** Part of the network costs as well as taxes generated by the Energy Taxation Directive are a result of EU legislation. Therefore, this outlook on natural gas bill components serves to shed light on the cost assessment that follows in the section.

Figure 39. Packaging glass: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 40. Packaging glass: Components of the natural gas bills paid by respondents (€/MWh, weighted averages, 2006-15)



Source: Authors' own elaboration.

Direct regulatory costs

This section addresses direct charges generated by energy taxation legislation.

Direct charges

Direct charges attributable to EU legislation make up approximately **two-thirds of all regulatory costs of natural gas legislation**. These charges remained relatively constant throughout the study period, as they were a tax per unit of gas consumed. **In 2015, the direct costs for the EU hollow glass sector were €0.76/tonne of production.**

For this Study, the minimum recommended tax value was applied to the data, but it is the responsibility of the regulatory board at Member State level to deduce a gas taxation for the packaging glass industry. As a result, these charges may not be entirely represented, particularly in the regional analysis. Note that in case exemptions are in place, the above-mentioned direct costs might not occur. This can be the case in the CEE region, where manufacturers' taxes and levies represented less than €0.01 of their natural gas bill in 2015.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the packaging glass subsector. Following the analysis of the relevance of EU energy legislation to the packaging glass subsector, this section looks at indirect compliance costs generated by internal market legislation.

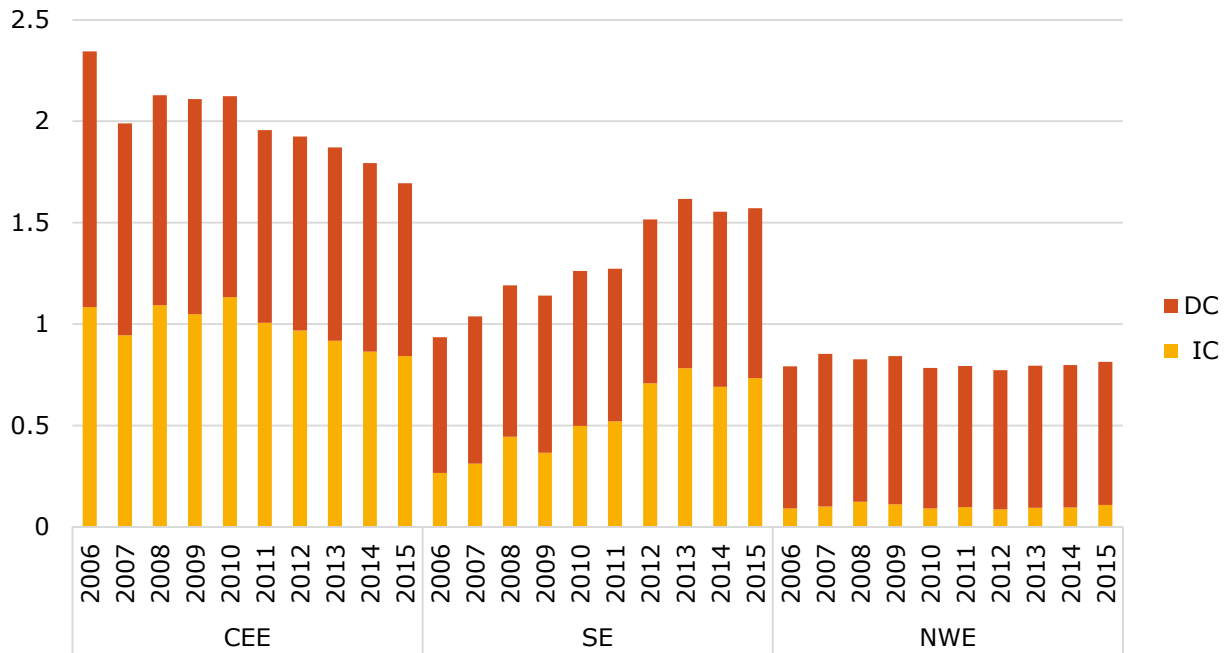
Two legislative acts and repealed acts on the Internal Energy Market have the potential to generate indirect regulatory costs for the glass sector:

- Directive 2009/73/EC which aims at creating common rules for the generation, transmission and distribution of gas repealing Directive 2003/55/EC;
- Regulation (EC) No 715/2009 which aims at setting fair rules for cross-border exchanges in gas, repealing Regulation (EC) No 1775/2005.

The potential costs generated by the legislation translate into higher network costs for the industry. This is due to the need to finance new infrastructure. Since this Study observes the effect of the Internal Energy Market for gas, charges are shown from the beginning of the study period and repealed acts are included.

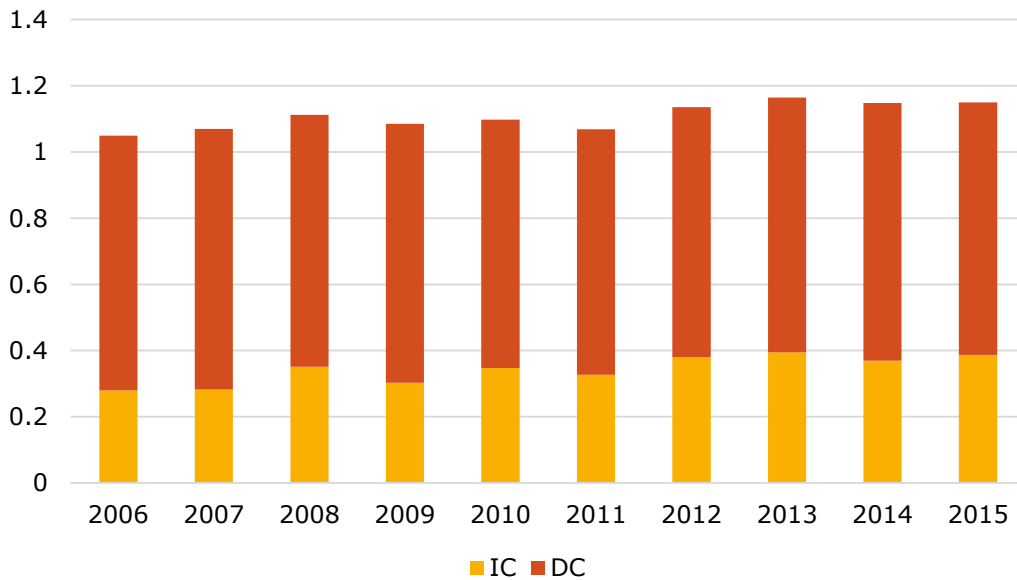
Indirect charges attributable to EU legislation are approximately one-third of all cumulative regulatory costs on gas bills. Regional differences are demonstrated in Figure 52. **Indirect costs represent the largest share of costs incurred in the CEE region, where they cover around 50% of the costs.** In the SE region indirect costs account for around 40-45% of costs whereas in the NWE region the share is approximately 10%. In 2015, the estimated costs of Internal Market legislation stood at €0.11/tonne in the NWE region, €0.84/tonne in the CEE region and €0.73/tonne in the SE region.

Figure 41. Packaging glass: Cumulative regulatory costs of natural gas legislation 2006-15 for the CEE, NWE and SE regions (€/tonne of production)



Source: Authors' own elaboration.

Figure 42. Packaging glass: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 29. Packaging glass: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0	0	0	0
	Direct charges	0.70	0.85	0.84	0.76
Indirect regulatory costs		0.11	0.84	0.73	0.38
Total regulatory costs		0.81	1.69	1.57	1.14

Source: Authors' own elaboration.

6.5.4 Cost assessment – Glass tableware

Sample

A short overview of the number of questionnaires received can be found below in Table 30. In total, the sample covers five respondents from the glass tableware sector.

Table 30. Glass tableware: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Glass tableware	5	5

Source: Authors' own elaboration.

Gas prices and costs

Natural gas is the main energy source for the glass sector, as it is used in the melting process. Natural gas costs are the key driver of the sector's competitiveness. This section presents information gathered from responding plants on their i) gas intensity, ii) net gas costs and ii) components present in the natural gas bills.

Gas intensity

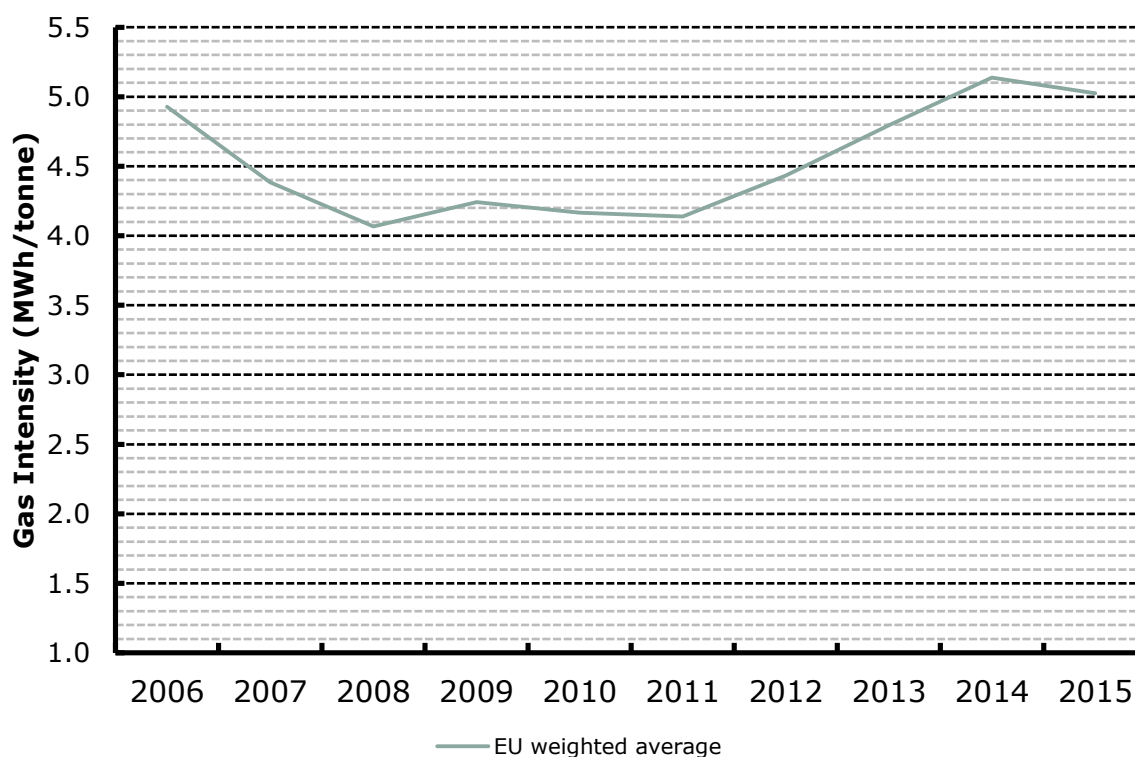
What follows is an analysis of natural gas intensity of production as reported by responding plants.

All plants in the sample provided the relevant information allowing the Research Team to assess the gas intensity based on the sample of five plants.

Glass manufacturing has a natural gas-intensive production process. This is particularly true for the glass tableware subsector, which is considerably more gas-intensive than flat glass and hollow glass subsectors. This is manifested by the data received from respondents. **Natural gas intensity in the glass tableware subsector fluctuated over the period 2006-15.** It first decreased from 4.9 MWh/tonne of production in 2006 to 4.1 MWh/tonne in 2011 and then increased back to above the 2006 level in 2015 (5 MWh/tonne of production).

Due to the limited size of this sample, the fluctuations presented are mostly explained by fluctuations in individual plants. Therefore, no solid conclusions on the development of natural gas intensity of the glass tableware subsector throughout the 10-year period can be drawn.

Figure 43. Glass tableware: Natural gas intensity per tonne of production (2006-15) (MWh/tonne)



Source: Authors' own elaboration.

Gas costs

This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. One plant reported reimbursements from taxes or levies.

The weighted average of natural gas cost for EU glass tableware producers fluctuated over the study period, following to some extent the global developments in natural gas costs presented in section 6.1.1 (Figure 12). Costs increased starkly to €33.30/MWh in 2012, then decreased to €24.40/MWh in 2015.

Figure 44. Glass tableware: Cost of natural gas paid by respondents, €/tonne (2006-15)



Source: Authors' own elaboration.

Components of the gas bill

In this section, the components of the price paid by respondents for natural gas are discussed.

The energy component has the biggest impact on the price of natural gas at EU level, representing around 90-95% of the natural gas bill in 2006-15: while the regulatory components have remained stable, the energy components fluctuated over time, following the trends described in the previous section on net natural gas costs. **The energy supply component peaked in 2011 at €31/MWh and then reduced to €23.30/MWh in 2015. Network costs at EU level show small fluctuations and an increase from €0.90/MWh in 2006 to €1.34/MWh in 2015.** On average, taxes, fees and levies have showed minor fluctuations. While in 2006 taxes and levies represented €0.58/MWh of the natural gas costs, in 2015 they stood at €1.17/MWh.

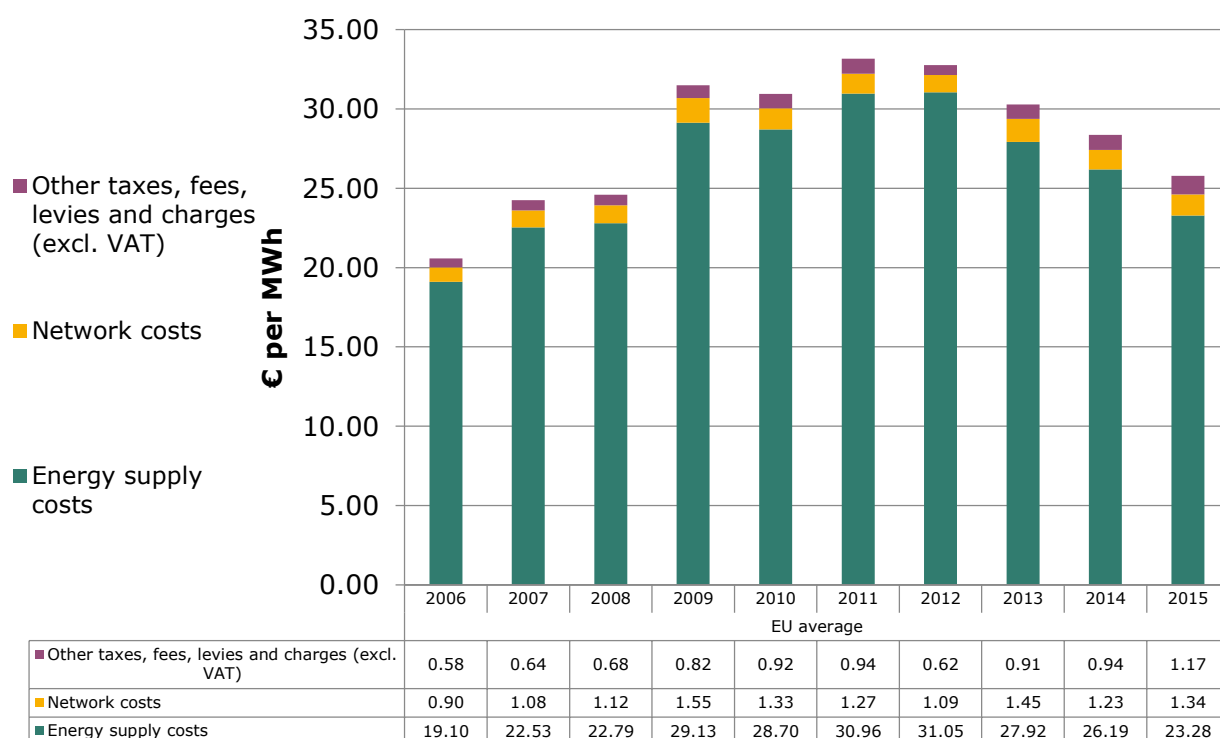
Data received from respondents on their natural gas cost components shows that unlike in the case of electricity cost components, **the energy component is the driver of the natural gas costs. Regulatory costs presented a share of the natural gas costs ranging from 5% to 10%.**

Figure 45. Glass tableware: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 46. Glass tableware: Components of the natural gas bills paid by respondents (€/MWh, weighted averages, 2006-15)



Source: Authors' own elaboration.

Direct regulatory costs

This section looks at the direct charges generated by energy taxation legislation.

Direct charges

Direct charges attributable to EU legislation make up approximately two-thirds of all regulatory costs of natural gas legislation. These charges remained relatively constant throughout the study period, as they are a tax per unit of gas consumed. For this Study, the minimum recommended tax value was applied to the data, but it is the responsibility of the regulatory board at Member State level to deduce gas taxation for the glass tableware industry. As a result, these charges may not be entirely represented, particularly in the regional analysis.

Note that in case exemptions are in place, the above-mentioned direct costs might not occur.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the glass tableware subsector. Following the analysis of the relevance of EU energy legislation to the glass tableware, this section addresses indirect compliance costs generated by Internal Market legislation.

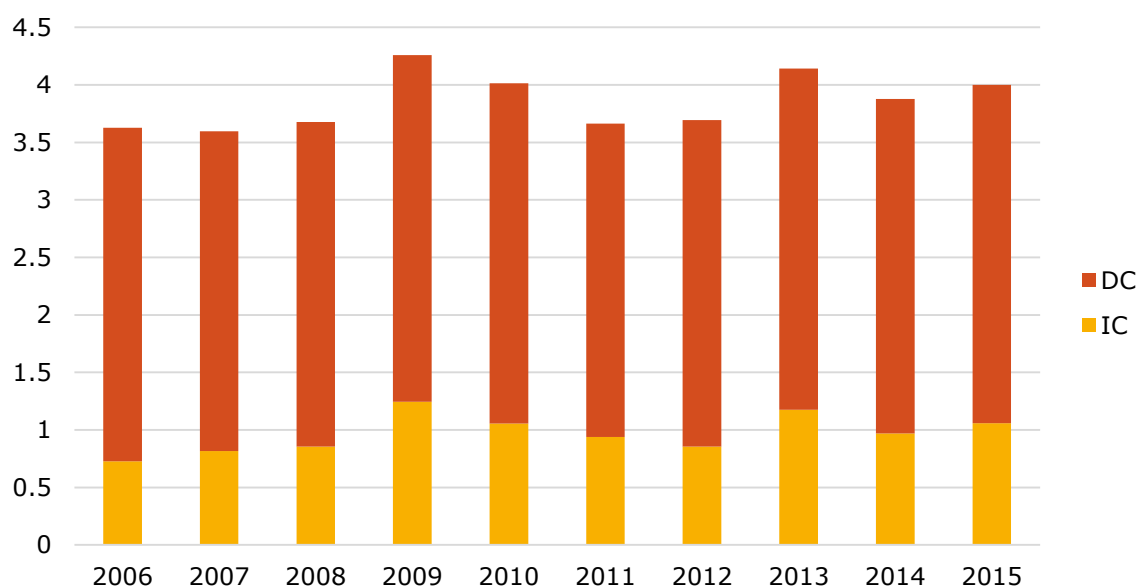
Two legislative acts and repealed acts on Internal Energy Market have the potential to generate indirect regulatory costs for the glass sector:

- Directive 2009/73/EC which aims at creating common rules for the generation, transmission and distribution of gas repealing Directive 2003/55/EC;
- Regulation (EC) No 715/2009 which aims at setting fair rules for cross-border exchanges in gas, repealing Regulation (EC) No 1775/2005.

The potential costs generated by the legislation translate into higher network costs for the industry. This is due to the need to finance new infrastructure.

Indirect charges attributable to EU legislation are approximately one-third of all cumulative regulatory costs on gas bills. Since this Study observes the effect of the Internal Energy Market for gas, charges are shown from the beginning of the study period and repealed acts are included. In 2015, the indirect costs amounted to €1.06/tonne.

Figure 47. Glass tableware: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 31. Glass tableware: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	0
	Direct charges	2.94
Indirect regulatory costs		1.06
Total regulatory costs		4.00

Source: Authors' own elaboration.

6.5.5 Cost assessment – Flat glass

Sample

A short overview of the number of questionnaires received can be found below in Table 32. In total the sample covers 15 respondents from the flat glass sector. More than three plants from each geographical region provided data enabling the Research Team to present regional cost assessments in the flat glass sector.

Table 32. Flat glass: Total number of questionnaires received and used in the Chapter

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Flat glass	15	5	5	5	15

Source: Authors' own elaboration.

Gas prices and costs

Natural gas is the main energy source for the glass sector, as it is used in the melting process. Natural gas costs are the key driver of the sector's competitiveness. This section presents information gathered from responding plants on their i) gas intensity, ii) net gas costs and ii) components present in the natural gas bills.

Gas intensity

What follows is an analysis of natural gas intensity of production as reported by responding plants.

Glass manufacturing has a natural gas-intensive production process. This is manifested by the data received from respondents. Natural gas intensity of the flat glass sector shows a

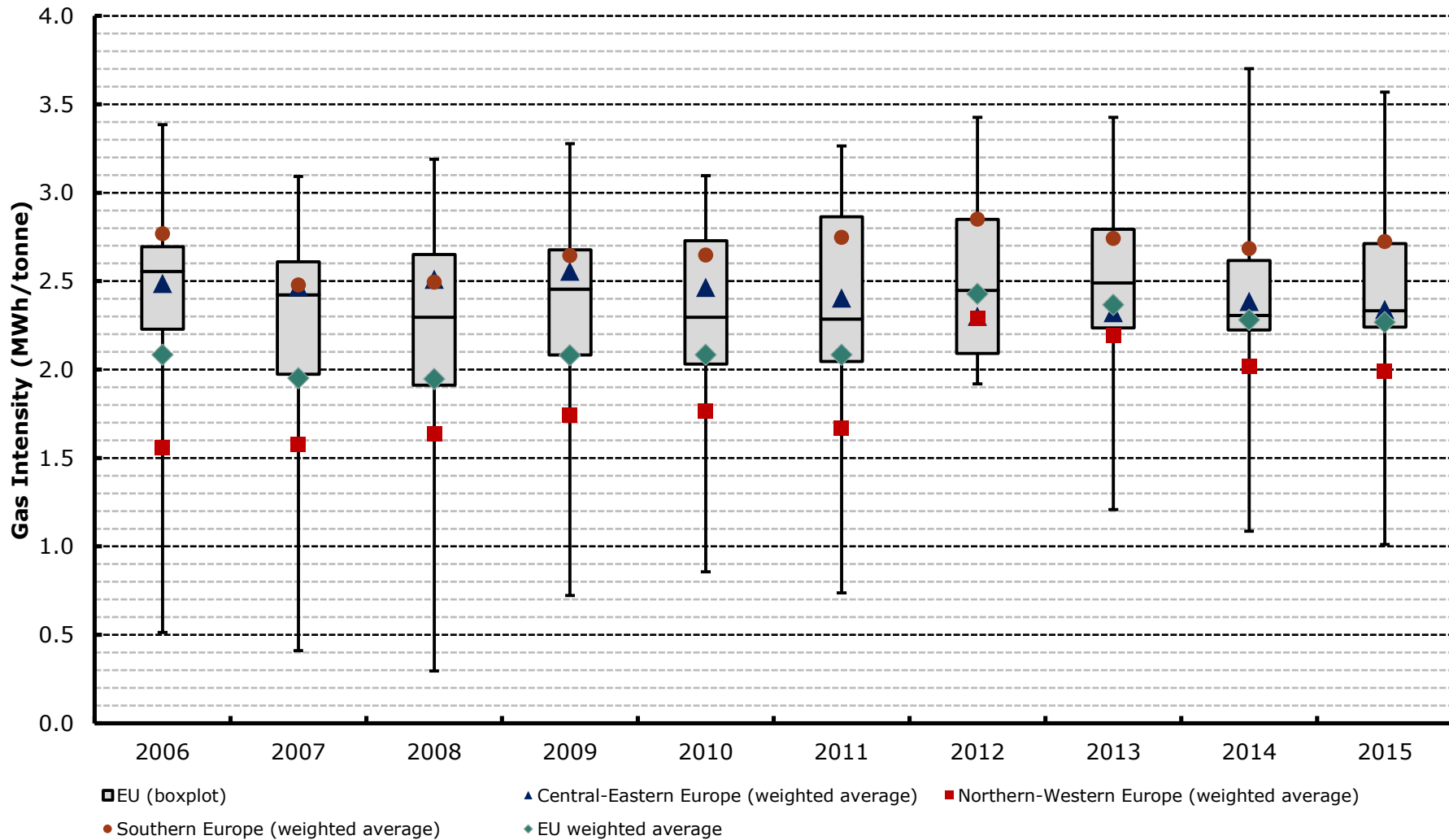
trend of slightly increasing natural gas intensity from 2006 to 2015. **EU weighted average decreased from 2.1 MWh/tonne of production (2006) to 1.9 MWh/tonne of production (2008), increased to 2.4 MWh/tonne of production (2013), and then decreased to 2.3 MWh/tonne of production (2015).** The low natural gas intensities in 2007-08 are mostly explained by data from individual plants reporting low gas intensities. Based on this dataset, the flat glass sector is more natural gas-intensive in comparison packaging glass industry but less gas-intensive than the glass tableware industry.

As shown in Figure 48, the weighted average is lower than the median in all years. This reflects the lower natural gas intensity of larger plants in the sample.

A regional comparison shows some variations between NWE, SE and CEE regions. **Data from respondents shows NWE plants reporting considerable lower natural gas intensities than their peers in the CEE and SE regions. While the average natural gas intensity of NWE plants was 2 MWh/tonne of production in 2015, the figure was 2.7 MWh/tonne of production for the SE and 2.3 MWh/tonne of production for the CEE region.**

Gas intensities in all three regions fluctuated over the period 2006-15. In 2006, the SE natural gas intensity was 2.8 MWh/tonne of production, dropped in 2007 and 2008 and then increased back to the 2006 level (2.7 MWh/tonne of production). The average gas intensity in the CEE region reflected a decreasing trend. While plants in the CEE region had on average an intensity of 2.5 MWh/tonne of production in 2006, in 2015 the plants consumed 2.3/MWh per tonne of production. Data from NWE producers reflects an opposite trend, as their natural gas intensity increased from 1.6/MWh per tonne of production to 2.0/MWh per tonne of production.

Figure 48. Flat glass: Natural gas intensity per tonne of production (2006-15)



Source: Authors' own elaboration.

Gas costs

This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Five plants in the reported reimbursements from taxes, levies, fees or other charges.

The weighted average of natural gas costs for EU flat glass producers fluctuated over the study period of 2006-15. **Costs increased to €28/MWh in 2008, decreased to €22.80/MWh in 2010, increased to €31.10/MWh in 2013, and decreased to €23.90/MWh in 2015.** The trend is similar to that reported by packaging glass manufacturers. The trend in natural gas costs to a large extent reflects the global development in natural gas pricing described in section 6.1.1.

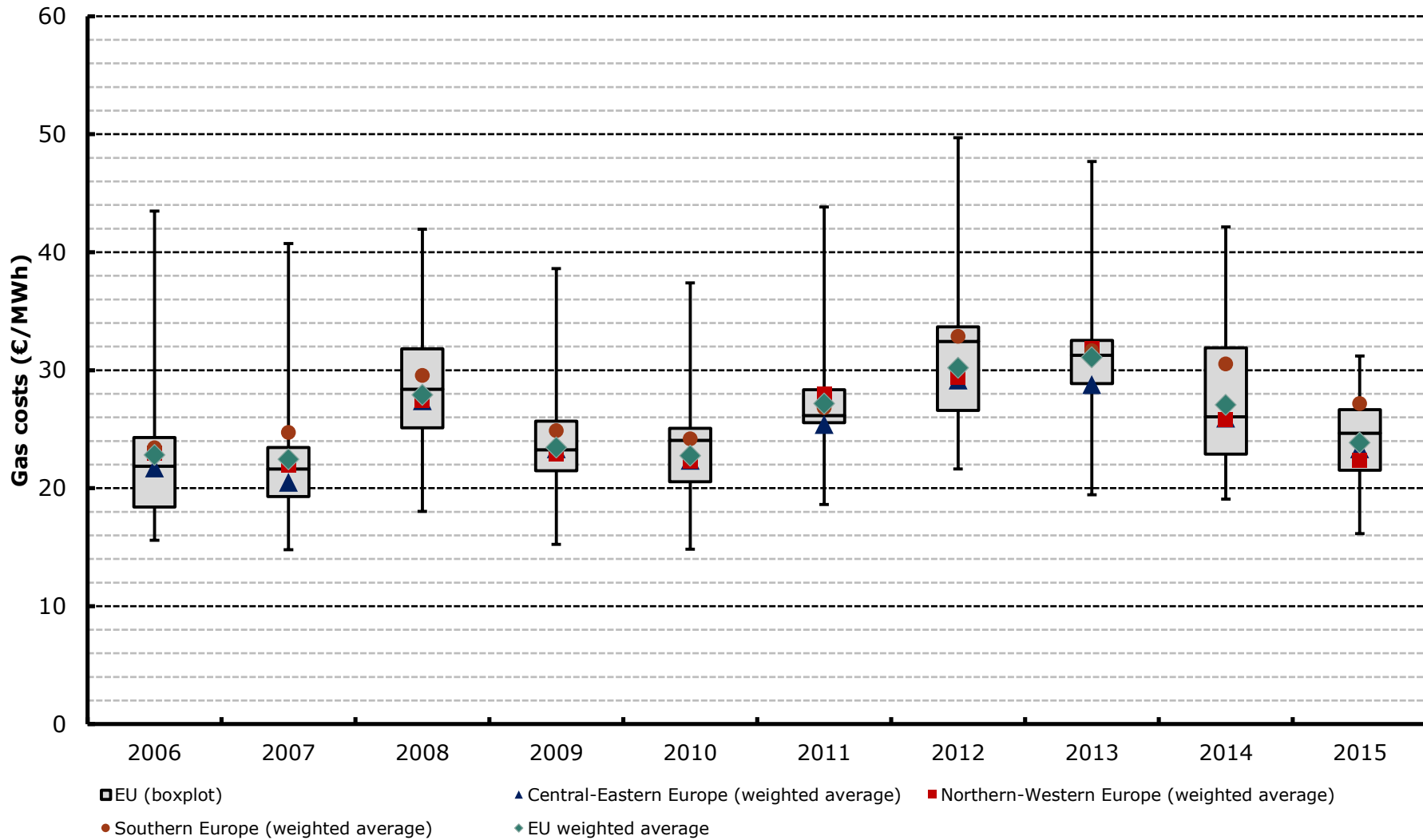
Data from respondents shows some regional differences. **Producers in the SE region report the highest natural gas costs for most years of the study period.** The years 2012-15 are interesting to analyse, as the regional data demonstrates the decreasing trend in costs. The costs decreased in the NWE region, from €30/MWh (2012) to €22.40/MWh (2015). Gas costs in the CEE region declined from €29.20/MWh in 2012 to €23.30/MWh in 2015, while costs in SE region decreased from €32.90/MWh in 2012 to €27.20/MWh in 2015.

Data collection from glass manufacturing plants somewhat corresponds to the global trends described in 6.1.1. This is because the energy supply costs make up a large share of the gas bill, with regulatory components having a much smaller share when compared with electricity bills, which is discussed later in this section. Note, however, that data from manufactures shows that in 2015, costs were below the 2008 level and above the 2006 level.

Cross-checked with previous research, these findings reflect observations in the 2013 CEPS Report "Composition and drivers of energy prices for energy-intensive industries", on natural gas costs for the flat glass sector.¹⁰³

¹⁰³ Some differences between findings of the 2013 study and the current results manifest themselves. The differences are likely to manifest themselves due to different definitions of geographical regions. Moreover, the 2013 study shows data on gas prices whereas the current study reports net costs.

Figure 49. Flat glass: Cost of natural gas paid by respondents (2006-15)



Source: Authors' own elaboration.

Components of the gas bill

In this section, the components of the price paid by respondents for natural gas are discussed.

The energy component has the biggest impact on the price of natural gas at EU level representing around 87-91% of the natural gas bill in 2006-15: **while the regulatory components remained relatively stable, the energy components fluctuated, following the trends described in the previous section on net natural gas costs.** The energy supply component increased to €25.90/MWh in 2008, decreased to €21.70/MWh in 2009, peaked to €28.90/MWh in 2013, and then declined to €22.10/MWh in 2015. The cost variations described in the previous section reflect the change in the cost of the energy supply component.

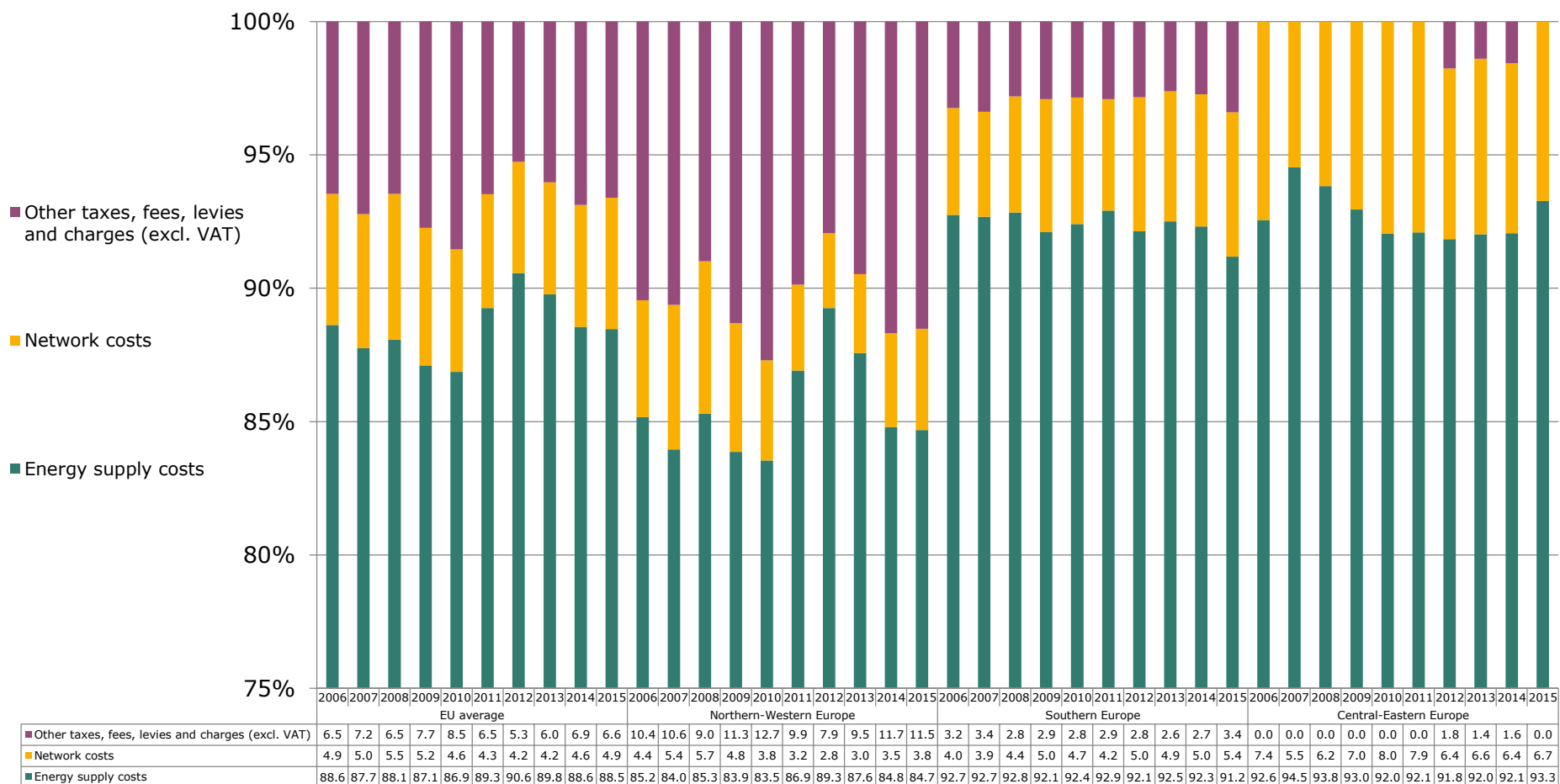
The regulatory component represented a small share of the natural gas bill, accounting for approximately 9-13%. Data on both network costs as well as taxes and levies show a small but noticeable increase during 2006-15. **Network costs at EU level increased from €1.20/MWh in 2006 to €1.40/MWh in 2013 and then back down to €1.20/MWh in 2015.** Taxes, fees and levies increased slightly during the 10-year study period: in 2006 taxes and levies represented €1.50/MWh; in 2015 they stood at €1.70/MWh.

Regional level analysis shows large differences between geographical areas. It is clear from the data that **in the NWE region, taxes and levies play a bigger role in natural gas costs than in the CEE and SE regions.** While NWE paid approximately €2.80/MWh of taxes and levies in 2015, the figure was less than €0.01/MWh in the CEE region and at €0.90/MWh in the SE region. The limited presence of taxes and levies is particularly notable in the CEE region, where respondents reported no taxes and levies until 2012.

While more taxes and levies are present in the natural gas bill in the NWE region, the network costs generate a larger share of natural gas costs in the SE and CEE regions. In 2015, SE producers' network costs were at €1.50/MWh and in the CEE region the average stood at €1.60/MWh. Network costs were smaller in NWE, reported by plants on average to cover €0.90/MWh in 2015. The differences across regions could possibly be due to higher fragmentation of national policies.

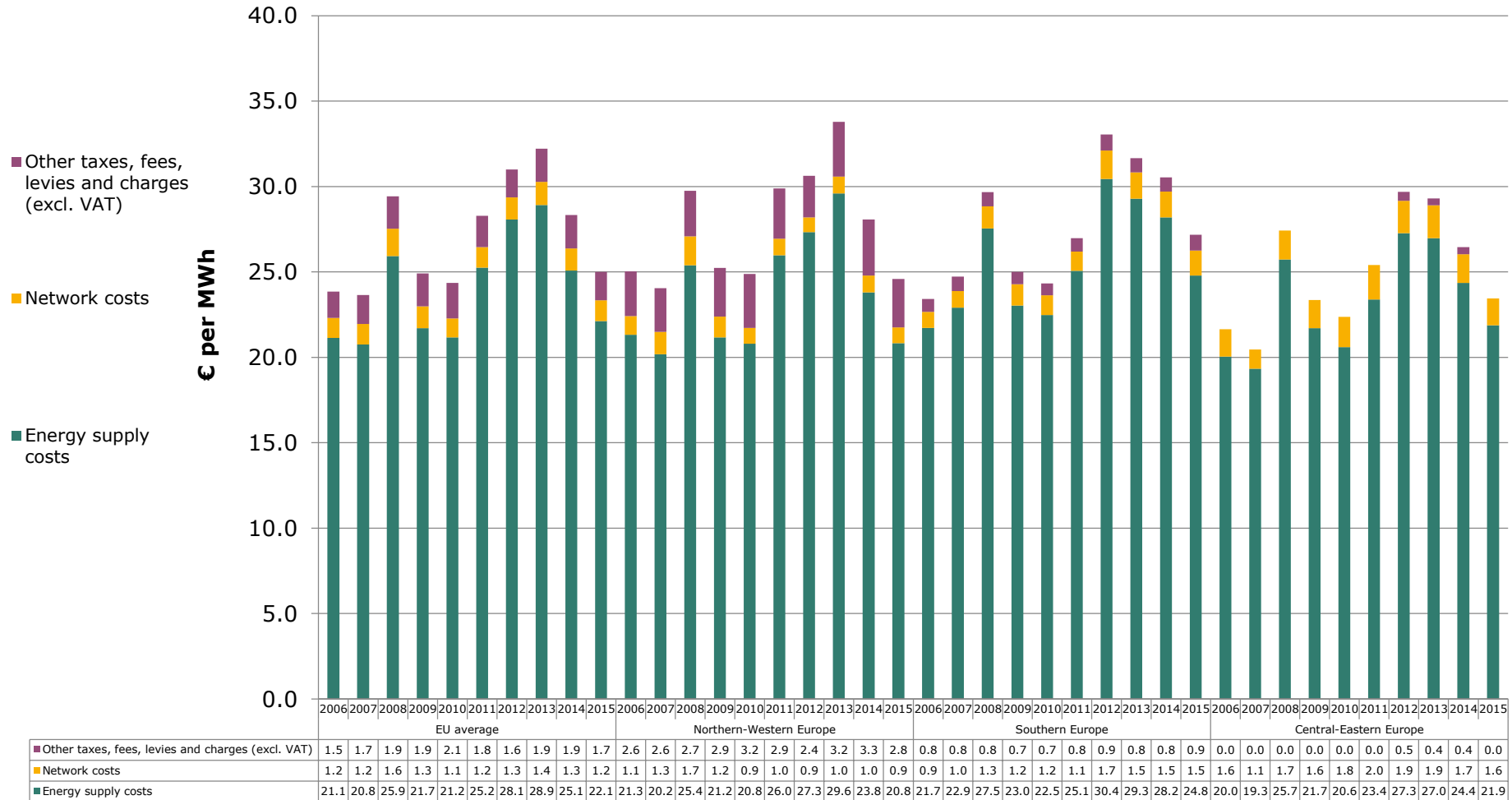
Data received from respondents on their natural gas cost components shows that unlike in the case of electricity cost components, **the energy component is the driver of the natural gas costs.** Part of the network costs as well as taxes generated by the Energy Taxation Directive are a result of EU legislation. Therefore, this outlook on natural gas bill components serves to shed light on the cost assessment that follows.

Figure 50. Flat glass: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

Figure 51. Flat glass: Components of the natural gas bills paid by respondents (€/MWh, weighted averages, 2006-15)



Source: Authors' own elaboration.

Direct regulatory costs

This section addresses direct charges generated by energy taxation legislation.

Direct charges

Direct charges attributable to EU legislation make up approximately two-thirds of all regulatory costs of natural gas legislation. These charges remained relatively constant throughout the study period, as they are a tax per unit of gas consumed. Due to the more limited role of indirect costs in the NWE region, the direct costs represent a larger share of costs in the NWE region than in CEE and SE regions.

For this Study, the minimum recommended tax value was applied to the data, but it is the responsibility of the regulatory board at Member State level to deduce gas taxation for the flat glass industry. As a result, these charges may not be entirely represented, particularly in the regional analysis. Note that in case exemptions are in place, the above-mentioned direct costs might not occur.

Indirect regulatory costs

What follows is an analysis of indirect regulatory costs presented by EU energy legislation to the flat glass sector. Following the analysis of the relevance of EU energy legislation to the flat glass sector, this section addresses indirect compliance costs generated by internal market legislation.

Two legislative acts and repealed acts on the Internal Energy Market have the potential to generate indirect regulatory costs for the glass sector:

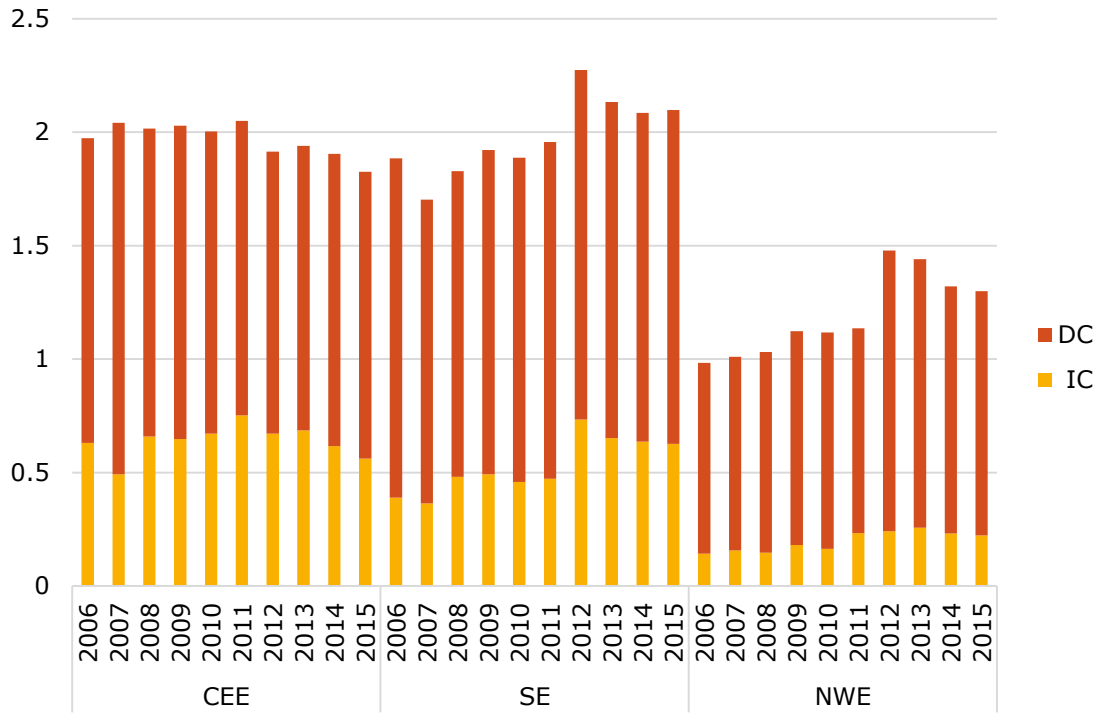
- Directive 2009/73/EC which aims at creating common rules for the generation, transmission and distribution of gas repealing Directive 2003/55/EC;
- Regulation (EC) No 715/2009 which aims at setting fair rules for cross-border exchanges in gas, repealing Regulation (EC) No 1775/2005.

The potential costs generated by the legislation translate into higher network costs for the industry. This is due to the need to finance new infrastructure.

Indirect charges attributable to EU legislation are approximately one-third of all cumulative regulatory costs on gas bills. Since this Study observes the effect of the Internal Energy Market for gas, charges are shown from the beginning of the study period and repealed acts are included.

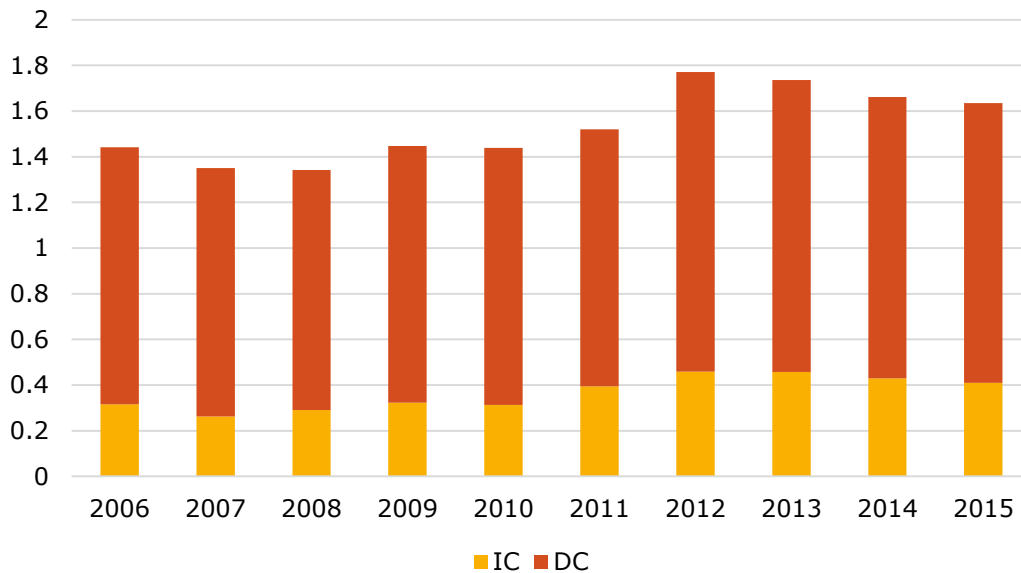
Regional differences are demonstrated in Figure 52. **While in the CEE and SE regions indirect costs accounted for around 30% of costs, in the NWE region the share was approximately 15%.** In 2015, the estimated costs of Internal Market legislation stood at €0.22/tonne in the NWE region, €0.56/tonne in the CEE region and €0.62/tonne in the SE region.

Figure 52. Flat glass: Cumulative regulatory costs of natural gas legislation 2006-15 for the CEE, SE and NWE regions (€/tonne)



Source: Authors' own elaboration.

Figure 53. Flat glass: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 33. Flat glass: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0	0	0	0
	Direct charges	1.08	1.26	1.47	1.22
Indirect regulatory costs		0.22	0.56	0.62	0.41
Total regulatory costs		1.30	1.82	2.09	1.63

Source: Authors' own elaboration.

6.6 Energy efficiency

6.6.1 Description of the Acts

While the section on electricity and natural gas addresses the regulatory costs related to electricity and gas used by the plants in their production process, this section shows the costs generated by working toward the EU's goal of promoting the industry's energy efficiency. Unlike in previous areas, costs are generated by one piece of legislation only. Below is a description of the energy efficiency legislation with an expected cost impact on the glass sector.

Energy Efficiency Directive. The Energy Efficiency Directive aims at supporting the transition of the EU to a more energy efficient economy. The directive establishes a common framework of measures for the promotion of energy efficiency within the Union in order to ensure the achievement of the Union's 2020 20% headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date. Member States were required to transpose this Directive by 2014.

The Energy Efficiency Directive includes provisions that incentivise large enterprises to make investments in energy efficiency improvements and may be associated with some direct and indirect costs for energy-intensive producers. In particular, every fourth year, from 2012 onwards, industrial players are obliged to pass energy audits and implement the energy efficiency recommendations of the audits. This entails **direct costs**, which involves **substantive compliance costs**, e.g. one-off costs to comply with the EED, the cost of implementing the auditors' recommendations and cooperating with auditors.

6.6.2 Categories of regulatory costs

Article 8 of the Energy Efficiency Directive required large companies to pass the obligatory energy audit by 5 December 2015. The four-year audit cycle means that the **substantive compliance cost** per MWh generated by the legislative obligation is to be spread across four years. Costs can occur in terms of purchased services and in terms of labour costs, as working hours might be allocated to carrying out the audit or accompanying external auditors in the plant. The energy audit obligation applies to large companies. After 5 June 2014, the Directive requires industrial players, in case of refurbishment of industrial installations generating waste heat at a useful temperature level with a total thermal input >20 MW, to carry out a cost-benefit analysis to assess the option of introducing co-generation in heating. This provision can generate additional **direct compliance costs**. Finally, some **indirect compliance costs** can stem from the obligation of energy companies to achieve end-use energy savings of 1.5% of the annual energy sales to final customers insofar as such companies pass on related costs to their customers. Member States have the option to exclude industrial players, hence at the moment it is not possible to assess whether any indirect costs will materialise.

6.6.3 Cost assessment – Packaging glass

Sample

A short overview of the number of questionnaires received can be found below in Table 34. In total, the sample covers 21 respondents from the packaging glass subsector. More than three plants from each geographical region provided data enabling the Research Team to present regional cost assessments in the packaging glass subsector.

Table 34. Packaging glass: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Packaging glass	21	7	6	8	21

Source: Authors' own elaboration.

Direct regulatory costs

This section addresses **substantive compliance costs generated by the Energy Efficiency Directive.**

Substantive compliance costs

The Energy Efficiency Directive can generate substantive compliance costs for the packaging glass manufacturers. Both the i) obligation to pass an energy audit and ii) the requirement of a cost-benefit analysis are expected to lead to substantive compliance costs. These costs are presented below based on the data acquired from responding plants.

Energy audit

The Energy Efficiency Directive can generate substantive compliance costs for the packaging glass subsector due to the obligatory energy audit that has been in place since 2012.

To assess the indirect costs generated by the directive, respondents from the packaging glass subsector were asked about the costs of hiring external auditors and the amount of time their employees¹⁰⁴ spend preparing the audit and to accompany the auditors in the plant. As there were no SMEs among respondents, all respondents were included in this sample.

Out of 21 packaging glass manufacturers, 15 reported having passed an energy audit for 2012-15. Three responding plants carried out the energy efficiency audit prior to 2012. These audits are not taken into account in the cost assessment, as they were passed prior to the EU obligation, put in place in 2012.

¹⁰⁴ These employees are assumed to be technicians and associate professionals. The hourly earnings of technicians and associate professionals are therefore applied.

Table 35. Packaging glass: Number of plants that have carried out the energy efficiency audit 2012-15

	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	15	5	2	8
Energy efficiency audit not carried out	6	2	4	0

Source: Authors' own elaboration.

The weighted average costs incurred at EU level were at €0.03/tonne of production.

In most cases when a plant carried out an energy audit, employees of the plants took part in preparing the audit, or in case of an external audit, accompanied auditors in the plant. This time spent by employees is counted as part of the cost of the audit. **The time that respondents reported their employees had spent in preparing the audit varies from three working days to up to 30 working days.** As labour costs vary from one Member State to another, the cost impact measured in the amount of working days varies.

One company foresaw an energy audit in 2016. Some regional differences were present: while all SE plants reported having carried out at least one energy audit in 2012-15, two plants in the NWE region and four plants in the CEE region had not yet conducted the obligatory audit. As the legislation entered into force in 2012, it is possible that the indirect cost generated by the Energy Efficiency Directive can increase in the future.

The energy efficiency audit generated minor costs for producers. Data shows that the most recent year, 2015, generated the highest costs for EU producers, as most audits were carried out in that year. No solid conclusions can be drawn from the sample, as the time period of analysis is limited to 2012-15.

Cost-benefit analysis

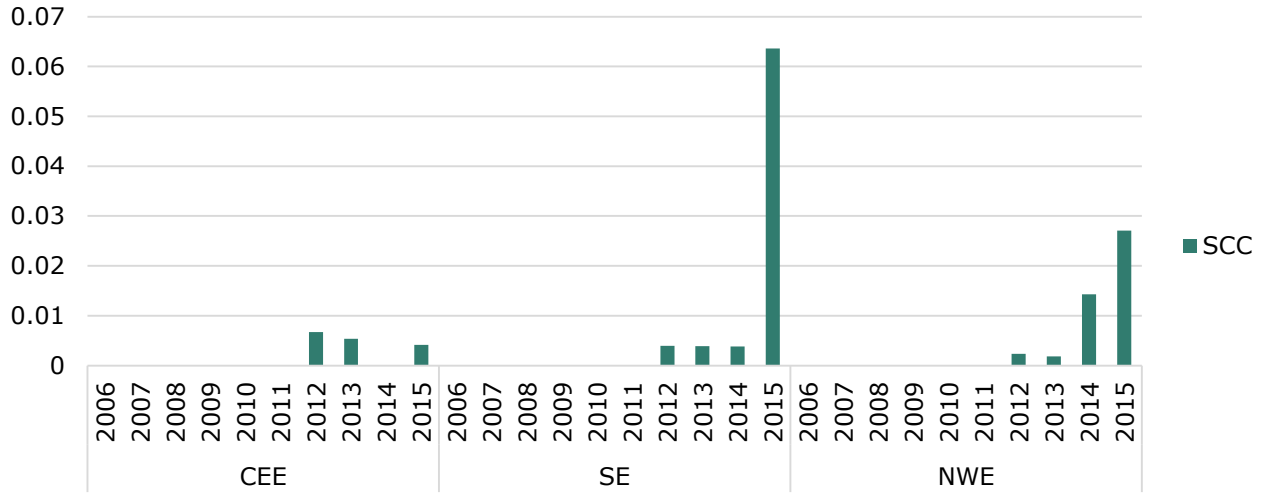
After 5 June 2014, the Energy Efficiency Directive requires that industrial players, in case of refurbishment of industrial installations generating waste heat at a useful temperature level with a total thermal input >20 MW, carry out a cost-benefit analysis to assess the option of introducing co-generation in heating. This provision can generate additional direct costs. What follows is an assessment of these substantive compliance costs generated by the requirement for cost-benefit analysis.

Responding glass manufacturers were asked whether they had done any refurbishments of their industrial installations generating waste heat (at a useful temperature level with a total thermal input >20 MW) in 2015. One of the respondents reported to have done refurbishments fitting the description of the Energy Efficiency Directive in 2015.

Due to confidentiality reasons, no further assessment of costs generated by the cost-benefit analysis to the packaging glass subsector can be shown.

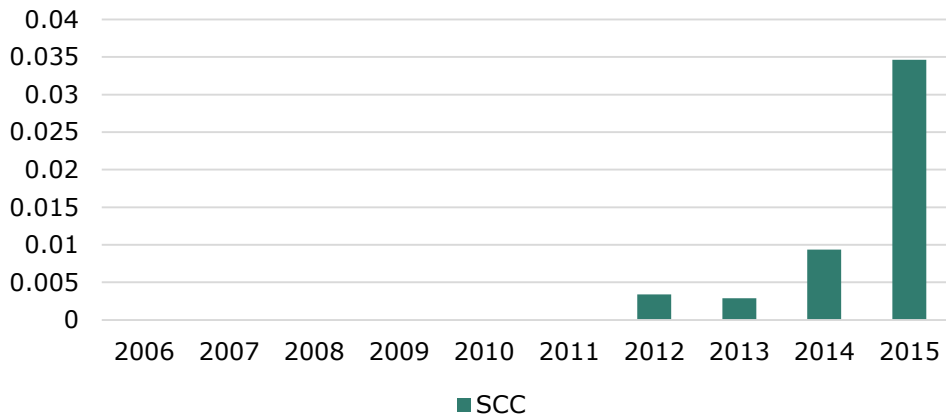
As the requirement for cost-benefit analysis entered into force only on June 2014, it is likely that costs will be incurred in the future.

Figure 54. Packaging glass: Cumulative regulatory costs of energy efficiency legislation 2006-15 for the CEE, NWE and SE regions (€/tonne of production)



Source: Authors' own elaboration.

Figure 55. Packaging glass: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 36. Packaging glass: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)

		Regions			EU
		NEW	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0.03	0.01	0.06	0.03
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		0.03	0.01	0.06	0.03

Source: Authors' own elaboration.

6.6.4 Cost assessment – Glass tableware

Sample

A short overview of the number of questionnaires received can be found below in Table 37. In total the sample covers five respondents from the glass tableware subsector.

Table 37. Glass tableware: Total number of questionnaires received and used in the Chapter

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Glass tableware	5	5

Source: Authors' own elaboration.

Direct regulatory costs

This section addresses **substantive compliance costs generated by the Energy Efficiency Directive.**

Substantive compliance costs

Energy audit

The Energy Efficiency Directive can generate substantive compliance costs for the glass tableware subsector due to the obligatory energy audit which has been in place since 2012.

To assess the indirect costs generated by the directive, respondents from the glass tableware subsector were asked about the costs of hiring external auditors and about the amount of time their employees¹⁰⁵ spent to prepare the audit and accompany the auditors in the plant. As there were no SMEs among respondents, all respondents were included in this sample. Note that the glass tableware sample is limited to five plants and therefore no solid conclusions can be drawn.

Out of five glass tableware manufacturers, one plant reported having passed an energy audit during 2012-15. Due to confidentiality reasons, no further assessment of costs generated by the energy audit to the glass tableware can be shown.

Table 38. Glass tableware: Number of plants that have carried out the energy efficiency audit 2012-15

	Number of responding plants
	Total EU
Energy efficiency audit carried out	1
Energy efficiency audit not carried out	4

Source: Authors' own elaboration.

Cost-benefit analysis

After 5 June 2014, the Energy Efficiency Directive requires that industrial players, in case of refurbishment of industrial installations generating waste heat at a useful temperature level with a total thermal input >20 MW, carry out a cost-benefit analysis to assess the option of introducing co-generation in heating. This provision can generate additional direct costs. What follows is an assessment of these substantive compliance costs generated by the requirement for cost-benefit analysis.

Responding glass manufacturers were asked whether they had done any refurbishments to their industrial installations generating waste heat (at a useful temperature level with a total thermal input >20 MW) in 2015. None of the respondents reported having done refurbishments fitting the description of the Energy Efficiency Directive in 2015.

Consequently, no plant reported to have carried out a cost-benefit analysis to assess the option of introducing co-generation in heating. **Therefore, this requirement is likely not to have generated any direct costs.** As this requirement, however, entered into force only on June 2014, it is likely that costs will be incurred in the future.

Due to confidentiality reasons, no further assessment of costs generated by the energy audit to the glass tableware can be shown.

¹⁰⁵ Ibid.

6.6.5 Cost assessment – Flat glass

Sample

A short overview of the number of questionnaires received can be found below in Table 39. In total the sample covers 15 respondents from the flat glass sector. More than three plants from each geographical region provided data enabling the Research Team to present regional cost assessments in the flat glass sector.

Table 39. Flat glass: Total number of questionnaires received and used in the Chapter

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Flat glass	15	5	5	5	15

Source: Authors' own elaboration.

Direct regulatory costs

This section addresses **substantive compliance costs generated by the Energy Efficiency Directive.**

Energy audit

The Energy Efficiency Directive can generate substantive compliance costs for the flat glass sector due to the obligatory energy audit that has been in place since 2012.

To assess the indirect costs generated by the Directive, respondents from the flat glass sector were asked about the costs of hiring external auditors and about the amount of time their employees¹⁰⁶ spent to prepare the audit and accompany the auditors in the plant. As there were no SMEs among respondents, all respondents were included in this sample.

Out of 15 flat glass manufacturers, 10 report having passed an energy audit 2012-15. Four of the plants that carried out audits during 2012-15 reported having undergone an audit already prior to 2012. These audits are not taken into account in the cost assessment as they were passed prior to the EU obligation, put in place in 2012.

¹⁰⁶ Ibid.

Table 40. Flat glass: Number of plants that have carried out the energy efficiency audit 2012-15

	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	10	4	3	3
Energy efficiency audit not carried out	5	1	2	2

Source: Authors' own elaboration.

The weighted average costs incurred at EU level were at €0.02/tonne of production.

In most cases when a plant carried out an energy audit, employees of the plants took part in preparing the audit, or in case of an external audit, accompanied auditors in the plant. This time spent by employees is counted as part of the cost of the audit. The time that respondents reported their employees had spent in preparing the audit varies from **three working days to up to 50 working days**. Plants have reported that carrying the energy audit in a facility with high production capacity is more labour-intensive than an audit in a smaller plant. Therefore, differences in plant sizes may explain the variation on the amount of days employees spent preparing the audit. As labour costs vary from one Member State to another, the cost impact measured in the amount of working days varies.

However, five responding plants reported no energy efficiency audits during the first compliance period of 2012–15. As the legislation entered into force in 2012, it is possible that the indirect cost generated by the Energy Efficiency Directive can increase in the future.

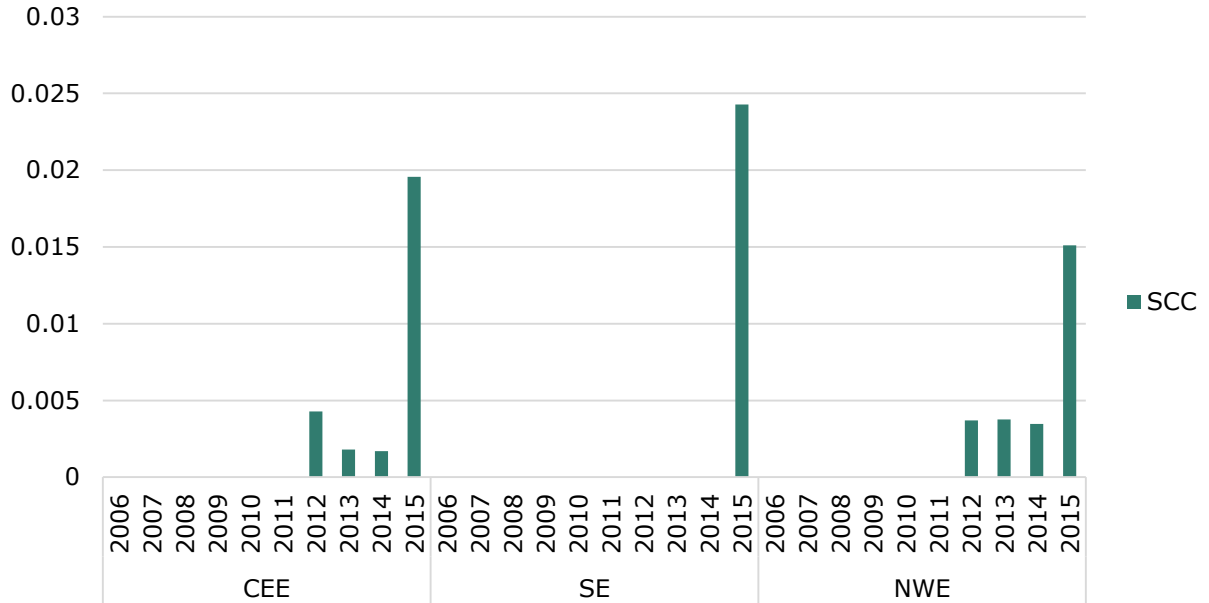
Cost-benefit analysis

After 5 June 2014, the Energy Efficiency Directive requires that industrial players, in case of refurbishment of industrial installations generating waste heat at a useful temperature level with a total thermal input >20 MW, carry out a cost-benefit analysis to assess the option of introducing co-generation in heating. This provision can generate additional direct costs. What follows is an assessment of these substantive compliance costs generated by the requirement for cost-benefit analysis.

Responding glass manufacturers were asked whether they had done any refurbishments to their industrial installations generating waste heat (at a useful temperature level with a total thermal input >20 MW) in 2015. None of the respondents reported having done refurbishments fitting the description of the Energy Efficiency Directive in 2015.

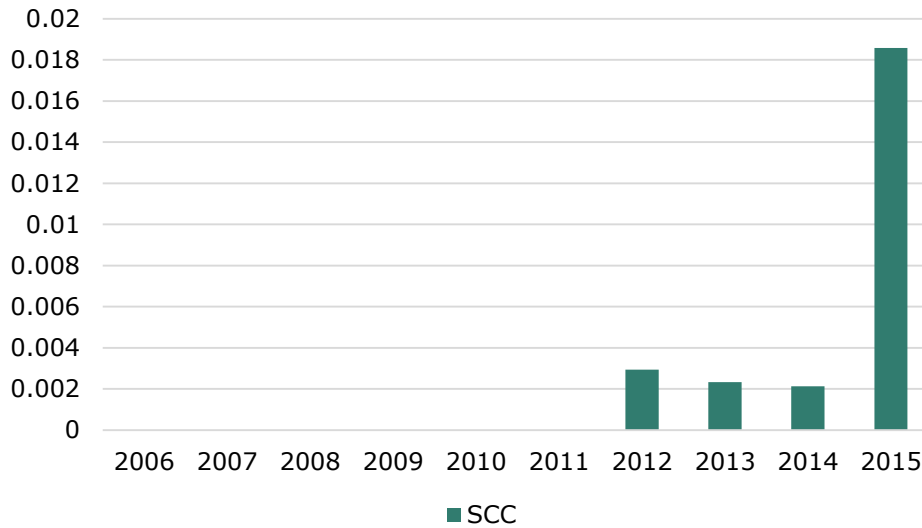
Consequently, no plant reported having carried out a cost-benefit analysis to assess the option of introducing co-generation in heating. **Therefore, this requirement is likely not to have generated any direct costs.** As this requirement, however, entered into force only on June 2014, it is likely that cost will be incurred in the future.

Figure 56. Flat glass: Cumulative regulatory costs of energy efficiency legislation 2006-15, CEE, SE and NWE regions (€/tonne of production)



Source: Authors' own elaboration.

Figure 57. Flat glass: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)



Source: Authors' own elaboration.

Table 41. Flat glass: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0.02	0.02	0.02	0.02
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		0.02	0.02	0.02	0.02

Source: Authors' own elaboration.

7 Climate legislation

The present Chapter focuses on **the impacts on the glass industry of four different acts**:

- Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance (also known as the EU ETS Directive);
- Commission Regulation No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council;
- Commission Regulation No 601/2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council;
- Commission Decision determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (2011/278/EU).

All the acts listed above are regarded at the same time below, as they are intrinsically linked. In fact, the EU ETS Directive is the main EU climate change legislation for the glass industry; the other acts are to be seen as implementing legislation. Further details on the EU ETS Directive and the other acts can be found in what follows.

7.1 Description of the Acts

The **European Union Emissions Trading Scheme (EU ETS) Directive** (Directive 2003/87/EC) established a **cap-and-trade system (starting in 2005) as a cost-effective tool to reach the greenhouse gas (GHG) targets** the EU had committed to. The EU ETS was expanded to the non-EU members of the European Economic Area – Lichtenstein, Norway and Iceland – in 2007.

EU ETS compliance is managed at the installation level. More than 11,000 installations in the manufacturing and power generation sector as well as aviation within the borders of the EU and EEA are covered by the scheme. Though the emissions of several gasses are covered by the scheme, the large majority is carbon dioxide (CO₂), and therefore all gasses are converted into CO₂ equivalent units according to their warming potential (known as CO₂e). To simplify matters, the present Study will use the terms 'carbon' and 'emissions' to address all GHG emissions under the EU ETS.

The total cap for emissions is equal to the total amount of European Union Allowances (EUAs) made available each year through free allocation or auctioning. Under that cap, market participants, including covered installations, are free to trade allowances. This is meant to maintain the cost-effectiveness of emissions reductions by ensuring that the cheapest reductions will be undertaken first. The EU ETS is based on the principle that operators of industrial and power installations covered by the EU ETS Directive and subsequent amendments surrender allowances to cover their emissions. Each year, each installation must surrender a number of emission permits equal to its carbon emissions during the past year. This policy thereby **seeks to put a price on carbon with a view to reducing GHG emissions**. The total cap of the EU ETS is set to decrease every year by a linear reduction factor of 1.74%.

The EU ETS is now in its third phase, and the scope of this Cumulative Cost Assessment extends to all three phases. Below is a brief summary of some of the main differences between the three phases.

7.2 Phase 1 (2005-07)

During the first phase, which was a pilot phase, caps were set at the national level through the National Allocation Plans (NAPs), which had to be approved by the European Commission. A maximum of 5% of the allowances could be auctioned; the rest was allocated free of charge on the basis of estimates of historical emissions (so-called 'grandfathering'). Due to a lack of good quality data and no banking provisions between phases, this resulted in a sizable over-supply of EUAs, driving prices close to zero at the end of the phase.

Although a pilot phase, Phase 1 resulted in significant outcomes. A price for carbon was established. It helped create the necessary infrastructure for future phases: at the installation level this included monitoring, reporting and verification (MRV); while in the marketplace National Registries, the Community Independent Transaction Log and carbon exchanges were founded.

7.3 Phase 2 (2008-12)

In Phase 2, allocation was granted on the basis of the reported emissions in the first phase. This process of grandfathering was considered fit to solve the problem of over-supply observed in Phase 1. However, the economic crisis had a clear impact and substantially decreased emissions in Phase 2. The European Commission estimates that between 1.5 and 2 billion EUAs were carried over to Phase 3.¹⁰⁷ The amount of allowances that could be auctioned was also increased, to a maximum of 10% of the total.

7.4 Phase 3 (2013-20)

Major amendments for Phase 3 include the **Phase 3 Directive** (Directive 2009/29/EC), determining the expansion of the EU ETS to new sectors and gases, and procedural improvements made **through the Benchmarking Decision** (Commission Decision 2011/278/EU), setting out harmonised rules for free allocation.

The EU ETS is now in its third phase. The major characteristic of the functioning of the ETS in this phase is an increase in auctioning of allowances – more than 40% of all allowances will be auctioned (including full auctioning for the power sector). Energy-intensive industries, however, continue to receive a large part of their needed allowances for free, and will have to buy any shortfall on the market (as was the case during Phases 1 and 2).

Allocation to energy-intensive industries is largely determined by using benchmarks, established per product, according to the Benchmarking Decision. In general, the average carbon-intensity of the top 10% (as measured by their emissions performance) of installations represents the benchmark for allocating free emissions. Every installations producing the same product has the same benchmark, and receives the same amount of free allocation per produced unit. Installations that are more emission-intensive than the benchmark thus receive a smaller percentage of free allowances relative to their total emissions than less emission-intensive installations. The former are thereby incentivised to catch up to their best-performing peers. This approach also rewards early action by industry towards reducing emissions.

The benchmarks are determined as the number of allowances received per tonne of production at the installation. However, the level of production at an installation is based on historical levels: the median production during the period from 1 January 2005 to 31 December 2008, or, where it is higher, the median production during the period from 1 January 2009 to 31 December 2010. Changes in production are currently only taken into account if production is scaled back to less than 50% of the historical level. Production

¹⁰⁷ European Commission (2012), "The state of the European carbon market in 2012", COM (2012)652.

increases beyond historical levels (and thus emission increases) are not taken into account during free allocation of allowances. However, allocation can be increased in case of investments to increase production capacity.

Sectors that are deemed to be at risk of carbon leakage, and which are listed in the **Carbon Leakage List** (Commission Decision 2010/2/EU), receive for free 100% of the allocation determined based on the benchmarks and production levels. The list was updated in 2014 and is valid for the period 2015-19. Sectors not on the list receive 80% of the calculated allocation for free in 2013, a share that annually decreases up to 30% in 2020. The various glass sectors included in the TOR for this Study are all on the carbon leakage list.

Monitoring, Reporting and Verification (MRV) obligations are defined in Commission Regulations No 600/2012 and No 601/2012. All installations and aircraft operators under the ETS need to have an approved plan for monitoring and reporting emissions. The operators must report annual emissions data, which must be verified by an accredited verifier. Once the reported emissions are verified, the installation surrenders allowances in order to comply with the EU ETS.

As explained above, the EU ETS has been amended various times since its inception, and major amendments are expected the coming years, such as the inclusion of the Market Stability Reserve and the results of the ongoing revision.

7.5 Categories of regulatory costs

The EU ETS generates three types of regulatory costs: direct (both substantive compliance costs and administrative burdens and indirect. If a plant is covered by the EU ETS, the ETS generates a **direct cost** that is linked to the surrender of EUAs to cover GHG emissions. The direct costs for an installation are directly related to (a) the emission-intensity of the plant and (b) the number of EUAs that the plant receives for free. In the context of this Study, the direct costs are to be defined as substantive compliance costs, and not as direct charges.

It is important to note that the EU ETS is meant to generate costs for installations that emit GHGs in order to change behaviour, incentivise different production technologies and make sure GHG emissions receive attention both in board rooms and in production process decisions. In this aspect climate change is a rather unique area of legislation.

Each production plant based in the EU (whether covered by the EU ETS or not) faces **indirect costs** as electricity producing installations pass on the costs of EUAs they have bought to their customers, in the form of higher electricity bills. Indirect costs are therefore directly related to the electricity-intensity of a plant. In a limited number of Member States, operators in electricity-intensive sectors can receive financial compensation for indirect costs (following state aid guidelines). No plants in the glass samples indicated that they received indirect cost compensation.

In addition, two kinds of **administrative burdens** can be identified under the EU ETS: one-off costs for the start-up of the process, and recurring costs, mostly related to the MRV process and the yearly compliance procedures. The start-up costs are generated by the investments necessary for monitoring compliance. For illustrative purposes, the infrastructure needed for the correct calculation of emissions would represent a one-off start-up cost.¹⁰⁸ MRV costs are the additional burdens placed on installations for continued compliance with monitoring duties, for example the wages of the staff dealing with the administrative aspects, or the cost of hiring a verifier. Administrative burdens are incurred internally, through staff time, or externally by retaining help and advice, in some cases mandatory, such as verifying activities. Administrative burdens are only relevant for plants covered by the EU ETS. Previous CCAs by CEPS in the steel and aluminium industries have shown that administrative burdens are minor, compared to the direct and indirect costs.

¹⁰⁸ Detailed Information Obligations are spelled out in the Commission Regulation (EU) No 601/2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC.

In addition, it proved complex and laborious to collect data on start-up costs for the entire sample, especially as these costs can be considered minor; many plants have been in the EU ETS since 2005 (beyond the scope of this project) and a large share of plants in the glass sectors indicated that instead of buying equipment for MRV, they rented it yearly from external verification companies. Therefore, the one-off start-up costs were not included in this assessment. If companies hired equipment on an annual basis for checks, it was included in the recurring administrative costs.

7.6 Methodological aspects

This section starts with an analysis of the model used for calculating the regulatory costs of the EU ETS. A description of the data, its sources and issues related to data availability is also included. The results of the assessment are presented in the final part of the Chapter for each of the subsectors under analysis.

It is difficult to pinpoint a typical year for the EU ETS in the time horizon covered by the Study. The rules for the EU ETS changed significantly twice in the period under analysis (2008 and 2012), while free allocation of EUAs to installations in most cases started decreasing significantly from 2013 onwards. Additionally, EUA prices were not stable, leading to very different impacts even in years without changes to the EU ETS functioning or free allocation rules. The year 2015 has been chosen as a 'typical' year, as it is the most representative of the current functioning, and, though this exercise is not forward looking, how the costs related to the EU ETS might evolve in the future.

Note that regulatory costs incurred in the past might not be a good proxy for future costs. The EU ETS is a system that is undergoing changes, and the main cost alleviation mechanism for the glass sectors (free allocation for sectors on the carbon leakage list) is being reviewed and could change significantly in the coming years.

7.6.1 Data validation

In the area of climate change many sources of data are used, however, only two sources of data are not public Commission sources but come from plant questionnaires: production output and electricity consumption. The validation of this data is discussed in depth in previous Chapters.

Data validation was also used to identify accounts linked to plants in the sample in the EU Transaction Log (the registry for emission and allocation data from all EU ETS installations). Companies were asked to provide the details of accounts linked to their installation, and the research team used the EU TL to assess whether other accounts are also linked to those installations.

7.6.2 Model

The ultimate objective of this Study is to provide one figure: the cost of the EU ETS per tonne of product.

The model for the cost of EU ETS is defined as:

$$\begin{aligned} \text{Total ETS Cost (€/Tonne of product)} &= \text{Substantive compliance cost (€/Tonne)} \\ &+ \text{Indirect cost (€/Tonne)} \\ &+ \text{Administrative burden (€/Tonne)} \end{aligned}$$

As mentioned before, no direct charges were identified. Substantive compliance costs and administrative burdens are the only considered direct costs throughout this section.

7.6.3 Substantive compliance costs

$$\begin{aligned} \text{Substantive compliance costs (€)} &= \text{Emissions (tonnes of CO}_2\text{)} \\ &- \text{Allocations (tonnes of CO}_2\text{)} \\ &* \text{CO}_2\text{Price (€/tonne of CO}_2\text{)} \end{aligned}$$

Where:

- Emissions are the verified emissions of the installation.
- Allocations are the EUAs freely allocated to the installation.
- CO₂Price is the average yearly market price of CO₂.

The sources we use for this calculation are:

- Emissions: National Allocation Plans (NAPs), National Registries and the EU Transaction Log.
- Allocations: NAPs, National Registries and the EU Transaction Log.
- CO₂Price:
 - o Yearly averages of the daily settlement prices for EUA Dec Future contracts for delivery in that year. The daily settlement prices were reported by the European Energy Exchange.¹⁰⁹

Table 42. Average yearly prices per tonne of CO₂ (euros)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CO ₂ Price	18.62	0.74	23.03	13.31	14.48	13.77	7.56	4.50	5.92	7.61

Source: Authors' own elaboration on European Energy Exchange.

- Total production (tonnes of product): this data is necessary for converting the price per installation into a price per tonne of product. These figures were made available by companies, and were included in the questionnaires received.

This results in an estimate of substantive compliance costs. In order to have a more exact calculation of EU ETS substantive compliance costs it would be necessary to analyse all trades in EUAs by plants under consideration. However, the data for this analysis is currently not available and is considered too sensitive for plants to share.

7.6.4 Indirect costs

$$\begin{aligned} \text{Indirect cost (€/tonne of product)} &= \text{Purchased electricity (kWh/tonne of product)} \\ &* \text{Carbon intensity of electricity (CO}_2\text{/kWh)} \\ &* \text{CO}_2\text{Price (€/tonne of CO}_2\text{)} \\ &* \text{Pass-on rate} \end{aligned}$$

Where:

- Purchased electricity: the amount of electricity to produce one tonne of product. This amount is plant and technology specific.

¹⁰⁹ This CO₂ price variable is a proxy and might result in imperfect results. To fully validate EUAs, a plant by plant analysis of transfers and trading strategies would be necessary.

- Carbon intensity of electricity generation indicates the number of tonnes of CO₂ emitted by utilities to generate one kWh.
- CO₂Price is the average yearly market price of CO₂.
- Pass-on rate: the proportion of direct costs incurred by utilities (disregarding any mitigating effects from free allocation) that they pass on to electricity consumers. For this Study two pass-on rates are used: 0.6 and 1.

Sources:

- Purchased electricity: these figures were made available by companies via the questionnaire.
- Carbon intensity of electricity generation: the maximum regional carbon intensity of electricity is utilised, provided by the Commission's Guidelines on State Aid Measures.¹¹⁰ Note that these figures are not national. Member States that are highly interconnected or have electricity prices with very low divergences are regarded as being part of a wider electricity market and are deemed to have the same maximum intensity of generation (for example, Spain and Portugal). It must be noted that the maximum regional carbon intensity of electricity generation is much higher for certain jurisdictions than the national average intensity, e.g. for France it is nine times higher. Additionally, these figures have not been updated since they were published in 2012 and do not take into account the significant gains in renewable and low-carbon electricity generation since then. This means that indirect costs are likely to be overestimated when using these regional carbon intensities of electricity generation.
- CO₂Price: the same data is utilised as in the previous section to create a yearly average price.

7.6.5 Administrative burdens

$$\text{Administrative burden (€/tonne of product)} = \text{Start-up costs (€/tonne of product)} + \text{MRV costs (€/tonne of product)}$$

Where:

- Start-up costs are the initial costs linked to entering the EU ETS. Such costs include obtaining and installing monitoring equipment.
- MRV costs are the yearly extra cost for an installation when it comes to monitoring, reporting and verification obligation in the EU ETS.

Source:

- All data for administrative sources was obtained through the questionnaire. It must be noted that start-up costs were incurred by plants before the start of the period that this Study analyses. Most installations were covered from the first year of the EU ETS (2005), while this Study analyses regulatory costs over the 2006-15 period.

¹¹⁰ Communication from the Commission (2012), Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04).

Additionally, it proved difficult for plants to provide numbers on start-up costs: many used equipment from external reviewers to monitor emissions and, therefore, costs that would be seen as start-up costs were considered recurring administrative burdens.

As the effort required to report yearly MRV costs (both internally in terms of hours invested and externally through external consultants) via the questionnaire was deemed excessive, plants were requested to report administrative burdens for 2015. The research team understands that these costs have changed somewhat, but not significantly, since 2006. Therefore, administrative burdens reported below are relatively constant, and are correlated directly with production output.

Administrative burdens that are labour-related were monetised using the hourly rates in the various Member States as provided by SecGen (see Part A above). When companies mentioned the position of employees working on MRV, these positions were used. In all other cases the employees were considered ISCO 3 level employees, i.e. technicians and associate professions. Interviews with stakeholders indicated that the MRV requirements for installations are usually fulfilled by technical officers. A small number of questionnaires indicated that managers and directors are involved, but this involvement is very limited in time.

7.7 Cost assessment – Packaging glass

7.7.1 Sample

The sample in this section is the same as in other areas of legislation, and has been discussed in depth in earlier Chapters (see Part A). Relevant for this Chapter on climate change is that the EU ETS covered all plants in this sample for all years.

7.7.2 Direct regulatory costs

Two types of direct regulatory costs are relevant for packaging glass plants:

- substantive compliance costs linked to the buying and selling of EUAs to cover emissions beyond free allocation;
- administrative burdens related to monitoring, reporting and verification of allowances, and the yearly procedures related to installation-level compliance.

Substantive compliance costs

Substantive compliance costs varied significantly between plants and years, and are negative for exactly 50% of all observations in this subsector. This means that many plants were over-allocated EUAs for at least one year, and therefore could have sold surplus EUAs on the market.

For one plant this over-allocation was so large that potential revenues were –€10.08/tonne for one year of the period. **The EU simple average of all plants and for all years for substantive compliance costs was –€0.20/tonne.**

Regional averages of substantive compliance costs are very different across regions, and show different trends. In CEE, substantive compliance costs started very low (–€3.33/tonne in 2006), which steadily increased to €0.45/tonne in 2015. The trend is defined by the new free allocation rules implemented in 2013, which reduced over-allocation and made substantive compliance costs positive for the CEE average starting in 2013. In SE substantive compliance costs started negative as well, at –€0.38/tonne. However, this decreased steadily by 2008, reaching –€1.73/tonne. Also in this region

Phase 3 allocation rules changed the trend, and caused substantive compliance costs to be positive from 2013 onwards (in 2015 it reached €0.88/tonne). In NWE, substantive compliance costs were positive for most years, only becoming negative between 2009 and 2012. In 2015 they stood at €0.82/tonne.

On the regional level we can therefore conclude that substantive compliance costs were negative for most regions and years, **but that from 2013 to 2015 each regional average was positive.**

Administrative burdens

As indicated above, administrative burdens are consistent across years and plants, as most installations reported MRV costs only for a typical year. The administrative burdens in CEE and SE were relatively stable at around €0.03/tonne across the entire period. In NWE it was slightly lower for the entire period at around €0.025/tonne.

7.7.3 Indirect regulatory costs

Indirect costs are the most relevant costs for the packaging glass plants in this sample over this period. As noted before, the methodology used here will likely lead to an overestimation of indirect costs as the carbon intensities of electricity generation could potentially be overstated in several Member States.

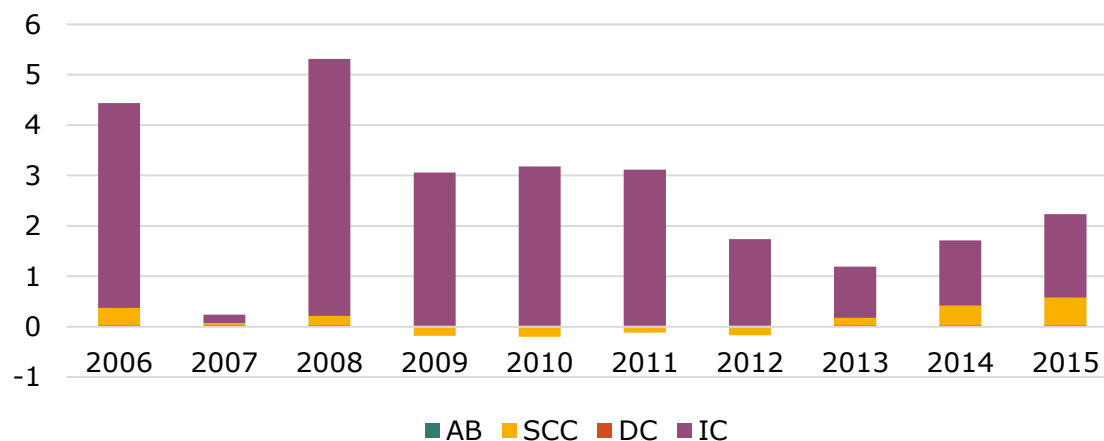
Two pass-on rates for indirect costs passed through by electricity providers to consumers were used in the analysis: 0.6 and 1. Of course, this had a direct impact on the results. When using a pass-on rate of 0.6, indirect costs vary between €0.05/tonne and €5.12/tonne, with an EU average of €1.50/tonne over the period. When using a pass-on rate of 1, indirect costs vary between €0.09/tonne and €8.53/tonne, **with an EU average of €2.51/tonne of hollow glass over the period.**

There are three main determinants for the indirect cost (beyond pass-on rates):

- Carbon intensity of electricity generation: in the case of this sample of packaging glass producers there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production: the packaging glass subsector is characterised by relatively high electricity purchases: the average of the sample is 0.31 MWh/tonne of product. However, there are large differences between installations: the most electricity efficient consume 0.14 MWh/tonne and the least electricity efficient consume 0.47 MWh/tonne. A more detailed analysis on this issue can be found in the energy Chapter of this Study.
- EUA prices: the prices of EUAs are one of the major factors in the estimation of indirect costs. Unsurprisingly, the year with lowest EUA prices (2007: €0.74, just 3% of EUA price in 2008) had by far the lowest indirect costs, while the years with the highest EUA prices (2006 and 2008) had high indirect costs.

7.7.4 Cumulative regulatory costs

Figure 58. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, EU weighted average (€/tonne – indirect cost pass-on rate 1), packaging glass subsector.



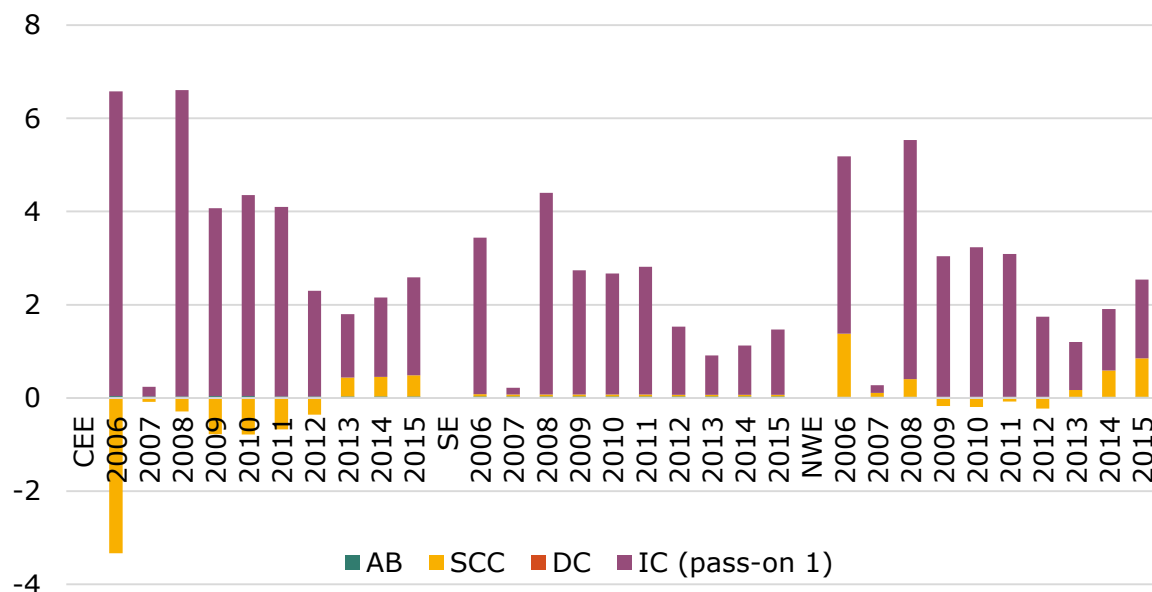
Source: Authors' own elaboration.

Figure 58 clearly indicates that direct charges are non-existent and administrative burdens are not significant. Substantive compliance costs are also not significant for most years when compared to indirect costs.

Substantive compliance costs were negative for a number of years, but were positive between 2006 and 2008, and from 2013 onwards. **They ended up at €0.55/tonne in 2015.** This evolution is due to three factors: evolution of EUA prices, reforms in the free allocation rules for Phase 3 of the EU ETS, and the impact of the economic crisis between 2009 and 2012.

Indirect costs are far more significant for installations, and the changes over time are mostly due to the evolution of EUA prices. The low prices in 2007 at the end of Phase 1 resulted in very low indirect costs, which rebounded together with the EUA price. The decline of EUA prices between 2008 and 2013 saw indirect costs decrease from €5.10/tonne in the EU in 2008 to around €1.02/tonne in 2013. Subsequently, the slowly rising EUA prices resulted in moderate increases in indirect costs. **In 2015 indirect costs with pass-on rate 1 were an estimated €1.66/tonne** (pass-on rate 0.6: €1/tonne).

Figure 59. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, regional weighted averages (€/tonne – indirect cost pass-on rate 1), packaging glass subsector



Source: Authors' own elaboration.

There were significant differences between regions, as can be observed in Figure 59 above. Substantive compliance costs were substantially lower in CEE up to 2012 than in NWE. In SE on the other hand, substantive compliance costs remained low and stable throughout the period, fluctuating around €0.37/tonne.

Indirect costs were more significant for all regions over the period, and show a very comparable trend: decreasing between 2008 and 2013 as EUA prices tumbled, and then rebounding slowly as EUA prices picked up again.

Administrative burdens were stable in all regions: between €0.025 (NWE) and €0.035/tonne (SE and CEE) for the entire period.

Table 43 shows the EU ETS related regulatory costs for 2015 as regional and weighted EU averages. As mentioned before, it is difficult to pinpoint a typical year for the EU ETS in this period due to significant changes in both the legislation and the EUA prices. The year 2015 has been chosen as a 'typical' year, as it is the most representative of the current functioning, and, though this exercise is not forward-looking, how the costs related to the EU ETS will evolve in the future.

On the EU level, administrative burdens were indeed not high (€0.03/tonne), while substantive compliance obligations (€0.55/tonne) were more significant. Indirect costs (€1 or €1.66/tonne depending on the pass-on rate) were the most relevant EU ETS related cost for EU packaging glass installations.

On the regional level some clear differences emerge. Substantive compliance costs were very low in SE when compared to CEE and especially NWE. This difference was due to plants receiving relatively more free allocation in SE and thereby not needing to buy as many additional EUAs. Indirect costs were highest in CEE as carbon intensity of electricity generation is substantially higher in the countries in that region than in most other countries in the EU.

Overall EU ETS related costs were substantive: €2.24/tonne in 2015. Indirect costs were responsible for nearly 75% of that amount.

Table 43. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, packaging glass subsector

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.03	0.03	0.03	0.03
	Substantive compliance costs	0.82	€0.46	0.04	0.55
	Direct charges	0	0	0	0
Indirect regulatory costs	Pass-on: 0.6	1.02	1.26	0.84	1.00
	Pass-on: 1	1.69	2.10	1.40	1.66
Total regulatory costs (pass-on rate 1)		€2.54	€2.59	€1.47	€2.24

Source: Authors' own elaboration.

7.8 Cost assessment – Glass tableware

7.8.1 Sample

The sample in this section is the same as in other areas of legislation, and has been discussed in depth in earlier Chapters (Part A). Relevant for this Chapter on climate change is that two out of the five plants in this sample were not covered by the EU ETS in the first year of the period (2006).

All plants are included for the entire analysis, as the aim of this Study is to quantify average regulatory costs for samples in the industry, independent of which areas of legislation are directly impacting them. These two plants did not face substantive compliance costs or administrative burdens in the years that they were not covered, but did face indirect costs throughout the period studied.

7.8.2 Direct regulatory costs

Two types of direct regulatory costs are relevant for refractories plants:

- substantive compliance costs linked to the buying and selling of EUAs to cover emissions beyond free allocation;
- administrative burdens related to monitoring, reporting and verification of allowances, and the yearly procedures related to installation-level compliance.

Substantive compliance costs

Substantive compliance costs varied significantly between plants, regions and years, were negative for 60% of the observations. This means that plants were overallocated EUA, and therefore could have sold surplus EUAs on the market. For one plant this overallocation was so large that potential revenues were –€12.95/tonne for one specific year. However, one plant faced very large underallocation (beyond what other plants in other subsectors observed) and potential substantive compliance costs of €17.67/tonne in one specific year. The same plant was, however, also substantially overallocated in other years. Overallocation remained an issue over the entire period for most plants in the sample.

Administrative burdens

As indicated above, administrative burdens were mostly consistent across years within plants as most installations reported MRV costs only for a typical year. **EU weighted averages was €0.07 in 2015.**

7.8.3 Indirect regulatory costs

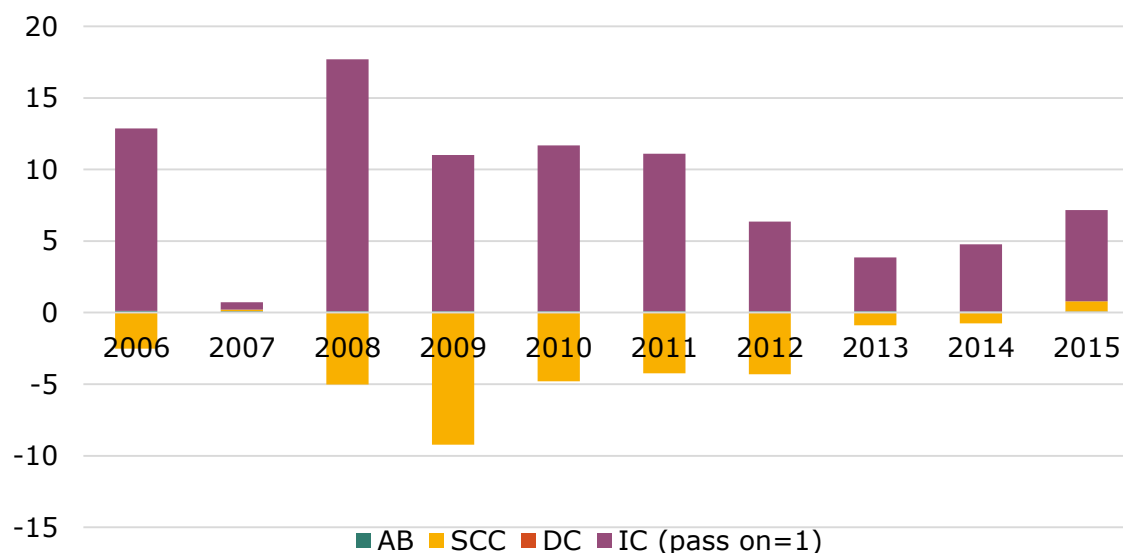
Indirect costs are the most relevant costs for the glass tableware plants in this sample over this period. As noted before, the methodology used here will likely lead to an overestimation of indirect costs as the carbon intensities of electricity generation could potentially be overstated in several Member States.

Two pass-on rates for indirect costs passed through by electricity providers to consumers were used in the analysis: 0.6 and 1. Of course, this had a direct impact on the results. When using a pass-on rate of 0.6, indirect costs vary between €0.13/tonne and €17.02/tonne, with an EU average of €5.02/tonne over the entire period. When using a pass-on rate of 1, indirect costs vary between €0.22/tonne and €28.34/tonne, **with an EU average of €8.36/tonne of glass tableware over the entire period.** There are three main determinants for the indirect cost (beyond pass-on rates):

- Carbon intensity of electricity generation: in the case of this sample of glass tableware producers there was a large difference in carbon intensity of electricity generation. The more carbon intensive Member States have higher estimated indirect costs.
- Purchased electricity intensity of production: the glass tableware subsector is characterised by a relatively high electricity purchases: the average of the sample was 0.95 MWh/tonne of product. However, there were large differences between installations, with the most electricity efficient consuming 0.25 MWh/tonne and the least electricity efficient consuming 1.81 MWh/tonne. These large differences are explained by the different products made by the various glass tableware plants.
- EUA prices: the prices of EUAs are one of the major factors in the estimation of indirect costs. Unsurprisingly, the year with lowest EUA prices (2007: €0.74, just 3% of the price in 2008) had by far the lowest indirect costs, while the years with the highest EUA prices (2006 and 2008) had high indirect costs.

7.8.4 Cumulative regulatory costs

Figure 60. Yearly overview of regulatory costs generated by the EU ETS. EU weighted average (€/tonne – indirect cost pass-on rate 1), glass tableware subsector



Source: Authors' own elaboration.

Figure 60 clearly indicates that direct charges were non-existent and administrative burdens were not significant. On the other hand, substantive compliance costs and indirect costs were very relevant for glass tableware producers.

Substantive compliance costs were negative between 2008 and 2014, meaning that the sample was overallocated free allowances and could have sold those extra allowances. The reforms in the free allocation rules for Phase 3 of the EU ETS decreased the absolute number of overallocated allowances, but did not take care of the problem in its entirety: substantive compliance costs remained negative throughout the entire period.

Indirect costs were significant for installations, and the changes over time were mostly due to the evolution of EUA prices. The low prices in 2007 at the end of Phase 1 resulted in very low indirect costs, which rebounded with the EUA price. The decline of EUA prices between 2008 and 2013 saw indirect costs decrease from over €17.60/tonne in 2008 to €3.76/tonne in 2013. Since then, slowly rising EUA prices resulted in moderate increases in indirect costs. **In 2015 indirect costs with pass-on rate 1 were an estimated €6.37/tonne** (pass-on rate 0.6: €3.82/tonne).

Table 44 shows the EU ETS related regulatory costs for 2015. As mentioned before, it is difficult to pinpoint a typical year for the EU ETS in this period due to significant changes in both the legislation and the EUA prices. The year 2015 has been chosen as a 'typical' year, as it is the most representative of the current functioning, and, though this exercise is not forward-looking, how the costs related to the EU ETS will evolve in the future.

On the EU level, administrative burdens were indeed not high (€0.07/tonne), while substantive compliance obligations (€0.71/tonne) were more significant. Indirect costs (€3.82/tonne or €6.37/tonne depending on the pass-on rate) were the most relevant cost for sampled EU installations. **Total EU ETS related costs for sampled glass tableware plants were the highest of all glass sectors: €7.16/tonne of product.** This was

mainly caused by the high indirect costs, which were in its turn due to high electricity intensity of production of glass tableware.

Table 44. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, glass tableware subsector

		EU
Direct regulatory costs	Administrative burdens	0.07
	Substantive compliance costs	0.71
	Direct charges	0
Indirect regulatory costs	Pass-on: 0.6	3.82
	Pass-on: 1	6.37
Total regulatory costs (pass-on rate 1)		7.16

Source: Authors' own elaboration.

7.9 Cost assessment – Flat Glass

7.9.1 Sample

The sample in this section is the same as in other areas of legislation, and has been discussed in depth in earlier Chapters. Relevant for this Chapter on climate change is that three plants were not covered by the EU ETS for one or more years. Two of those entered the EU ETS starting 2007, one plant entered in 2008. All other plants were covered by the EU ETS for all years of interest for this Study.

All these plants are included for the entire analysis, as the aim of this Study is to quantify average regulatory costs for samples in the industry, independent of which areas of legislation are directly impacting them. These three plants did not face substantive compliance costs in the years that they were not covered but did face indirect costs throughout the period studied. A limited number of those plants indicated that they did face administrative burdens due to the necessity of monitoring emissions levels so to show that their emissions levels were lower than the thresholds set to be included in the EU ETS.

7.9.2 Direct regulatory costs

Two types of direct regulatory costs are relevant for flat glass plants:

- substantive compliance costs linked to the buying and selling of EUAs to cover emissions beyond free allocation;
- administrative burdens related to monitoring, reporting and verification of allowances, and the yearly procedures related to installation-level compliance.

Substantive compliance costs

Substantive compliance costs varied significantly between plants and years, and were negative for over 60% of all observations in this sector. This means that plants were overallocated EUAs, and therefore could have sold surplus EUAs on the market.

For one plant this overallocation was so large that potential substantive compliance costs were –€19.10/tonne for one specific year. The observations with very negative substantive compliance costs are also linked to years with significant drops in output such as the financial and economic crisis years of 2008 and 2009.

Regional averages conformed to an increasing trend. The CEE average increased from –€5.96/tonne in 2006 to –€0.16/tonne in 2015. SE averages started at €0.16/tonne but dropped substantially till 2008 (–€4.36/tonne) and then rebounded to –€1.78/tonne by 2009. Subsequently, substantive compliance costs in SE increased steadily to –€0.18/tonne by 2013. In 2014 and 2015 it was positive (reaching €0.40/tonne in 2015). In NWE it started at –€2.19/tonne and reached its minimum in 2010 (–€3.40/tonne). After 2010, its trend was unclear, reaching €1.45/tonne by 2014 but subsequently dropping to €0.45/tonne in 2015.

On the regional level we can therefore conclude that substantive compliance costs were relatively low in all three areas at the start of the period but ended substantially higher.

Administrative burdens

As indicated above, administrative burdens were consistent across years and plants as most installations reported MRV costs only for a typical year. However, there were large variations between plants. Several plants reported MRV costs of less than €0.01/tonne, while another plant reported MRV costs of over €1.58/tonne. That plant was dropped, as its verification costs were substantially higher than those for its peers.¹¹¹ The EU average over all plants and years was €0.06/tonne.

The difference in administrative burdens is related to differences in procedures and related costs between Member States, as well as differences in prices of external consultants that are commonly used by companies. Also smaller plants observe larger administrative burdens per tonne of product as fixed costs such as plant visits, laboratory expenses and fees for consultants are the same order of magnitude as for larger plants while production output is significantly lower. At the same time, smaller companies have less bargaining power when outsourcing MRV costs compared to companies with a large number of plants.

7.9.3 Indirect regulatory costs

Indirect costs were the most relevant costs for the flat glass plants in this sample over this period. As noted before, the methodology used here will likely lead to an

¹¹¹ Outliers for MRV costs are expected, as not all installations need to follow the same MRV rules. Some Member States are more stringent than others and require different MRV procedures. Installations with variable process emissions are in some Member States required to have third-party accredited laboratories sample and analyse the different materials and mixes used during each time period (time periods also vary widely between Member States). Installations that need regular analysis have high laboratory costs and therefore high MRV costs. These installations are considered outliers because they are not representative of the entire EU industry, and have therefore been left out of the analysis of administrative costs. Verifying which MRV procedures each installation has to fulfil in depth is considered outside the scope of this analysis, and too time-consuming given the tight deadlines.

overestimation of indirect costs as the carbon intensities of electricity generation could potentially be overstated in several Member States.

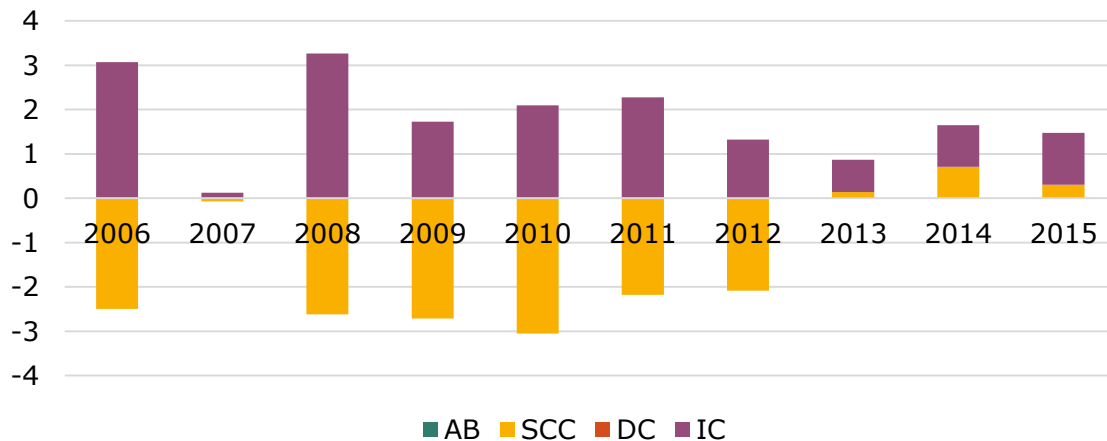
Two pass-on rates for indirect costs passed through by electricity providers to consumers were used in the analysis: 0.6 and 1. Of course, this had a direct impact on the results. When using a pass-on rate of 0.6, indirect costs vary between €0.03/tonne and €6.67/tonne, with an EU average of €1.12/tonne over the entire period. When using a pass-on rate of 1, indirect costs vary between €0.05 €/tonne and €11.12 €/tonne, **with an EU average of €1.87/tonne of flat glass over the entire period.**

There are three main determinants of indirect costs (beyond pass-on rates):

- Carbon intensity of electricity generation: in the case of this sample of flat glass producers there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production: the flat glass sector is characterised by a relatively low electricity purchases: the average of the sample was 0.21 MWh/tonne of product. However, there were large differences between installations, with the most electricity efficient plants consuming 0.07 MWh/tonne and the least electricity efficient plants consuming more than 0.76 MWh/tonne. A more detailed analysis on this issue can be found in the energy section of this Study.
- EUA prices: the prices of EUAs are one of the major factors in the estimation of indirect costs. Unsurprisingly, the year with lowest EUA prices (2007: €0.74, just 3% of the 2008 EUA price) had by far the lowest indirect costs, while the years with the highest EUA prices (2006 and 2008) had high indirect costs.

7.9.4 Cumulative regulatory costs

Figure 61. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, EU weighted average (€/tonne – indirect cost pass-on rate 1), flat glass sector



Source: Authors' own elaboration.

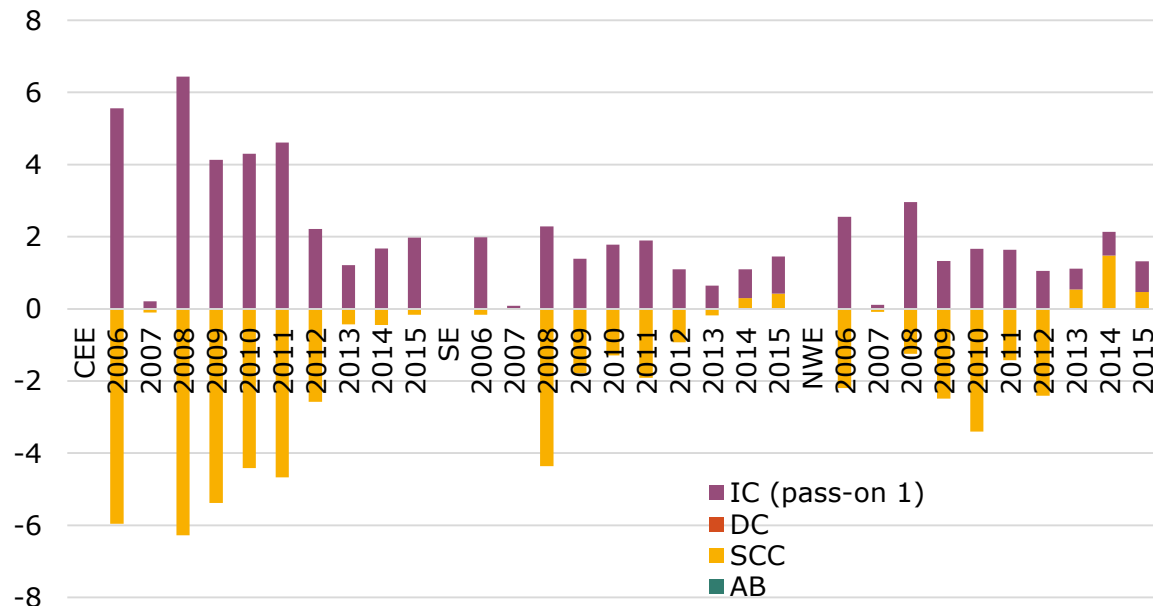
Figure 61 clearly indicates that direct charges were non-existent and administrative burdens were not significant. On the other hand, substantive compliance costs and indirect costs were very relevant for flat glass producers.

Substantive compliance costs were negative until the introduction of new free allocation rules in 2013. This means that up to that point the sample was overallocated free

allowances and could have sold those extra allowances. Starting in 2013 the overallocation had, however, decreased significantly, and potential substantive compliance costs turned positive. This evolution was due to two factors: evolution of EUA prices and reforms in the free allocation rules for Phase 3 of the EU ETS. In 2006 the EU average (weighted regionally) substantive compliance costs was –€2.50/tonne, which decreased to –€3.05/tonne by 2010, and since then increased significantly and **in 2015 stood at €0.29/tonne.**

Indirect costs are significant for installations, and the changes over time are mostly due to the evolution of EUA prices. The low prices in 2007 at the end of Phase 1 resulted in very low indirect costs, which rebounded together with the EUA price. The decline of EUA prices between 2008 and 2013 put downward pressure on indirect costs. On the other hand, lower production volumes in 2009 and 2010 led to higher electricity intensity of production and somewhat mitigated the downward pressure of dropping EUA prices on indirect costs. Indirect costs (pass-on rate 1) increased from €3.06/tonne in the EU in 2006 to €3.25/tonne in 2008. Indirect costs fell to €0.73 by 2013 due to tumbling EUA prices. Since 2013, slowly rising EUA prices resulted in moderate increases in indirect costs. **In 2015 indirect costs with pass-on rate 1 were an estimated €1.17/tonne (pass-on rate 0.6: €0.70/tonne).**

Figure 62. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, regional weighted averages (€/tonne – indirect cost pass-on rate 1), flat glass sector



Source: Authors' own elaboration.

At the regional level there were significant differences, as can be observed in Figure 62 above. Indirect costs in CEE were substantively higher than in NWE and SE. This was mostly due to higher carbon intensity of electricity generation in that region and higher electricity intensity of production in a number of CEE plants.

Substantive compliance costs were also substantially different in the three regions. While the trend was very comparable (low substantive compliance costs until 2013, then minor increases and close to zero – except for NWE in 2014), substantive compliance costs were very low in CEE up to 2013, and never became positive. They ended at –€0.16/tonne in 2015. In 2014, substantive compliance costs in NWE was very much an outlier, also when compared to other glass sectors. The significantly higher substantive compliance costs in

NWE in 2014 than in 2015 was due to one plant being undersupplied in 2014, which was compensated in 2015: allocation for this plant was more than twice as high in 2015 when compared to 2014. The impact of the Phase 3 allocation rules is clearly observed in all three regions as overallocation decreased sharply between 2012 and 2013.

Administrative burdens were stable in CEE: around €0.01/tonne. In SE however, decreasing production volumes influenced administrative burdens during the period. Administrative burdens in 2006 was also €0.01/tonne, but this increased to nearly €0.02/tonne in 2015. While not a large increase in absolute terms, in relative terms administrative burdens increased by around 60% over that period. In NWE it was stable at around €0.02/tonne for the entire period.

Table 45 shows the EU ETS related regulatory costs for 2015 as regional and weighted EU averages. As mentioned before, it is difficult to pinpoint a typical year for the EU ETS in this period due to significant changes in both the legislation and the EUA prices. The year 2015 has been chosen as a 'typical' year, as it is the most representative, and, though this exercise is not forward-looking, how the costs related to the EU ETS will evolve in the future.

On the EU level, administrative burdens were indeed not high (€0.02/tonne), while substantive compliance obligations (€0.29/tonne) were more significant for producers. **Indirect costs (€0.70 or €1.17/tonne, depending on the pass-on rate) were the most relevant EU ETS related costs for EU flat glass installations.**

On the regional level some clear differences emerge. As discussed above, administrative burdens in NWE were significantly higher than in CEE and SE. Indirect costs were substantially higher in CEE than in SE and NWE due to higher carbon intensity of electricity generation in that region, linked with high electricity intensity of production. Indirect costs in CEE were approximately twice as high as those in SE.

Substantive compliance costs were comparable between SE and NWE: €0.40-0.45/tonne. However, due to continued overallocation in CEE, substantive compliance costs were – €0.16/tonne in 2015. **Total EU ETS costs were substantial at €1.48 €/tonne on average in EU.**

Table 45. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, flat glass sector

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.03	0.01	0.02	0.02
	Substantive compliance costs	0.45	-0.16	0.40	0.29
	Direct charges	0	0	0	0
Indirect regulatory costs	Pass-on: 0.6	0.51	1.18	0.62	0.70
	Pass-on: 1	0.85	1.97	1.03	1.17
Total regulatory costs (pass-on rate 1)		1.32	1.82	1.45	1.48

Source: Authors' own elaboration.

8 Environmental legislation for the glass sector

8.1 Description of the Act

The **Industrial Emission Directive (IED)**¹¹² is currently the main piece of EU legislation in the area of industrial emissions to air, water and land. The **IED applies the integrated pollution prevention and control (IPPC) framework to industrial activities** by laying down “rules designed to prevent or, where that is not practicable, to reduce emissions [...] in order to achieve a high level of protection of the environment taken as a whole”.¹¹³

The IED entered into force in subsequent steps between 2014 and 2016,¹¹⁴ replacing the Integrated Pollution and Prevention Control (IPPC) Directive,¹¹⁵ which, therefore, applied for a significant part of the period in the scope of this Study. In any case, the scope and objective of the IPPC Directive were similar to those of the IED, with a set of common rules for allowing and controlling emissions from industrial installations.¹¹⁶

Both the IED and the IPPC Directive require operators of industrial installations to obtain and renew an **integrated environmental permit** to operate from national or local competent authorities.¹¹⁷ In the permit, Emission Limit Values (ELVs) are set based on the so-called Best Available Techniques (BAT). The BAT and the associated emission levels (the so-called BAT-AELs) applicable to the various lines of business covered by the Directive are to be specified in technical documents, the so-called BAT Reference Documents (BREF), whose conclusions are formally adopted by the Commission through an Implementing Decision (the so-called BAT Conclusions). These technical documents are progressively drafted and updated for the various sectors falling in the scope of the IED¹¹⁸ by the Commission and the industry stakeholders, under the coordination of the JRC; under the IED regime, BREFs are then adopted via Commission implementing decisions.

Finally, the IED includes provisions on **monitoring and compliance**, mandating emission levels to be monitored and environmental inspections to be carried out by the competent authorities at different intervals (at least every one to three years) depending upon the level of risk. The competent authorities shall base the period between two site visits on a systematic appraisal of the environmental risks of the installations concerned and the period shall not exceed one year for installations posing the highest risks and three years for installations posing the lowest risks.¹¹⁹

Legislation on industrial emissions is relevant for all glass sectors and applies to the vast majority of installations of the glass industry, which are included among industries listed in Annex I of IED and have their own approved BREF document.¹²⁰ The IED and the

¹¹² Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (Industrial Emissions Directive, IED).

¹¹³ Art. 1 IED.

¹¹⁴ IED provisions became applicable from January 2014 for existing industrial installations, while the minimum requirements for Large Combustion Plants came into effect on January 2016.

¹¹⁵ Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC).

¹¹⁶ The IED also recasts six other pieces of EU legislation concerning industrial emissions: (i) the three Titanium Dioxide Directives (78/176/EEC, 82/883/EEC and 92/112/EEC on waste from the titanium dioxide industry); (ii) the Volatile Organic Compounds Solvents Directive (99/13/EC); (iii) the Waste Incineration Directive (2000/76/EC); and (iv) the Large Combustion Plants Directive (2001/80/EC).

¹¹⁷ Art. 4 and Art. 5 IED.

¹¹⁸ Art. 13 IED.

¹¹⁹ Art. 16 and 23 IED.

¹²⁰ European Commission (2013), Best Available Techniques (BAT) Reference Document for the Manufacture of Glass.

BREFs specifically apply to the **manufactures of glass, including glass fibre, with a melting capacity exceeding 20 tonnes per day**.¹²¹

The **BREF** for glass regulates emissions to air, water and waste, as well as noise and odours. The most important emissions produced by the glass industry are those to air, from both the raw material preparation phase (dust emissions), and the melting phase (fossil fuels, particulate matter, and gas emitted by melting raw materials). Coating, cutting and polishing may also result in emissions to air.¹²² In addition to that, water is used as a coolant in float glass manufacturing and in the recycling process for cleaning crushed used glass, and must be subsequently disposed of. Furthermore, liquid solvents are used in some finishing processes, e.g. coating. Nonetheless, emissions to water from the glass industry are relatively low. As for waste production, most of the internally generated glass waste is recycled to the furnace (except for the production high-quality glass). This notwithstanding, the glass industry produces other waste, such as residues from raw materials, deposits (sulphates), gas flues and refractory materials.¹²³

The BREF identifies a series of **BATs** for the prevention or minimisation of pollution applicable to the various stages of the glass production process. These BATs concern the introduction of certain technologies for pollution abatement (typically, in the form of end-of-pipe devices) and/or the modification of production processes, e.g. through a modification in the composition of inputs, and/or the adoption of enhanced process control methods of a general, e.g. the implementation of environmental management systems, or specific nature, e.g. the adoption of measures to control fugitive emissions. Given the nature of the production process, the BATs largely focus on the reduction/minimisation of energy consumption and the prevention and control of air emissions, with special emphasis on dust emissions from the storage and handling of solid materials as well as nitrogen and sulphur oxides (NO_x and SO_x) and hydrogen chloride and fluoride (HCl and HF) from melting furnaces. However, in line with the integrated approach inspiring the EU legislation, the BATs also concern water consumption and the treatment of effluent water, the minimisation of waste generation and noise control. The techniques listed and described in the BAT conclusions are neither prescriptive nor exhaustive and other techniques may be used that ensure at least an equivalent level of environmental protection.

8.2 Categories of regulatory costs

The IED and the IPPC Directive, together with the attached BREFs, may have a substantive impact on the activities of companies falling within their scope, depending on the level of company readiness with respect to the implementation of the BATs.¹²⁴ In particular, the impact of the acts is considerable both from a substantive point of view, concerning the regulation of industrial processes, and from an administrative point of view, concerning the application and renewal of permits, as well as monitoring and verification duties. More in detail, the facilities subject to the IED (and, formerly, to the IPPC) have to incur the following **direct costs**:

¹²¹ Annex I to the IED, § 3.3.

¹²² At any rate, it is worth mentioning that downstream processing of flat glass (NACE rev. 23.12) is out of the scope of the present Study.

¹²³ See JRC (2013), Best Available Techniques (BAT) Reference Document for the Manufacture of Glass, pp. 85-90 (http://eippcb.jrc.ec.europa.eu/reference/BREF/GLS_Adopted_03_2012.pdf).

¹²⁴ The BATs laid out in the BAT conclusions are defined as techniques developed on a scale allowing implementation in the relevant industrial sector, under economically (meaning not entailing excessive costs) and technically viable conditions, taking into consideration the costs and advantages.

- **administrative burdens**, i.e. those incurred to obtain a permit (or to renew the existing permit within specified deadlines) based on the BAT-AELs as well as to comply with monitoring and inspection requirements;¹²⁵ and
- **substantive compliance costs**, i.e. those costs incurred for fulfilling the obligations spelled out in EU legislation and/or in the permit in terms of prevention and control of air emissions, effluent waters, waste generation, etc. Three categories of substantive compliance costs are considered, namely: i) **investment costs**, i.e. the resources invested in the retrofitting of plants and/or in the adoption of more environmentally friendly technologies (these costs are gross of subsidies that could be granted by Member States to invest in environmental protection technologies, whose incidence was, however, assessed as almost negligible in the glass sector, as illustrated in Box 11); ii) **financial costs**, represented by the opportunity cost of the capital invested; and iii) **operating costs**, which include the incremental expenses associated with environmental protection measures, e.g. for the maintenance of new equipment or facilities.

Box 11. The Role of the Environmental Subsidies in the Glass Sector

All surveyed plants were asked to provide (i) information on whether they received support from national or local authorities to reduce the costs linked to environmental expenditures ('environmental subsidies') during the 2006-15 period; and (ii) their evaluation of the role played by environmental subsidies in their sector.

All in all, 31 out of 41 plants replied to this additional questionnaire, indicating that the impact of these subsidies in the glass industry was minimal. Indeed, almost half of the respondents (14) reported a total absence of environmental subsidies in the sector. Seven plants assessed their role as marginal, while seven plants were not able to provide an accurate assessment due to their limited knowledge of the topic (which seems to further confirm the limited occurrence of these subsidies). Thus, only three respondents considered the role of the environmental subsidies in the glass sector 'moderate'. Coherently, only five plants claimed to have received an environmental subsidy between 2006 and 2015. When compared with the total estimate of environmental investment made by the 31 plants, **the incidence of these environmental subsidies was estimated at 2.2% of these costs.**

Such a result is confirmed by the review of secondary sources. Indeed, in the "state aid transparency public search page", which gives access to state aid individual award data provided by Member States in compliance with the European transparency requirements, no relevant results for the glass sector was found. However, this is not surprising considering that in the case of glass industry, only aid greater than €7.5 million per firm and €15 million as of 2014 are notified, and these values are much greater than our estimated environmental protection measures.

More important, according to the Impact Assessment of the 2014 Guidelines on Energy and Environmental State Aids, the value of state aids granted to undertakings exceeding Community standards (or increasing the level of environmental protection in the absence of Community standards) amounted to €1.4 billion for the period 2008-12. Unfortunately, there is no sectoral allocation of environmental state aid, preventing a more accurate assessment for the glass industry. Still, assuming that the sector under review has benefited to the same degree as other industries, when this figure is compared with the total estimate of environmental expenditures in the manufacturing sector (NACE B, C and D35), set at €160 billion, **subsidies are estimated to account**

¹²⁵ The costs assessed in this study are evaluated against a 'No Legislation' counterfactual, i.e. the absence of any kind of (pre-existing) national legislation. Consequently, the estimated total costs are costs resulting from any kind of legislation regardless of its origin, which, in this case, is the IED. These costs are not to be mistaken with additional costs arising from EU legislation.

for as low as 1% of these expenditures (a value in line with the estimates provided above, based on information retrieved from companies).

Source: Authors' own elaboration on data from plants and secondary sources.

Seven major regulatory obligations were identified in the IED. Four of them are information obligations linked to the obtaining, renewal and updating of the Integrated Environmental Permit (IEP), including the preparation of accompanying documents, such as the baseline report on soil and groundwater. Two additional information obligations concern i) the monitoring of emissions and reporting to competent authority, and ii) the periodical environmental inspections. Finally, one of them is a substantive obligation concerning the investments (and related operating and financial costs borne) by glass companies to comply with the applicable environmental standards specified in BAT conclusions.

In the context of the IED, it is also necessary to explore the **role of national and sub-national public administrations**. Firstly, EU legislation allows national and local administrations flexibility in the implementation of emission limits. However, in no case can the minimum emission limits set directly in the Annexes to the IED be derogated. Secondly, implementation and enforcement, e.g. the burdensomeness of the application, and the frequency of renewals and inspections, are again partly left to national or local public administrations and rules.

Box 12. Evidence on the Relevance of National and Local Factors

During the interviews, several instances of national and local factors were discussed with companies.

Several respondents argued that national or local administrations might be considerably stricter with respect to limits, prescriptions, and enforcement than the minimum floor set by the IPPC/IED. This may be problematic for operators in case a level playing field for various installations is not ensured. Several operators complained about limits and production prescriptions being different across Member States, and even attributed plant relocation to differences in severity and timeliness of the implementation of the IPPC for certain products.

In Member States where the administration and enforcement of the IED is demanded by local authorities, operators reported different treatments even within the same country. Differences, again, concern both substantive aspects, i.e. limits and prescriptions set out in the permit, as well as administrative procedures, e.g. duration of the permit procedure, frequency of inspections.

However, the above plants' feedback was challenged by the European Commission, which stressed that, although flexibility is indeed part of the IED, Member States only set stricter emission limits if the local environmental quality requires it. According to the European Commission, this flexibility has been only limitedly used, and the number of granted derogations reported by Member States to the Commission is small.

Source: Authors' own elaboration.

8.3 Methodological aspects

To estimate regulatory compliance costs generated by environmental legislation, a **cumulated approach** was chosen as the most correct in order to adequately account for the fact that, in any given year, each plant bears costs related to investments made in the same year as well as costs linked to investments previously made. Indeed, i) investments made in previous years continue to affect financial accounts until they are fully depreciated; ii) operating costs related to investments made in a certain year continue to be incurred also in subsequent years; and iii) the financing of investments made in prior years continue to generate costs over time, although on a declining basis as part of the financing has been reimbursed. However, this also means that a realistic cost estimate is possible only for the last year of the period under analysis, i.e. **2015**. In practice, in 2015, cumulated compliance costs included: i) the depreciation for that year as well as depreciation for all the investments made since 2006, ii) the operating costs linked to the investments between 2006 and 2015; and iii) the financial costs incurred for the financing of all investments made since 2006.

To measure the regulatory costs associated to the environmental legislation, companies were submitted three sets of questions:

1. Questions on the **substantive costs incurred in connection with emissions limits.**
2. Questions on the **administrative burdens due to the monitoring of and inspections to verify compliance with emissions limits.**
3. Questions on the **administrative burdens linked to the IEP.**

With respect to the measurement of the **substantive costs**, plants were asked to provide detailed information on the investments made to comply with applicable environmental standards ('environmental protection expenditures') over the 2006-15 period, including i) the type of technology acquired, e.g. electrostatic precipitator, filter, scrubber, etc., ii) the investment year and value, as well as iii) an indication of the importance of the environmental legislation as a motivation of these investments (on a 1-5 scale). Information on the incremental operating expenses associated with these environment-related investments in the form of maintenance costs, extra energy consumption, e.g. in the case of electrostatic precipitator, use or costs of raw materials and consumables (such as chemical agents), were also collected.

In order to measure the annual, cumulated substantive costs borne by the glass plants the following steps were followed:

- 1) Plants' investment costs (CAPEX) were discounted by the BAU factor (see section 2.3) to estimate the value of the investments attributable to the EU legislation. The minimum applied BAU, even when companies report that an investment is fully motivated by environmental legislation, was set at 15% in order to take into account the non-measurable role played by local and national factors (see Box 13),¹²⁶ as well as the normal replacement of equipment. After deducting the portion of the environmental investments due to other company motivations, such as equipment replacement due to obsolescence or the achievement of energy savings, based on the plant's own assessments and, whenever appropriate, applying ad-hoc corrections,¹²⁷ **the average share of CAPEX attributable to EU legislation was**

¹²⁶ During the pilot phase, companies proved unable to distinguish between EU and national burdens (as they usually face only local or national norms); however, they proved able to distinguish, although over a qualitative scale, between business-as-usual decisions and legal requirements. For this reason, the former distinction was incorporated in a question that companies could understand.

¹²⁷ For instance, prescriptions by local authorities may also go beyond the remit of the IPPC/IED, e.g. by taking into account energy efficiency and greenhouse gas emissions. While greenhouse gas emissions are not covered by the IPPC/IED (Art. 9.1), recital (10) allows Member States to introduce

set at 75% for the plants surveyed in both flat glass and hollow glass sectors.

Box 13. BAU Factor and National and Local Legislation

During the Cumulated Cost Assessment of the Steel and Aluminium Industries, the Research Team faced the same problem, i.e. distinguishing between BAU costs, EU burdens and national/local burdens. The approach taken was simpler, as companies were not asked about the link of each investment with the environmental legislation. Rather, a global discount factor which incorporated both the role of national/local legislation and normal business practices was applied, and it was set, under two scenarios, at 50% and 80% of reported costs. The approach adopted in this Study, though different and more granular, led to comparable results to the overall BAU factor for the glass subsectors fall within the range used in the other Studies.

Source: Cumulated Cost Assessment of the Steel and Aluminium Industries (CEPS & EA, 2013)/

- 2) Total investment costs attributable to EU legislation were annualized, considering an average life of the assets of 15 years, a fairly typical value for capital expenditure in the glass industry (as indicated by interviewees as well as secondary sources, such as the general depreciation rates adopted by national revenue authorities¹²⁸).
- 3) Annual operating costs (OPEX) were accounted for starting from the year following of the relevant investment. To verify the accuracy and sensitivity of figures collected, the value of operating costs as a share of connected investment expenditure was preliminary computed and compared with external sources¹²⁹;
- 4) Financial costs have to be computed by applying the sectoral WACC (7.40%) (see section 2.3).
- 5) Finally, OPEX, CAPEX, as well as financial costs, were cumulated over the 10-years period.

The measurement of the **administrative burdens** associated with: i) the issuance, renewal and updating of the IEP; and ii) the costs connected with monitoring and reporting on emission limits, as well as with the carrying out of inspections for checking compliance with the conditions based on which the IEP was issued, is done for a typical year. Plants were asked for information on the following cost and resource items:

- 1) The occurrence of relevant obligations, such as i) the number of IEP issuance/renewal/updating; and ii) the frequency of environmental inspections, during the 2006-15 period.
- 2) Amount of personnel (in FTE) per each obligation or on annual basis working on different relevant activities, namely: i) the preparation of applications for the IEP; ii) the periodical monitoring of the emissions limits; and iii) the preparation, participation in and follow-up of the environmental inspections. FTE were converted in monetary values through the SecGen elaboration of the Eurostat Earnings Structure (see section 2.3). Based on replies to the questionnaire and qualitative information retrieved from the interviews, the personnel time was allocated across two categories of personnel, i.e. managerial and technical staff.

more stringent measures with respect to them as well. In these cases, the related investments and other costs were not accounted for, as they cannot be attributed to the EU legislation.

¹²⁸ The retained value is also broadly in line with the assumptions made in a recent EC study that examined how EU business spending on environmental protection has changed over time, which allocated the investment expenditures in equipment and civil construction over a period of 10 and 25 years, respectively (see EC, Environmental Expenditures in EU industries, November 2015).

¹²⁹ In particular, Chapter 4 and Annex 8 of the BREF document provide extensive information on the economics of BATs.

- 3) Out-of-pocket expenses that may have been incurred, in particular for i) consulting services for issuance/renewal/updating of the IEP; and ii) monitoring /auditing emission limits.
- 4) Annual investment and operational costs for monitoring emission limits.

8.4 Cost assessment – Hollow glass (packaging glass and glass tableware)

8.4.1 Sample

The sample includes 21 plants manufacturing container glass and five producing glass tableware, which are jointly treated in this section to facilitate cross-sector comparisons and, at the same, avoid repeating common pieces of analysis (especially as far as the measurement of the administrative burdens is concerned). Still, separate estimates for each subsector were computed and are duly presented here below. Questionnaires received from container producers offer an adequate coverage of different regions, i.e. six from CEE, seven from NWE and eight from SE; hence, regional estimates can also be presented. As for the glass tableware subsector, only EU average can be presented.

8.4.2 Substantive compliance costs

For the substantive costs incurred in connection with emission limits, estimated cost parameters are briefly illustrated here below.

- Over three-fourths of the container glass plants surveyed (17) reported to have made **environment-related investments** over the 2006-15 period, for a total of some €51 million (with average value of €1.9 million per plant, and most of the values falling between €500,000 and €4.5 million). Investments somewhat more sizable were reported by the five operators producing glass tableware, totalling €16.1 million, i.e. €3.7 million per plant. When only the share of these investments motivated by compliance with EU legislation is taken into account, these values decrease to €38.4 million (with an average value of €1.6 million per plant) and €12.5 million (average per plant of €2.4 million) for container glass and glass tableware producers, respectively. Electrostatic precipitators, sometimes in connection with SO_x or NO_x reduction systems, were by far the most common environment-related investments made. Other kinds of investments reported by surveyed operators concern waste water treatment systems, low NO_x burners, and measures to increase the availability of suitable cullet.
- Additional operating costs were reportedly associated with these environment-related investments, typically including extra energy consumption, replacing filters and de-SO_x raw materials. On average, the OPEX/CAPEX ratios have been estimated in the 4-5% range, leading to an **annual average value of OPEX** during the 2006-15 period of about €40,000 and €60,000 per plant for container glass and glass tableware producers, respectively.
- When the financial costs incurred in connection with environmental protection investment are added to the above cost components, **the cumulated substantive compliance costs for the container glass producers were an estimated €2.12/tonne at EU (weighted average) level in 2015**. Differences across regions were rather minor, going from €1.42/tonne in SE region to €2.55/tonne in NWE region (the CEE region stands somewhere in between, with a value of €1.77/tonne). Consistent with the comparatively higher investments reported, on the one hand, and the smaller production levels, on the other hand, the estimated value of **the cumulated substantive compliance costs for the glass tableware producers over the 2006-15 period at EU level was significantly higher, i.e. €5.69/tonne in 2015**.

8.4.3 Administrative Costs

For administrative costs associated with the environmental legislation, estimated cost parameters are briefly illustrated here below.

- A tiny majority (15 out of 26) of the hollow glass plants surveyed, including four glass tableware producers, were issued a new IEP between 2006 and 2015. The remainder of the operators obtained the permit in the first half of 2000s. The vast majority of the hollow glass operators (20) had to update and/or renew the IEP at least once during the period of analysis, typically due to an expansion of the plant's capacity or a modification of the production process, or the expiration of the permit validity period. In most of the cases (14), the permit had to be updated and/or renewed only once, but a handful of operators reported a higher frequency of this practice. Almost all hollow glass plants paid external experts to assist them in the preparation of technical documents. The amount of these out-of-pocket expenses incurred to obtain the IEP for the first time typically falls in the €3,500-40,000 range, with an average value of about €20,000 per plant. Somewhat smaller amounts were paid for each renewal/updating of the IEP, i.e. some €15,000, on average. Overall, **annual, administrative costs linked to the issuance/renewal/updating of the IEP** incurred by hollow glass producers over the 2006-15 period have been estimated in the €1,500-12,000 range, with an average value of some €6,000. No significant differences in absolute terms were detected between container glass and glass tableware producers.
- All the hollow glass producers surveyed reported to be subject to inspections to verify the fulfilment of conditions specified in the IEP. The frequency of inspections varies, although in most cases it occurs every two years (11) or on annual basis (9). Related administrative costs are negligible, i.e. about €2,000 per year. Almost all the operators surveyed (24) resorted to external service providers for monitoring and/or auditing emission limits. The value of the annual fees paid to these providers by the hollow glass producers surveyed largely varies, going from as low as €2,000 up to €50,000-70,000, with an average value of some €12,000 per plant. Rather expectedly smaller values were detected in the CEE region (below €5,000, on average), while more expensive services were charged to plants located in the NWE region (more than €20,000, on average). Overall, **annual costs linked to compliance inspections and monitoring of emissions** typically range between about €10,000 and €90,000 per plant, with an average value of some €40,000.
- Summing up the above annual, administrative costs and dividing them by the average output production, the **administrative costs incurred by container glass producers** in 2015 has been estimated at **€0.22/tonne at EU (weighted average) level**. As in the case of substantive costs, cross-regional differences are minor, going from €0.19-20/tonne in the CCE and NWE to €0.27/tonne in the SE. As for **the glass tableware producers, the annual administrative burden in 2015 at EU level has been estimated at €1.05/tonne**.

8.4.4 Cumulative regulatory costs

Table 46 and Table 47 show the regulatory costs per tonne generated by the environmental legislation costs over the 10-year period of the analysis on the hollow glass subsectors, for the EU and, whenever feasible, for the three regions. **The EU weighted average of the cumulated regulatory costs in the packaging glass subsector in 2015 has been estimated at €2.34/tonne**, essentially driven by the substantive compliance costs, which account for 90% of the total. The estimated costs are below the results of the Commission report on the costs of environmental legislation,¹³⁰ which, in 2012, set the environmental protection expenditure at about 2% of value added of the

¹³⁰ EC, Environmental Expenditures in EU industries, November 2015.

manufacturing sector. According to an ILO working paper,¹³¹ in 2013, the EU produced 25 million tonnes of container glass. Thus, based on the estimated unitary costs, **the environmental protection expenditures** can be assessed at about €25 million, which **represents 0.5% of sector value added at factor costs**. Overall, the cumulated regulatory costs per tonne generated by the environmental legislation in 2015 represents 0.8% of total production costs and 3% of EBITDA (which represents an underestimated proxy of the value added)¹³² in the packaging glass sector.

In the case of the glass tableware subsector, the cumulative regulatory costs have been estimated at €6.73/tonne, a value significantly higher than the other glass subsectors. The cumulated regulatory costs per tonne generated by the environmental legislation in 2015 represents 0.5% of total production costs and 5.5% of EBITDA in the glass tableware subsector, as a result of the higher production costs and lower profitability compared to the container glass subsector.

Table 46. Regulatory costs generated by the environmental legislation on the packaging glass subsector (€/tonne, 2015)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.20	0.19	0.27	0.22
	Substantive compliance costs	2.55	1.77	1.42	2.12
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		2.75	1.96	1.69	2.34

Source: Authors' own elaboration.

¹³¹ ILO (2015), "The glass industry: Recent trends and changes in working conditions and employment relations."

¹³² The value added is closely approximated by EBITDA, as well as compensation of employees.

Table 47. Regulatory costs generated by the environmental legislation on the glass tableware subsector (€/tonne, 2015)

		EU
Direct regulatory costs	Administrative burdens	1.05
	Substantive compliance costs	5.69
	Direct charges	0
Indirect regulatory costs		0
Total regulatory costs		6.73

Source: Authors' own elaboration.

8.5 Cost assessment – Flat glass

8.5.1 Sample

The analysis covers all 15 flat glass plants that responded to the questionnaire. Questionnaires received evenly cover the three regions, i.e. five plants per region, hence regional estimates can also be presented.

8.5.2 Substantive compliance costs

For the substantive costs incurred in connection with emission limits, estimated cost parameters are briefly illustrated here below.

- A tiny majority of the operators surveyed (eight) reported to have made **environment-related investments** over the 2006-15 period, for a total of €45.7 million, giving an average value of some €3 million per plant. From a regional perspective, more sizable investments were reported by plants located in the CEE region, suggesting a comparatively lower diffusion of BAT equipment at the start of the period. Indeed, most of the plants in the other regions reportedly made similar investments in the first half of the 2000s (while a couple of plants just made them in 2016). Compliance with the EU legislation was indeed rather unanimously identified as the key motivation for these investments. Nonetheless, when corrected for the BAU factor, the total value of environment-related investments decreases to €34.4 million (with an average value of €2.3 million per plant). As in the case of hollow glass producers, electrostatic precipitators are by far the most commonly reported type of investment. However, systems to reduce NOx and, to a lesser extent, SOx emissions were also mentioned by surveyed operators.
- Additional operating costs associated with these environment-related investments were reported as slightly higher than in the case of hollow glass producers. Still, OPEX/CAPEX ratios provided by the producers surveyed are fairly consistent in the case of electrostatic precipitators, in most of the cases falling in the 6-8% range. These ratios are also in line with low-end estimates provided in the BREF document, typically setting the ratio between annual operating costs and total investment for air pollution control systems with electrostatic precipitators plus dry scrubbing in

the 8-20% range.¹³³ The **annual average value of OPEX** during the 2006-15 period was set at €90,000 per plant.

- When the financial costs incurred in connection with environmental protection investment are also taken into account, **the cumulated substantive compliance costs for the flat glass producers has been estimated at about €1.69/tonne at EU (weighted average) level in 2015.** This value is the result of rather significantly different regional estimates, going from €1.1-1.2/tonne in SE and NWE regions, up to €3.5 per tonne in CEE region (consistent with above considerations).

8.5.3 Administrative Costs

For administrative costs associated with the environmental legislation, estimated cost parameters are briefly illustrated here below.

- Eleven out of 15 surveyed operators were issued a new IEP between 2006 and 2015. In the case of the few remaining plants, permits were obtained in previous years. The majority of operators (10) had to update and/or renew the IEP (typically once) due to an expansion of the plant's capacity or to permit expiration. Besides internal staff costs, all the plants that got and/or updated the IEP incurred out-of-pocket expenses, which refer primarily to fees paid to consultants for the preparation of the technical documentation to be submitted to competent authorities, with an average value of about €11,000. Overall, **annual administrative costs linked to the issuance/renewal/updating of the IEP** incurred by operators over the 2006-15 period have been estimated at some €6,000 per plant, on average (typically falling in the €1,500-9,000 range).
- Flat glass producers are regularly subject to inspections to verify the fulfilment of conditions specified in the IEP, typically on an annual basis. Still, a couple of plants reported a higher frequency of inspections, i.e. on quarterly or semi-annual basis; while three plants indicated a lower frequency, every two or three years. Irrespective of the frequency of the inspections, related administrative costs for the flat glass producers have been estimated below €2,500 per year. Comparatively more significant are the costs incurred by plants to monitor emissions. Besides internal staff costs, most of the plants (11) made recourse to external contractors for monitoring (and auditing) emission limits, to whom they paid an annual amount typically falling between €2,500 and €20,000. A tiny majority of the operators surveyed (eight) also reported incurring investment and related-operating costs to the same purpose. The annual value of these investments usually ranges between €5,000 and €20,000, while their annual operational costs, including equipment maintenance and regular calibration, fall in the €2,000-10,000 range. Overall, **annual costs linked to compliance inspections and monitoring of emissions** typically range from €10,000 to some €65,000 per plant (with an average of €35,000).
- Based on the above, in 2015, the **annual value of administrative costs** incurred by flat glass producers expressed in terms of unit of output has been estimated at **€0.21/tonne at EU (weighted average) level.** Regional estimates fall in a rather narrow range, going from €0.12/tonne in CEE, to €0.16/tonne in NWE and up to €0.39/tonne in SE.

¹³³ For more information, see Table 8.3 of Annex 8 of the BREF document (pp. 421-422).

8.5.4 Cumulative regulatory costs

Table 48 shows the regulatory costs per tonne generated by the environmental legislation costs over the 10-year period of the analysis on the flat glass sector, for the EU as well as for the three regions. The costs for the flat glass producers are very consistent with the estimates previously illustrated for the packaging glass subsector. Indeed, **the EU weighted average of the cumulated regulatory costs in this sector in 2015 has been estimated at €1.9/tonne** (compared to €2.3/tonne for the packaging glass subsector). Also in this case, substantive compliance costs represent the bulk of regulatory costs, accounting for almost 90% of the total. Regional differences are significant, as the estimated cumulative regulatory costs in the CEE region are about three times greater than in the other regions, essentially due to a larger share of plants having made environmental protection investment (of a bigger size) during the period under investigation.

Table 48. Regulatory costs generated by the environmental legislation on the flat glass sector (€/tonne, 2015)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.16	0.12	0.39	0.21
	Substantive compliance costs	1.10	3.50	1.16	1.69
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		1.26	3.62	1.55	1.90

Source: Authors' own elaboration.

As in the case of hollow glass subsectors, the estimated costs are broadly significantly below the values reported by the Commission report on the costs of environmental legislation for the manufacturing sector,¹³⁴ which, in 2012, set the environmental protection expenditure at about 2% of value added. Indeed, according to a recent ILO working paper,¹³⁵ in 2013, the EU produced 8 million tonnes of flat glass. Thus, based on the estimated unitary costs, the **environmental protection expenditures can be assessed at about €10 million, which represents 0.6% of sector value added at factor costs.**

¹³⁴ EC, Environmental Expenditures in EU industries, November 2015.

¹³⁵ ILO (2015), "The glass industry: Recent trends and changes in working conditions and employment relations."

9 Waste legislation

This section presents the identified costs generated by and the relevance for the EU glass industry of the following acts belonging to the waste legislation area:¹³⁶

- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste (Waste Framework Directive);
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste;
- European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste (Packaging and packaging waste Directive).

The section is thereby split into waste legislation relevant for both flat glass and hollow glass (Directive 2008/98/EC and Council Directive 199/31/EC) and a section on Directive 94/62/EC only relevant for hollow glass. Cost estimates for flat glass are presented at the end of the first section, hollow glass at the end of both waste legislation sub-chapters (aggregating all costs for hollow glass).

9.1 Waste Framework Directive and Landfill of Waste Directive

9.1.1 Description of the Acts

The **Waste Framework Directive** is the overarching legislation governing the management of all waste in the EU. This Directive **sets the basic concepts and definitions related to waste management**, such as those on waste, recycling and recovery. It explains when waste ceases to be waste and becomes a secondary raw material (according to so-called 'end-of-waste criteria'), and how to distinguish between waste and by-products. The Directive introduces the "polluter pays principle" and the "extended producer responsibility".

The **Landfill of Waste Directive**, approved in 1999 and amended in 2003, 2008 and 2014, is **intended to prevent or reduce the adverse effects of the landfill of waste** on the environment. It defines the various categories of waste and sets the requirements for the establishment and operations of landfills.

9.1.2 Categories of regulatory costs

The **Waste Framework Directive** provides definitions of "waste", which is crucial for businesses as it influences the associated regulatory costs. In case a certain product or substance is defined as a "by-product" (Article 5), different rules apply and the products do not have to be treated according to the Framework Directive's guidelines (as it is not "waste"). Accordingly, they do not have to be treated by a certified waste operator (a certified recycler or waste manager, for example), which reduces costs significantly. Similarly, the Waste Framework Directive sets out (Article 6) when waste ceases to be a 'waste' product. After such criteria have been met, the handling of the product tends to be much less costly and easier. However, to date, only a few end-of-waste criteria have been developed and adopted for the glass industry, notably for glass cullet. The Waste Framework Directive also stipulates that the **costs of waste disposal must be borne by the holder of waste**, by previous holders or by the producers of the product from which the waste came (so-called 'polluter-pays principle'). This is important, because it instructs Member States to levy (at least part of) the costs onto the producer of waste. Member States do this in different ways, with different consequences for the cost burden

¹³⁶ Costs generated by the EU Regulation No 1179/2012 establishing criteria determining when glass cullet ceases to be waste have not been measured because the expected cost impacts of the Regulation were identified as marginal during the Inception Phase of the Study; accordingly, the Regulation has not been covered by the questionnaire. Neither were these costs mentioned as relevant by any respondent at the end of the waste legislation section of the questionnaire, where companies were asked to provide further cost insights.

of industries involved. Concerning glass, the share of costs for producing waste could therefore vary slightly across countries.

When assessing the costs for waste management in the glass segment, recycling needs to be taken into consideration. Glass can in principle be recycled almost up to 100%. This means that all glass plants have systems in place to recycle (at least their own) glass. Depending on the national and local setting, the amount of glass from outside the factory included in the production varies. The high use of recycled glass in the production causes a high BAU score when assessing costs of waste management systems.

Box 14. Waste management in an average glass plant

Based on the questionnaire responses, in most glass plants waste management is done partially by **internal employees**, e.g. collection of waste within company, preparation of documentation, preparation for transport, and partially by **external companies**, e.g. provision of containers for waste collection, disposal of waste. In the glass industry, a **high percentage of waste is recycled**: interviews confirm that up to 99% of glass cullet can be recycled into new products, thus keeping the costs for waste disposal and landfilling low in comparison to other industries. Further waste streams include: packaging waste (paper, wood, plastics), glass mixture that cannot be recycled, municipal waste and hazardous waste (oils, fluorescent lamps, laboratory waste, etc.).

Source: Authors' own elaboration on interviews

The remaining costs added by EU legislation to the BAU waste management system consist of **substantive compliance costs** for waste collection, segregation, reuse, recycling and disposal and landfilling. According to some of the interviewed glass plants, waste management would take place even in the absence of any specific legal obligation, but in such cases it would be done at a lower cost, e.g. if a special liquidation method would not be required by the legislation,¹³⁷ waste disposal would be handled in a less costly manner.

The Waste Framework Directive from 2006 was updated in 2008. Based on the sample interviewed, **no major changes in costs were identified**. It was stated that the new Directive obliges the companies to: 1) recycle their waste and 2) promote waste prevention (for example, through educational activities). Most of the activities seem to be performed internally; yet, some of the interviewed glass manufacturers reported that they outsource some activities, such as cleaning and waste disposal.

The **Directive on Landfilling Waste** distinguishes three separate classes of landfill: inert waste, non-hazardous waste and hazardous waste. In the Directive, waste glass-based fibrous materials, bricks, tiles and ceramics are on the "list of wastes acceptable at landfills for **inert waste without testing**".¹³⁸ In case of suspicion of contamination, testing should be applied or the waste refused.¹³⁹ If the listed wastes are contaminated or contain other material or substances such as metals, asbestos, plastics, chemicals, etc., to an extent which increases the risk associated with the waste sufficiently to justify their disposal in other classes of landfills, they may not be accepted in a landfill for inert waste.¹⁴⁰ This Directive is more relevant for downstream users of glass products, e.g. construction companies involved in building demolition, than for the industry itself. Based on the questionnaire findings, the glass industry is landfilling a relatively small amount of its waste and the landfilling costs relate to direct charges on the waste being landfilled, what is seen as BAU. Thus, this Directive is of **low relevance for the glass industry**.

¹³⁷ Directive 2008/98/EC (Waste Framework Directive).

¹³⁸ Directive 1999/31/EC on the Landfill of Waste.

¹³⁹ Ibid.

¹⁴⁰ Ibid.

9.1.3 Methodological aspects

This assessment aims at quantifying the costs registered by companies to comply with the Waste Framework Directive. The Research Team investigated and produced an estimate of costs for a typical year. More specifically, information on the costs related to the management of **(a) generic waste** and **(b) hazardous waste** were collected. For both areas, the data collection was structured in a similar way.

Regarding generic waste, the Research Team first collected data on labour costs, namely investigating the number of employees working on assuring recovery, reuse, recycling and disposal of waste. Costs were indicated by surveyed plants in heterogeneous formats. In fact, respondents were allowed to provide information related either to

- the number of employees and their share of yearly working time with respect to waste management, or
- the tonnes of waste processed per hour and how they relate to the total tonnes of waste/the tonnes of output per hour.

We allowed for more elasticity in answers, to ensure a higher rate of response. Completeness of primary replies was privileged over exact consistency. Responses were then elaborated and standardised, to derive a stock of hours required to undertake the operations, and hence the number of people involved annually, wherever such information was not already directly provided in the survey. Indeed, firms were also allowed to provide additional information on the professional qualification and the share of yearly working time of personnel involved, e.g. one plant official dedicates 50% of his yearly working time to ensure waste disposal. Whenever such a detailed breakdown was not possible, firms usually delivered an estimate of the average share of yearly working time.

Replies which included a detailed breakdown of labour costs provided evidence to extrapolate standard scenarios, namely the breakdown of workers that an average efficient firm would assign to the aforementioned operations. The standard scenarios served to refine the determination of total labour costs. Three scenarios were determined: if a company declares to involve one worker, it is assumed to be of managerial category (corresponding to level 1 of ISCO classification¹⁴¹); if 15 or fewer workers are involved, it is reasonable to consider the higher panels to be involved (ISCO 1 and ISCO 3 workers categories, with a share of total work of 30% and 70%, respectively); if more than 15 people are involved, then it can be considered as if a broad share of plant staff participate in the operation (ISCO 1, ISCO 3, ISCO 8 and ISCO 9, with shares of 10%, 30%, 50% and 10% of total time, respectively). Once the breakdown was applied to the number of total hours specified by the company, the Research Team computed the total cost, by matching the information with average salary estimates for ISCO categories at country level, **to derive overall labour costs.**

The Research Team additionally investigated operational costs (excluding staff costs). This entailed the computation of costs of systems for waste collection, reuse, recycling, disposal and cost directly related to landfilling, e.g. preparation of documentation. In case the operations related to waste are **outsourced to external subjects**, firms were asked to provide an estimate of such cost.

Regarding to investment costs, e.g. special machines or containers for waste disposal, we applied a linear depreciation rate to determine the annual share of CAPEX. On the basis of desk research as well as on the *ad hoc* information provided by companies, we decided **to consider two broad investment categories**: investments on high-value and long-term assets are expected to last over 15 years, while low-value short-term investments are expected to last five years. We also took into account incremental operational expenditures which are paid annually by firms, in terms of maintenance, increased energy

¹⁴¹ *International Standard Classification of Occupation*, International Labour Organization, UN.

consumption, cost of consumables, etc. Investments made in years preceding 2006 were excluded.

The Research Team computed the **cost of capital** used for investment, by elaborating an estimate of the average weighted cost of capital in the sectors analysed, on the basis of economic literature on WACC in the EU (see Chapter 2.3 above).

Computation of costs for **processing of hazardous waste** followed a parallel structure, entailing collection of data over labour costs, outsourcing costs, operational costs and investments.

Finally, the Research Team asked companies to report BAU factors by adopting a Likert Scale from 1 to 5 (see Chapter 2.3 above). This information was specifically requested for different groups of questions, in order to identify the share of costs generated solely by the legislation. Whenever an answer was not provided we interpolated the figure with the average of the answers provided by other respondents.

All the cost items listed are considered **substantive compliance costs**, incurred while ensuring the implementation of the legislative prescriptions. Even if administrative burdens were expected, they were not independently identifiable by plants. Consequently, they were included in the substantive compliance costs estimates.

This part of the questionnaire was the same across the considered sectors, as the legislation similarly applies to firms operating in the flat glass industry as well as in the hollow glass industry.

9.1.4 Cost assessment – Packaging glass

Sample

The sample used to estimate costs for this area of legislation in the packaging glass sector comprises the following plants, divided into the three defined regions.

Table 49. Packaging glass: Sample size by geographic region

Packaging glass: Waste Framework Directive, Landfill of Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	7	7	8	22

Source: Authors' own elaboration.

The target sample of five plants per geographic area was reached for all regions.

Direct regulatory costs

The cost assessment shows **only substantive compliance costs**. Companies did not report on specific administrative burdens. It can, however, be assumed that some level of administrative burdens is integrated in the cost estimates provided for compliance. The costs are estimated to be **€1.24/tonne of production output in a typical year at the EU level**. Differences occur between geographic areas: whereas in NWE the costs are

estimated to be €1.66/tonne of production output, in CEE the costs are estimated to be €1.22/tonne of production output and in SE €0.42/tonne of production output. Plants operating in SE tend to have lower costs in both of the two thematic areas analysed under the Waste Framework Directive. Operations regarding **management of general waste** (which include recovery, reuse, recycling and disposal) appear more costly for plants from NWE (examples indicated higher costs in terms of a higher share of yearly working time of workers, higher operational costs – such as system costs for waste reuse – and significant investment). Plants in CEE have higher costs when it comes to **managing hazardous waste** (examples experienced higher investment expenses and more extensive labour costs). The combination of these two dimensions results in overall lower costs per tonne in SE plants, relative to the implementation of the Waste Framework Directive. BAU covers more than half of the costs (between 50% and 65%, depending on the region). Given the high importance of recycling glass for packaging glass production, it might appear striking that the BAU factor is not higher than reported. An explanation for this can be that companies would organise their waste management systems differently in the absence of legislation. Alternatively, firms may have complied with waste management procedures to a lesser extent compared to what is prescribed by waste legislation. The BAU is the highest in SE and the lowest in CEE. In CEE, EU legislation caused greater changes than in the other regions, which might explain the low BAU. Differences in the BAU might also be explained by the different transposition of Directives into national law, which differs from Member State to Member State.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for producers of Packaging glass due to Waste legislation.

Table 50. Packaging glass: Regulatory costs generated by waste legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	1.66	1.22	0.42	1.24
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		1.66	1.22	0.42	1.24

Source: Authors' own elaboration.

9.1.5 Cost assessment – Glass tableware

Sample

The sample adopted for cost estimates in this area of legislation consists of the following glass tableware plants.

Table 51. Glass tableware: Sample size

Glass tableware/ Waste Framework Directive, Landfill of Waste Directive	EU
Number of plants in the sample	5

Source: Authors' own elaboration.

Direct regulatory costs

Direct regulatory costs of waste legislation for glass tableware consist only of substantive compliance costs, which are estimated at **€2.12/tonne of production in a typical year at the EU level**. Variance of costs reported is high, but not as high as in other legislative areas. In principle, this is not surprising given the heterogeneity of the products and therefore the differences in production and the expression of costs in per tonne values. The BAU factor is at about 50%. Contrary to the dispersion observed on the amount of costs, the opinions on the business-as-usual tend to be uniform, especially with regards to general waste management.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated by the waste legislation on glass tableware producers.

Table 52. Glass tableware: Regulatory costs generated by waste legislation (€/tonne, typical year, averages)

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	2.12
	Direct charges	0
Indirect regulatory costs		0
Total regulatory costs		2.12

Source: Authors' own elaboration.

9.1.6 Cost assessment – Flat glass

Sample

The sample used for cost estimates for this area of legislation consists of the following number of plants, divided into the three defined regions.

Table 53. Flat glass: Sample size by geographic reason

Flat glass: Waste Framework Directive, Landfill of Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	5	5	14

Source: Authors' own elaboration.

The target sample of at least five plants per geographic area was reached in CEE and SE. NWE estimates can also be shown (even though these are to be treated with additional care) given that they fulfil the confidentiality requirement of being provided by at least three independent companies.

Direct regulatory costs

Direct regulatory costs of waste legislation for the EU flat glass industry are estimated to **be €0.62/tonne of production output in a typical year**. Identified direct costs are classified as substantive compliance costs (as stated above, these might also contain some administrative burden). The main costs observed based on our sample contain mainly CAPEX and OPEX related to waste disposal and recycling systems. Costs in terms of person-days are relatively limited. The reason for this is the large extent of automation of waste disposal systems. Usually, plants have automated control systems sorting out and reintegrating their own glass that does not comply with the standards required to sell the product. In addition, they have recycling machines to sort out unwanted materials in cullet. Person inputs are more and more limited and mainly needed to oversee the machines and to extract or assess larger pieces. Cost estimates of individual companies do not differ largely (variance of estimates is low). But there are visible differences when comparing geographic areas: whereas in NWE costs are estimated to be €0.82/tonne, in CEE costs are estimated at €0.50/tonne and in SE at €0.37/tonne. The BAU factor is not an explanatory factor for regional difference, given that it is almost the same across regions – almost 80% of the identified substantive compliance costs are also expected to occur in the absence of any EU rule. This is not surprising as glass can be recycled to almost 100% and hence, fully fledged waste disposal systems are also supported by market mechanisms. In addition, it is part of good business conduct (or corporate social responsibility) to avoid causing harm to the environment due to large amounts of waste.¹⁴² A possible factor in explaining the higher regulatory costs in NWE may lie in the height of

¹⁴² Based on interviews.

landfill taxes. According to a study by Bio,¹⁴³ the level of landfill taxes in place for the disposal of non-hazardous municipal waste sent to legal landfills ranges very widely, from €3 per tonne in Bulgaria to up to €107.49 per tonne in the Netherlands. The analysis suggests that there is a relationship between higher landfill taxes (and higher total landfill charges) and lower percentages of waste being sent to landfill. Three broad groups of Member States emerge:

- those with high total charges for landfill and low percentages of landfilled municipal waste (AT, BE, DE, DK, LU, NL, SE);
- those with mid- to high-range total charges and mid-range percentages landfilled (FI, FR, IE, IT, SI, UK); and
- those with low total charges and high percentages landfilled (BG, CZ, GR, HU, LT, LV, PL, PT, RO, SK, CY, EE, and ES). All except the last three of these Member States have total landfill charges of less than €40 and are landfilling more than 60% of their municipal waste.

A similar trend is also visible for inert waste (including construction and demolition waste).

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated on flat glass producers by EU waste legislation.

Table 54. Flat glass: Regulatory costs generated by waste legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	0.82	0.50	0.37	0.62
	Direct charges	0	0	0	0
Indirect regulatory costs		0	0	0	0
Total regulatory costs		0.82	0.50	0.37	0.62

Source: Authors' own elaboration.

¹⁴³ BIO (2012), "Use of economic instruments and waste management performances" (http://ec.europa.eu/environment/waste/pdf/final_report_10042012.pdf).

9.2 Packaging and packaging waste

9.2.1 Description of the Acts

The Packaging and Packaging Waste Directive lays down **essential requirements related to all packaging placed on the EU market** as well as requirements related to markings and identification (labelling of materials). The Directive entered into force in 1994.

In 2004, the Packaging and Packaging Waste Directive was amended to increase the targets for recovery and recycling of packaging waste and provide criteria clarifying the definition of the term “packaging”. The Directive was revised in 2005 to provide new Member States transitional periods for attaining the recovery and recycling targets. Annex I to the Directive, containing the list of illustrative examples of items that are or are not to be considered packaging, was revised in 2013 with the purpose of providing more clarity by adding a number of examples to the list.¹⁴⁴

9.2.2 Categories of regulatory costs

The Packaging and Packaging Waste Directive is relevant for packaging glass products, which themselves serve as a type of packaging.¹⁴⁵ Annex II to the Directive specifies the essential requirements which relate to: 1) the manufacturing and composition of packaging; 2) the reusable nature of packaging; 3) the recoverable nature of packaging (recycling, energy recovering, composting and biodegradable packaging).¹⁴⁶ The Directive sets maximum concentration levels for certain metals (100 ppm by weight for lead, cadmium, hexavalent chromium and mercury).¹⁴⁷ In case of glass packaging produced from recycled material, it can exceed the limit of 100 ppm by weight if none of the covered substances are added during the recycling process. However, if the content of the metals exceeds 200 ppm, the company placing the product on the market has to submit a report to the competent authorities in the EU Member States, where it places its product on the market. In order to fulfil this requirement, glass manufacturers have to regularly test their product on heavy metal content (measuring of chemical composition, taking samples and sample preparation for external lab analysis, doing an analysis of heavy metal content, entering results into databases and verification with internal and external labs), which creates additional substantive compliance costs.

To facilitate collection, reuse and recovery (including recycling), packaging can be marked in such a way that it is possible to identify and classify the nature of the packaging material.¹⁴⁸ At the moment, this identification system is on a voluntary basis; companies use a system of numbers and abbreviations to specify the types of recyclable materials in the packaging. Even if the marking is voluntary, some of the interviewed glass manufacturers stated that they use the identification system because their consumers ask for it. Thus the Directive creates **administrative burdens** (putting appropriate marking on glass packaging), and **substantive compliance costs** (purchase of special printer).

¹⁴⁴ For further details, see:

http://ec.europa.eu/environment/waste/packaging/index_en.htm.

¹⁴⁵ For further details, see Ministry of Foreign Affairs of the Netherlands (2011), EU legislation: Packaging and packaging waste (www.s-ge.com/sites/default/files/EU%20legislation%20Packaging%20and%20packaging%20waste.pdf).

¹⁴⁶ Ibid.

¹⁴⁷ Some companies report a lack of understanding for requirements set out in the Directive given that glass can be up to 100% recycled. Also, companies argue that glass does not dissolve in water and hence even if thrown away has no negative impact on groundwater. They claim that given the existing legislation, to avoid increasing levels of metal content (which risks occurring when using cullet), companies need to mix recycled glass with sufficient raw materials. Using only or mainly recycled glass would otherwise increase the metal content of the final bottle.

¹⁴⁸ Directive 94/62/EC.

The adaptation of the packaging to the requirements of each individual country causes additional costs which may differ from Member State to Member State.

Box 15. Transposition of the Packaging and Packaging Waste Directive into national laws of the Member States

“The requirements of the Packaging and Packaging Waste Directive have been transposed properly into the national laws of Member States. Progress has been made to achieve both the Internal Market objective as well as the environmental objective, but implementation issues remain for both objectives. For the Internal Market objective some problems still occur due to the requirement on market operators to adapt their packaging to the requirements of each individual country. For the environmental objective recycling and recovery targets have generally been met, but some uncertainty exists about the accuracy of the reported data”.¹⁴⁹

9.2.3 Methodological aspects

The assessment of costs related to Packaging and Packaging Waste was assessed along the lines of three thematic areas: we investigate the costs pertaining to **(a) marking and identification systems, (b) requirements on the nature of packaging and (c) derogation for glass packaging from the heavy metals concentration limits.**

This legislation creates costs for firms both in the forms of administrative burden, e.g. ensuring the proper marking of glass packaging, in term of labour and investment, and substantive compliance cost, e.g. workers ensuring compliance with Art. 11 of the Packaging and Packaging Waste Directive. Precisely, costs incurred under (a) were considered to be **administrative burden** while those under (b) and (c) were considered as **substantive compliance costs.**

Regarding (a) we collected information for the costs incurred in assuring proper marking of glass packaging in terms of labour costs, investment costs and operational costs. We first asked firms to indicate the number of employees involved and the share of their working time to carry out such operations. Some firms provided additional information on the professional qualification and the individual share of yearly working time of personnel involved, e.g. 13 employees dedicate 5% of their yearly working time to labelling pallets loads. Whenever such a detailed breakdown could not be extrapolated, firms usually delivered an estimate of the average share of yearly working time. Respondents who presented a detailed breakdown provided evidence to extrapolate baseline scenarios. They provided information on the breakdown of workers that an average efficient firm would assign to the aforementioned operations. The baseline scenario served to refine the determination of total labour costs. Three scenarios were determined: if a company declares to involve one worker, it is assumed to be of managerial category (corresponding to level 1 of ISCO classification¹⁵⁰); if 15 or fewer workers are involved, it is reasonable to consider the higher panels to be involved (ISCO 1 and ISCO 3 workers categories, with a share of total work of 30% and 70%, respectively); if more than 15 people are involved, then it can be considered as if a broad share of plant staff participate in the operation (ISCO 1, ISCO 3, ISCO 8 and ISCO 9, with shares of 10%, 30%, 50% and 10% of total time, respectively). Once the breakdown was applied to the number of total hours specified by the company, the Research Team computed the total cost, by matching the information with average salary estimates for ISCO categories at country level, **to derive overall labour costs.**

¹⁴⁹ BIO, Arcadis, Institute for European Environmental Policy (2014), “Ex-post evaluation of certain waste stream Directives”.

¹⁵⁰ *International Standard Classification of Occupation*, International Labour Organization, UN.

The Research Team additionally investigated operational costs (excluding staff costs). This entailed the computation of costs for the marking of glass packaging, e.g. cost of solvent, printers. **Regarding investment costs**, e.g. special machines, a linear depreciation rate was applied to determine the annual share of total value of investment. On the basis of desk research as well as on the *ad hoc* information provided by companies, the Research Team decided **to consider two broad investment categories**: investments on high-value and long-term assets are expected to last over 15 years, while low-value short-term investments are expected to last five years. We also took into account incremental operational expenditures which are paid annually by firms, in terms of maintenance, increased energy consumption, cost of consumables, etc. Investments made in years preceding 2006 were excluded.

The Research Team estimated the **cost of capital** used for investment, by elaborating an estimate of the average weighted cost of capital in the sectors analysed, on the basis of economic literature on WACC in the EU (see Chapter 2.3). It was then investigated whether companies face additional operational costs to **commit to the essential requirements (b)** set by the Directive, with specific regards to glass packaging, e.g. minimise waste. Finally, the Research Team collected data on labour costs, operational costs and investment undertaken to comply with Art. 11 of the directive on **concentration levels of heavy metals present in packaging (c)**.

For each of the three areas analysed, the Research Team collected information to estimate the BAU factor using a Likert scale from 1 to 5 (see Chapter 2.3). Whenever an answer was missing, the BAU was based on the average of the answers provided by other respondents.

9.2.4 Cost assessment – Packaging glass

Sample

The sample on which cost estimates for this area of legislation relies is presented in the table below.

Table 55. Packaging glass: Sample size by geographic region

Packaging glass: Packaging and Packaging Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	7	6	17

Source: Authors' own elaboration.

Our sample reaches the target of five companies per region in CEE and SE. NWE data can also be shown (but needs to be treated with additional care as the number of observations is below the 5-plant target).

Direct regulatory costs

Direct regulatory costs of waste legislation for packaging glass are estimated at **€0.25/tonne of production output in a typical year at the EU level**. These costs include both substantive compliance costs and administrative burdens, such as testing and

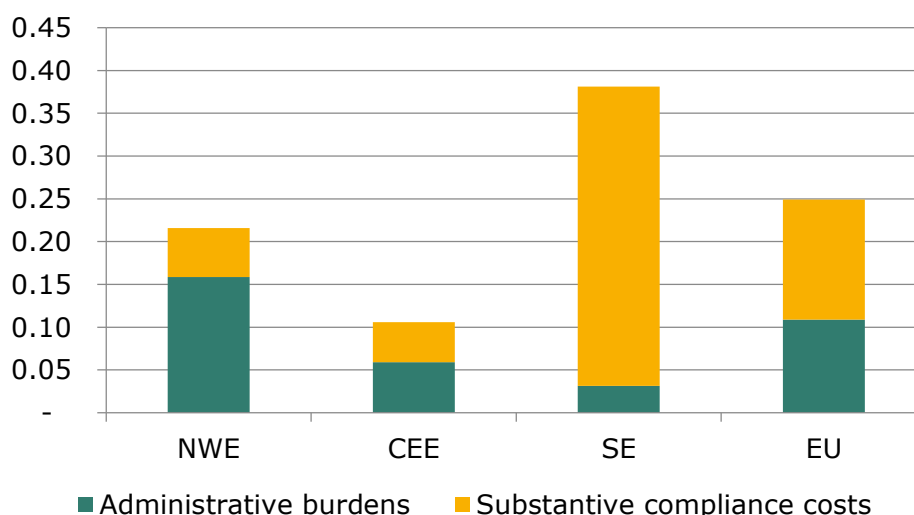
documentation. Regional differences (NWE: €0.22/tonne; CEE: €0.11/tonne; SE: €0.38/tonne) can be partially explained due to different BAU factors (which range from less than 30% in SE to about 35% in NWE and 51% in CEE). A key reason for this variation in BAU is the different transposition of the Directive into national laws. Surveyed companies in some Member States claim to be obliged to do testing which they do not perceive as necessary. Another aspect explaining differences is that the recycling rates differ between regions. The more glass is recycled, the higher the risk of increased metal components.

The direct regulatory costs mainly consist of:

- substantive compliance costs;
- administrative burdens.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 63. Packaging glass: Regulatory costs generated by Packaging and Packaging Waste Directive by region (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Substantive compliance costs

Substantive compliance costs (€0.14/tonne) capture about 56% of total costs. Differences occur between geographic areas: whereas in NWE the substantive compliance costs are estimated to be €0.06/tonne of production output, in CEE the costs are estimated to be €0.05/tonne of production output and in SE to be €0.35/tonne of production output. These costs arise in ensuring compliance with Art. 11 of the Packaging and Packaging Waste Directive on concentration levels of heavy metals present in packaging, in terms of allocation of workers to the necessary operations and other operational costs in general. Additional costs are also generated by the essential requirements set by the Packaging and Packaging Waste Directive as regards the nature of glass packaging. The majority of plants surveyed incur labour costs, while a limited number of plants additionally reported investments in machinery as x-ray analysers or inductively coupled plasma.

Administrative burdens

Administrative burdens (€0.11/tonne) are responsible for 44% of total costs. In NWE the administrative burden is estimated to be €0.16/tonne of production output, in CEE the costs are estimated to be €0.06/tonne of production output and in SE to be €0.03/tonne of production output. The entirety of administrative burdens stems from the costs incurred when assuring the proper marking of glass packaging. Companies displayed different approaches towards the procedure. Some plants dedicate a limited number of personnel for a significant share of their working time, i.e. usually one or two people committing 10% to 30% of yearly working time. Other plants opt instead for a distribution of functions across a broader set of their staff, employing up to almost 40 people for 1% to 5% of their working time. In this scenario workers are dedicated to UV printers, labelling of pallet loads or to the scanning of labels. Operational costs generate the largest share of costs for the vast majority of firms surveyed.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for packaging glass in the area of packaging and packaging waste legislation.

Table 56. Packaging glass: Regulatory costs generated by Packaging and Packaging Waste Directive (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.16*	0.06	0.03	0.11
	Substantive compliance costs	0.06*	0.05	0.35	0.14
	Direct charges	0*	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		0.22*	0.11	0.38	0.25

Note: *Number below sample target but can be presented as being above confidentiality threshold.

Source: Authors' own elaboration.

9.2.5 Cost assessment –Glass tableware

Sample

The sample used for cost estimates for this area of legislation consists of the following number of plants.

Table 57. Glass tableware: Sample size

Glass tableware: Packaging and Packaging Waste Directive	EU
Number of plants in the sample	5

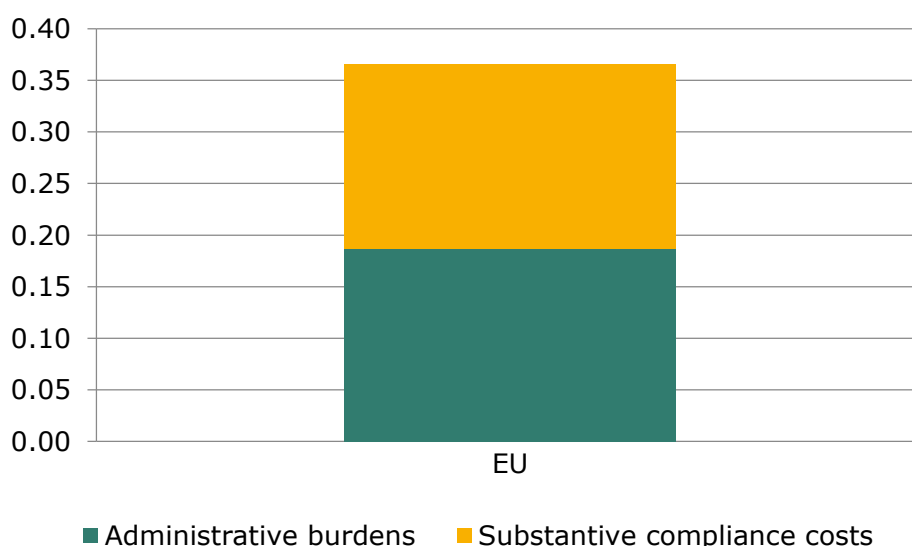
Source: Authors' own elaboration.

No regional splits can be shown, but with four companies in the sample an EU estimate can be presented.

Direct regulatory costs

Direct regulatory costs of the Packaging and Packaging Waste Directive for glass tableware, which comprise substantive compliance costs and administrative burdens, are estimated at an indicative **€0.37/tonne of production output** for a typical year. The total cost can be split into 50% substantive compliance costs (€0.18/tonne) and 50% administrative burdens (€0.19/tonne). Both administrative burdens and substantive compliance costs are due to the costs of workers, respectively, when following marking procedures and identification systems, and when ensuring compliance with general prescriptions of the legislation, as on the levels of concentration of heavy metals in glass packaging or in the minimisation of packaging waste. The BAU factor is estimated at 40%, which shows that companies would expect a fair share of the costs to occur also in the absence of legislation, mainly due to requirements from their downstream clients.

Figure 64. Glass tableware: Regulatory costs generated by Packaging and Packaging Waste Directive by region (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated by Packaging and Packaging Waste Directive on glass tableware manufacturers.

Table 58. Glass tableware: Regulatory costs generated by Packaging and Packaging Waste Directive (€/tonne, typical year, averages)

		EU
Direct regulatory costs	Administrative burdens	0.19
	Substantive compliance costs	0.18
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		0.37

Source: Authors' own elaboration.

10 Consumer and health legislation

This section presents the costs generated on the EU glass industry by the following EU rules belonging to the consumer and health legislation area:

- Framework Regulation EC 1935/2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC;
- Commission Regulation 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food;
- Directive 2001/95/EC on general product safety.

10.1 Description of the Acts (Materials and Articles in contact with food and General Product Safety Directive)

This section on consumer and health legislation, as well as the questionnaire submitted to the companies, is divided in two parts: material and articles in contact with food and general product safety.

Regarding the legislation on **materials and articles in contact with food**, the **Framework Regulation** sets out **general requirements for all food contact materials and articles that are intended to come into contact with food**, including all types of packaging, bottles (plastic and glass), and cutlery, but also adhesives and inks for printing labels. All these materials and articles used to package food must comply with the requirements of the Regulation. Annex I to the Framework Regulation lists 17 groups of materials and articles which may be covered by specific measures. Regarding glass, no specific measure has been taken yet.

In addition, the **Commission Regulation** complements the Framework Regulation by defining good manufacturing practice for materials and articles intended to come into contact with food. It **lays down the rules on good manufacturing practice (GMP)** for those groups of materials and articles listed in Annex I to the Framework Regulation. Also, combinations of the previous materials and articles, or again recycled materials and articles used in those materials and articles, are covered by the previous provisions.

Finally, with regard to **general product safety**, the Directive **lays down a definition of a safe product**. The main purpose of the Directive is to ensure that products placed on the market are safe.

Box 16. Absence of specific measures for Glass

Annex I to the Framework Regulation lists 17 groups of materials and articles, including glass, which may be covered by specific measures regarding food contact. In the absence of specific measures at European level, Member States can adopt national provisions (Article 6 of the Framework Regulation). As of today, five materials are covered by EU specific measures, including ceramics but not glass.

Regarding the latter, as rules have not been harmonised at EU level, national legislation should apply. However, anecdotal evidence based on interviews shows that the same rules as for ceramics are also applied for glass companies in some cases. The precise origin of this situation is not captured by the questionnaire, but is currently under assessment of the European Commission. It might be due to the transposition of Directive 84/500/EC into national laws, which then apply the same provisions for glass.

Even though not yet existing at a European level, specific measures for glass are being prepared. According to a recent study published by the European Parliament, some glass manufacturers and processors have reported that they are in a process of

revising/finalising their industry guidance on good manufacturing practices for food contact materials.

10.2 Categories of regulatory costs

With regard to rules on **materials and articles in contact with food** and more particularly the **Framework Regulation**, the main regulatory costs detected in the scoping phase are based upon three articles. The general requirements stipulate that the business operators have the obligation to comply with good manufacturing practices and to ensure that labelling, advertising and presentation of a material or an article shall not mislead the consumers (Article 1). Then, companies have to ensure good labelling, advertising and presentation (Article 15) regarding the material or article which is meant to be in contact with food. Finally, there is a traceability requirement (Article 17) which implies that companies must ensure that they provide sufficient traceability, by means of labelling or relevant documentation or information.

In parallel, the **Commission Regulation** states that companies ('business operators') must ensure that manufacturing operations are carried out in accordance with the general and detailed rules (Article 4), and they should also establish and implement a quality assurance system (Article 5) as well as a quality control system (Article 6). Finally, business operators must fulfil documentation requirements (Article 7) which oblige them to establish and maintain appropriate documentary evidence.

Concerning **general product safety**, the overall objective of the legislation is to make sure that operators place only safe products on the market (Article 1). However, this obligation cannot be only considered as generating EU regulatory costs, since specific obligations can be established at national level by Member States, e.g. establishing competent authorities to monitor the compliance of products (Articles 6, 7, 8 and 9).

Rules affecting materials and articles in contact with food generate administrative burdens and potentially substantive compliance costs. Administrative burdens involve, for example, employees working on the declaration of compliance of certain materials and articles. These costs are only relevant for hollow glass. Substantive compliance costs linked to employees working on general requirements regarding conformity with good manufacturing practices on quality assurance systems, general requirements on labelling and traceability can also affect flat glass.

An additional factor of high importance in this legislative area is the BAU factor, which is rather high. In fact, even in the absence of specific rules, companies tend to manufacture products compliant with high safety standards. Moreover, according to a study conducted by the European Parliament,¹⁵¹ companies may have other rules to respect besides the legal framework set out at EU level. For instance, self-Regulation, exports of EU-made food contact material goods to third countries and non-binding rules developed by the Council of Europe that require transposition at national level to become binding may create additional burdens on companies. Also, it was reported that the current legal framework is seen as not entirely complete and some issues in the implementation of the current rules were identified, i.e. day-to-day implementation problems due to traceability and official controls which are not carried out with the same intensity across Member States.

Finally, it has to be stressed that none of the companies have reported recent use of RAPEX, which does not generate relevant regulatory costs for the EU glass industry.

¹⁵¹ European Parliament (2016), "Food Contact Materials Regulation (EC) 1935/2004 European Implementation Assessment Study".

10.3 Methodological aspects

Regarding **hollow glass**, the part on consumer and health legislation was divided into two sections, i.e. materials and articles in contact with food and general product safety requirements for all products, while for **flat glass** only the latter is relevant. Responses from companies point to the fact that there are diverse interpretations of where to allocate costs in the case of hollow glass and also very diverse responses within their segments. Therefore, the Research Team opted to combine the two sections in **hollow glass** in the cost assessment and to conduct further validation of the data.

The impact of the legislation on **materials and articles in contact with food** was examined through the perspective of two broad themes, namely (1) the costs generated by compliance with general requirements (such as quality management, consumer information and conformity measures) and (2) the costs of information and documentation obligations to public authorities. Costs falling into the former area were considered **substantive compliance costs**, and costs falling into the latter **administrative burdens**.

Regarding the **general product safety requirements set for all products**, we distinguished between producers/distributors' obligations and the costs associated with rapid intervention situations, such as a product being notified in RAPEX. According to the companies' responses, RAPEX does not generate significant regulatory costs.

The types of costs assessed were overall similar, both for safety requirements for all products and for contact with food requirements. The Research Team collected data on employees involved, the costs incurred when outsourcing certain activities and other residual costs. Estimates were discounted on the basis of the BAU factor indicated by each plant.

10.4 Cost assessment – Packaging glass

Activities to fulfil the general requirements of the legislation, e.g. quality insurance systems, labelling and analytical testing, are mainly done internally. In practice, employers should make sure that the following activities are covered: conformity with good manufacturing practices (implementing quality assurance systems, quality control systems and making sure that relevant documentation is up to date and available), labelling (for the consumer) and traceability and other activities such as analytical testing and information sharing. Depending on the plant, either fewer employees work full time or more at a lower share of their working time (about 20%) on such aspects. Outsourcing is rather rare and occurs mainly for maintenance, cleaning activities or for specific needs of specialised products where external expertise is of added value at specific occasions. It is also worth noting that most of the companies replied that some activities regarding general requirements, such as providing relevant information, would occur "to a full extent" in the absence of any specific legal obligation, mainly because of demand from the customers. Regarding these good business practices, some of the companies pointed out the fact that clients' requirements are sometimes higher than those of legislative provisions.

Sample

The sample adopted to estimate regulatory costs in this area of legislation consists of the following number of plants split across the three defined regions.

Table 59. Packaging glass: Sample size by geographic region

Packaging glass	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	6	6	8	20

Source: Authors' own elaboration.

Direct regulatory costs

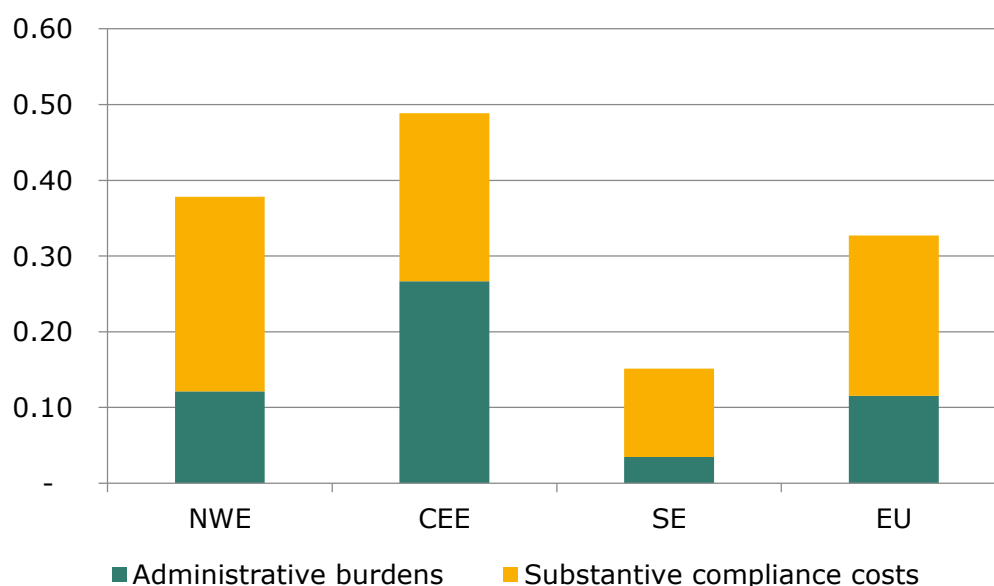
Total direct regulatory costs are estimated at €0.33/tonne in a typical year at the EU level. These costs can be split into administrative burdens and substantive compliance costs. The BAU factor is very similar across regions at an average of about 68%, with minor regional differences (CEE and NWE about 64% and SE about 73%).

The direct regulatory costs mainly consist of:

- administrative burdens; and
- substantive compliance costs.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 65. Packaging glass: Regulatory costs generated by consumer and health legislation by region (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Administrative burdens

Administrative burdens are responsible for about 35% of the costs in this legislative area and represent €0.12/tonne. Differences between geographical areas show that in CEE administrative burdens are estimated at €0.27/tonne, in SE they are €0.035/tonne and in NWE €0.12 €/tonne. The regional differences in costs caused by legal prescriptions on general requirements regarding materials and articles intended to come into contact with food are the main factor explaining the higher costs experienced by plants operating in Northern-Western Europe. Plants in NWE tend to dedicate a small number of qualified employees with a high share of their working time to administrative tasks. Those tasks include procedures of declaration of compliance of materials and articles, provision of information to public authorities regarding scientific or technical data, and provision of specific documents for the authorisation of substances.

Plants operating in CEE face higher administrative burdens regarding safety requirements of general products. Plants face high labour costs in operations, such as the provision of information to competent authorities and the processes of cooperation with them in case of risk to the consumer.

In neither case do plants in SE report costs as high as those of their counterparts, which results in overall lower administrative burdens in the case of consumer and health legislation.

Substantive compliance costs

Substantive compliance costs represent about 65% of the total cost in this legislative area with €0.21/tonne. In CEE, they are above the EU average with €0.27/tonne, in SE below with €0.12/tonne and in NWE just slightly below CEE with €0.26/tonne.

The main driver behind the lower substantive compliance costs of SE plants parallels the explanation provided for administrative burden. The specific legislation applying to materials and articles in contact with food pose higher costs in NWE, while plants in CEE usually face higher costs in relation to the legislation applying to general products. The specific legislation on materials and articles in contact with food requires the allocation of workers to ensure conformity with good manufacturing practices, e.g. quality control and assurance systems, compliance with the requirements on labelling and traceability and compliance with general rules on analytical testing. With the exception of some outliers, plants in SE show relatively lower costs than their NWE counterparts.

Plants in CEE put in a large volume of investment to ensure the compliance of their production lines and facilities with the requirements posed by the legislation on general products.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for packaging glass in the area of consumer and health legislation.

Table 60. Packaging glass: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.12	0.27	0.035	0.12
	Substantive compliance costs	0.26	0.21	0.12	0.21
	Direct charges	0	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		0.38	0.48	0.15	0.33

Source: Authors' own elaboration.

10.5 Cost assessment – Glass tableware

Sample

The sample adopted to estimate regulatory costs in this area of legislation consists of the following number of plants.

Table 61. Glass tableware: Sample size by geographic region

Glass tableware	EU
Number of plants in the sample	5

Source: Authors' own elaboration.

Direct regulatory costs

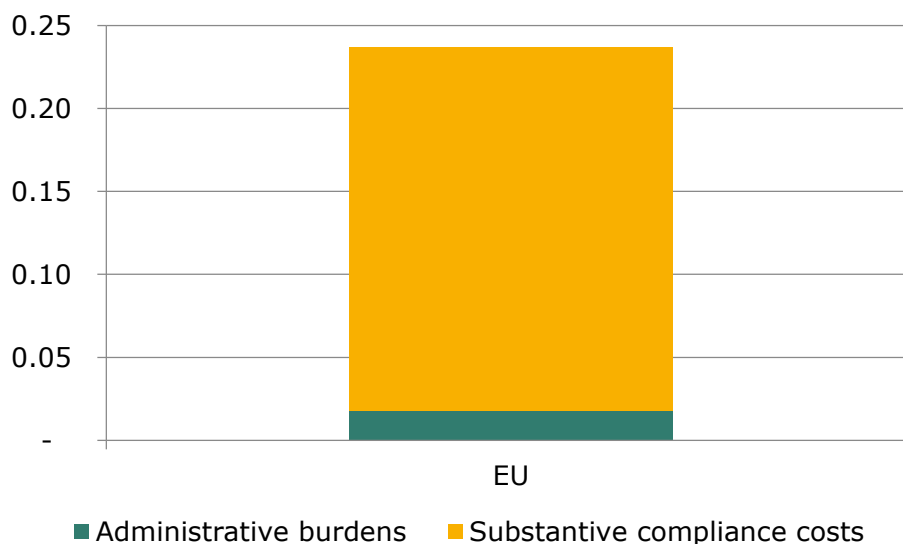
Total direct regulatory costs are estimated to be €0.24/tonne for a typical year in the EU. These can be split into administrative burdens and substantive compliance costs. The BAU factor is at 50%.

The direct regulatory costs mainly consist of:

- substantive compliance costs; and
- a very small share of administrative burden.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 66. Glass tableware: Regulatory costs generated by consumer and health legislation for the EU (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Administrative burdens

Administrative burdens are responsible for only 7% of the costs in this legislative area and represent €0.02/tonne. In the case of glass tableware producers, burdens arise both from the administrative procedures regarding the safety requirements (a) for general products and (b) for specific products and materials in contact with food. The fulfilling of a Declaration of Compliance, for example, is a process that takes from a few minutes to several hours, depending on the complexity of the case, and some plants reported having undertaken this process for several hundred cases each year. Other plants indicated the preparation of product safety reports or the need for notification to public authorities – such as national food agencies – as an additional source of burden.

The plants analysed highlighted a common approach with regards to these procedures: they opt to involve a limited number of workers for a limited share of their working time. Glass tableware companies dedicate, for example, only one to six workers for no more than 6% of their working time in fulfilling their information and documentation obligations to public authorities, figures that are lower than those reported by plants producing packaging glass, which provides an explanation for the spread in administrative burdens across the two sectors.

Substantive compliance costs

Substantive compliance costs represent 93% of the total regulatory costs in this legislative area. **They are equal to €0.22/tonne.** Compliance costs originate from the allotting of

worker time to procedures such as conformity with good manufacturing practices, labelling requirements and analytical testing. Glass tableware plants, unlike packaging glass producers, exclude outsourcing these operations and prefer to implement them internally.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs borne by glass tableware producers due to consumer and health legislation.

Table 62. Glass tableware: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)

		EU
Direct regulatory costs	Administrative burdens	0.02
	Substantive compliance costs	0.22
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		0.24

Source: Authors' own elaboration.

10.6 Cost assessment – Flat glass

Sample

The sample adopted to estimate regulatory costs in this area of legislation consists of the following number of plants split across the three defined regions.

Table 63. Flat glass: Sample size by geographic region

Flat glass	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	4	3	10

Source: Authors' own elaboration.

Direct regulatory costs

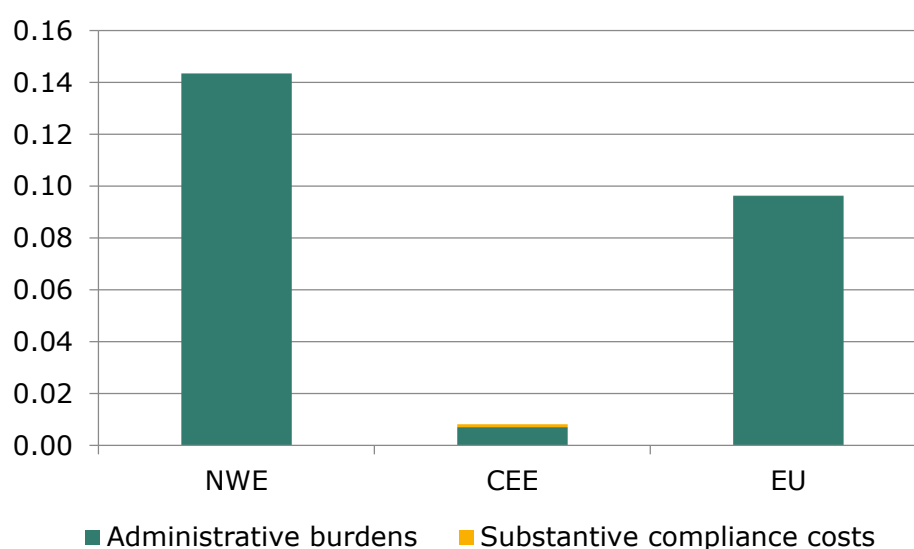
Total direct regulatory costs are estimated to be €0.10/tonne for a typical year in the EU. These can be split into administrative burdens and substantive compliance costs. The BAU factor is at 45%.

The direct regulatory costs mainly consist of:

- administrative burdens; and
- a negligible share of substantive compliance costs.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 67. Flat glass: Regulatory costs generated by consumer and health legislation for the EU (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Administrative burdens

Administrative burdens are responsible for almost 100% of the costs in this legislative area and represent €0.10/tonne. Differences between geographical areas show that in CEE administrative burdens are estimated at €0.01/tonne while in NWE €0.14/tonne. The difference registered between the two regional groups is driven, among other factors, by the presence of plants reporting costs at the two extremes of the distribution (caused by the final use of the product and hence their specific downstream clients), which push the averages of CEE and NWE regions downwards and upwards, respectively. The reasons for the presence of these outliers are 1) the large differences in the share of working time of workers dedicated to the provision of information, and 2) cooperation with the competent authorities in case of risk to the consumer. Differences in the share of working time are further amplified by the fact that employees assigned to these procedures tend to be of higher seniority level, which entails a higher cost per hour. Additionally, higher ISCO salary categories are those with the highest variance between Member States, a finding that can provide additional evidence for cross-regional differences.

Substantive compliance costs

In the present analysis, the major share of substantive compliance costs was generated by the legislation on safety requirements applying to specific material and products in contact with food. Since flat glass is excluded by this legislation, costs falling within substantive compliance tend to be limited or absent.

The following table summarises the cumulative regulatory costs borne by flat glass producers due to consumer and health legislation.

Table 64. Flat glass: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.14*	0.01*	<i>Confidential</i>	0.10
	Substantive compliance costs	0*	0*	<i>Confidential</i>	0
	Direct charges	0*	0*	<i>Confidential</i>	0
Indirect regulatory costs		NA	NA	<i>Confidential</i>	NA
Total regulatory costs		0.14*	0.01*	<i>Confidential</i>	0.10

*Note: *Number below sample target but can be presented as being above confidentiality threshold.*

Source: Authors' own elaboration.

11 Workers' safety and health legislation

This section discusses the costs generated by and the relevance for the EU glass industry of the following acts belonging to the workers' safety and health area:

- Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (89/391/EEC);
- Council Directive of 30 November 1989 concerning the minimum safety and health requirements for the workplace;
- Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work;
- Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (Noise Directive);
- Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC;
- Directive 2004/40/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (Electromagnetic Directive);
- Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation).

The first two legislative acts will be assessed in the "General workers' safety and health and general workplace safety" section, and the remaining five acts will be assessed in the "Special workers' safety and health" section. A main feature of this legislative area is that all legislative acts are directives and thus need to be transposed into national laws. This means that the risk of different implementation and interpretation as well as the possibility for gold-plating are high.

11.1 General workers' safety and health and general workplace safety

11.1.1 Description of the Acts

During the Inception Phase, two main EU legal instruments regulating general workers' health and general workplace safety were identified as sources of regulatory costs for the glass industry. The Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (hereinafter the Framework Directive on Workers' Safety) sets out basic requirements; the Council Directive of 30 November 1989 concerning the minimum safety and health requirements for the workplace (hereinafter the Workplace Directive) is the first individual Directive adopted after the Framework Directive on Worker's Safety.

The **Framework Directive** on Workers' Safety contains **general principles** concerning the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the informing, consultation, balanced participation in accordance with national laws and/or practices and training of workers and their representatives, as well as general guidelines for the implementation of the said principles.

The **Workplace Directive** defines **general obligations for the employer**, i.e. traffic routes to emergency exits and the exits themselves have to be kept clear at all times; technical maintenance of the workplace and of the equipment and devices have to be carried out as quickly as possible; workplace and the equipment and devices have to be regularly cleaned to an adequate level of hygiene; safety equipment and devices intended to prevent or eliminate hazards need to be regularly maintained and checked.

11.1.2 Categories of regulatory costs

The main regulatory costs created by EU rules are linked to the **general provision of the Framework Directive on Workers' Safety**, which states that the employer shall have a duty to ensure the safety and health of workers in every aspect related to the work (Article 5), which implies for instance that the employer should designate one or more workers to carry out activities related to the protection and prevention of occupational risks for the undertaking and/or establishment (Article 7) and that each worker should receive adequate safety and health training, in particular in the form of information and instructions specific to his workstation or job (Article 12). Regarding the **Workplace Directive**, most of the costs are engendered by the list of requirements stated in Article 1 which includes technical maintenance of the workplace and of the equipment and devices and that for instance the workplace and the equipment and devices are regularly cleaned to an adequate level of hygiene.

Based on the responses provided by the companies, it can be observed that **substantive compliance costs** are mainly engendered by the general obligation of ensuring workers' safety and health. More specifically, training is the most important in terms of employees involved and in terms of allocated hours. Very often, one employee works for a large share of his/her time to arrange different activities regarding general workers' safety and health. At any rate, these activities entail a high BAU factor, in fact "to a high extent" they would occur even in the absence of specific legal obligations. Also, some investment costs are linked, for instance, to fire alarm systems, defibrillators, first-aid kits or emergency lighting systems. Finally, these activities seem to be performed internally; yet, outsourcing of some specific tasks is also quite common. For instance, medical surveillance, first-aid training and technical prevention were reported as the main outsourced activities. In this context, most of the regulatory costs are included in the substantive compliance cost category (organising training, maintaining equipment, providing relevant information to employees, etc.).

According to a recent study 'Evaluation of the Practical Implementation of the EU Occupational Safety and Health (OSH) Directives in EU Member States' for DG Employment¹⁵², several reasons for addressing health and safety can be identified across the EU: fulfilling legal obligations, meeting expectations of employees by their representatives, avoiding fines from the labour inspectorate, maintaining the organisation's reputation and maintaining or increasing productivity. The study shows that in some countries, particularly those that joined the European Union in 2004, the most frequently reported driver to address health and safety is maintaining the organisation's reputation.

Finally, according to the same study, the fact that **Member States have different regulatory regimes has an impact on the implementation of the Directives**. For instance, countries from the NWE region have national goal-setting regulatory approaches to OSH management, with a strong focus on process, which largely predates the Framework Directive by around 20 years. In contrast, other Member States have, according to the study, a more traditional management system with prescriptive legislative approaches. Yet another regulatory regime can be found in Bulgaria, where risk

¹⁵² COWI, Milieu and IOM (2015), "Evaluation of the Practical Implementation of the EU Occupational Safety and Health (OSH) Directives in EU Member States".

assessment is regulated by a specific ordinance which is effective for all individual Directives. In addition, general requirements can there be found in the national framework law while specific requirements are in the laws transposing the individual Directive.

11.1.3 Methodological aspects

This assessment aims to quantify the costs registered by companies to comply with workers' safety and health procedures. These costs are expected to be quite stable over the years. Hence the Research Team focused on costs incurred in a typical year. More specifically, the Research Team first investigated **(a) the number of specifically qualified employees who are involved in ensuring workers' health and safety.** This implies gathering data on the number of people who provide general trainings for plant staff, monitor safety equipment/information, organise session on first aid, fire-fighting and evacuation procedures. Secondly, the Research Team collected information on **(b) how much time those other employees** who are not dedicated to safety and health obligations **spend on familiarisation with procedures.**

Firms were also asked to provide additional information on the professional qualification and the share of yearly working time of personnel involved, e.g. one H&S officer dedicates 30% of his yearly working time to provide training for workers. Whenever such a detailed breakdown was not possible, firms delivered an estimate of the average share of yearly working time.

During interviews, the Research Team asked typical companies to provide a further detailed breakdown of data to, e.g. assess the type of workers (and hence wage categories) involved in a normal efficient company. Such information was then used to develop a standard scenario extrapolated across companies for the aforementioned operations. The standard scenario served to refine the determination of total labour costs. On the basis of plant level responses, it can be observed, for example, that plants prefer to allocate a limited number of workers to organise H&S trainings or to monitor safety equipment, while ensuring that a broad range of plant staff attend training and information activities.

Three scenarios were determined: if a company declares to involve one worker, it is assumed to be of managerial category (corresponding to level 1 of ISCO classification¹⁵³); if 15 or fewer workers are involved, it is reasonable to consider the higher panels to be involved (ISCO 1 and ISCO 3 workers categories, with a share of total work of 30% and 70%, respectively); if more than 15 people are involved, then it can be considered as if a broad share of plant staff participate in the operation (ISCO 1, ISCO 3, ISCO 8 and ISCO 9, with shares of 10%, 30%, 50% and 10% of total time, respectively). Once the breakdown was applied to the number of total hours specified by the company, the total labour cost was computed by matching the information with average salary estimates for ISCO categories at country level.

In case the organisation of trainings and information activities is **outsourced to external entities**, firms were asked to provide an estimate of 'out of pocket' expenses. Additionally, we asked companies to report on the **amount spent yearly on information material.**

Regarding investment costs on health and safety equipment, e.g. fire alarm systems, fire doors, emergency lighting systems, the Research Team applied a linear depreciation rate to determine the annual share of total value of investment. On the basis of desk research as well as on the *ad hoc* information provided by companies, the Research Team decided **to consider two broad investment categories**: investments on high-value and long-term assets are expected to last over 15 years, while low-value short-term investments are expected to last five years. The Research Team also took into account incremental operational expenditures which are paid annually by firms, in terms of

¹⁵³ *International Standard Classification of Occupation*, International Labour Organization, UN.

maintenance, increased energy consumption, cost of consumables, etc. Investments made in years preceding 2006 were excluded.

We computed the **cost of capital** used for investment, by elaborating an estimate of the average weighted cost of capital in the sectors analysed, on the basis of economic literature on WACC in the EU (see Chapter 2.3).

We finally asked companies to report **how much of the aforementioned costs would have occurred in the absence of the legislation** to determine the BAU factor. Answers were provided in the form of a Likert scale from 1 to 5 (see Chapter 2.3 above). This information was specifically requested for different groups of answers, in order to better identify regulatory costs generated by specific sets of obligations. Replies show on average a BAU equal to four, i.e. companies claim that the costs would have occurred in any case to a high extent, also without EU rules imposing regulatory obligations concerning workers and workplace safety. This implies that companies consider the H&S of workers to be a compelling issue.

This part of the questionnaire was the same across the sectors considered, as the legislation similarly applies to firms operating in the flat glass industry as well as in the hollow glass industry. All cost items identified are **substantive compliance costs**, incurred while ensuring the implementation of the legislative prescriptions.

11.1.4 Cost assessment – Packaging glass

Sample

The sample adopted to estimate regulatory costs in this area of legislation consists of the following number of plants split across the three defined regions.

Table 65. Packaging glass: Sample size by geographic region

Packaging glass: General workers' safety and health and general workplace safety	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	7	6	8	21

Source: Authors' own elaboration.

Direct regulatory costs

In a typical year, direct regulatory costs of general workers' safety and health and general workplace safety for packaging glass are estimated at **€1.10/tonne of production output at the EU level**. All costs observed can be classified as substantive compliance costs. The main costs are the labour cost for managing/organising workers safety requirements and procedures which include the attendance of such procedures. The absolute costs of such processes were substantially higher than the regulatory costs, as a high BAU factor was observed. Companies during interviews, however, mentioned that they would organise related activities differently if legislation did not exist. In fact, some differences exist in the BAU factor when comparing regions. The share of costs expected to occur anyway was the highest in NWE (~75%), followed by SE (~65%) and CEE (~60%). This is not surprising given that Member States included in the NWE sample already face a longer tradition of stricter health and safety standards. The differences in the BAU partially affect the differences in costs per region. However, they are partially outbalanced by aspects such as efficiency in implementation of health and safety systems

due to greater experience, better public infrastructure and support, less need to outsource and/or training, etc. In NWE, the costs are estimated to be €1.15/tonne of production output, in CEE the costs are estimated to be €1.25/tonne of production output and in SE to be €0.94/tonne of production output.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for packaging glass producers in the area of general workers' safety and health and general workplace safety legislation.

Table 66. Packaging glass: Regulatory costs generated by general workers' safety and health and general workplace safety legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	1.15	1.25	0.94	1.10
	Direct charges	0	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		1.15	1.25	0.94	1.10

Source: Authors' own elaboration.

11.1.5 Cost assessment – Glass tableware

Sample

The sample used for cost estimates in this area of legislation consists of the following number of plants.

Table 67. Glass tableware: Sample size

Glass tableware: General workers' safety and health and general workplace safety	EU
Number of plants in the sample	5

Source: Authors' own elaboration.

Direct regulatory costs

Direct regulatory costs of general workers’ safety and health and general workplace safety legislation for glass tableware are indicatively estimated to be **€4/tonne of production output** for a typical year at the EU level. All costs can be classified as substantive compliance costs. The BAU factor covers about 50% of the costs. The main costs observed based on our sample are similar to other subsectors, labour cost for managing/organising workers’ safety requirements and procedures which include the management and attendance of such procedures. Cost estimates are relatively high in comparison to other sectors when measured in €/tonne. In fact, overall production costs for a tonne of glass tableware is substantially higher than those for a tonne of packaging glass or flat glass.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for glass tableware producers generated by general workers’ safety and health and general workplace safety legislation.

Table 68. Glass tableware: Regulatory costs generated by general workers’ safety and health and general workplace safety legislation (€/tonne, typical year, averages)

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	4.0
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		4.0

Source: Authors’ own elaboration.

11.1.6 Cost assessment – Flat glass

Sample

The sample used to estimate costs in this area of legislation comprises the following number of plants split across the three different regions.

Table 69. Flat glass: Sample size by geographic region

Flat glass: General workers' safety and health and general workplace safety	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	5	5	15

Source: Authors' own elaboration.

Direct regulatory costs

In a typical year, direct regulatory costs generated by general workers' safety and health and general workplace safety legislation on EU flat glass producers are estimated to be **€1.07/tonne of production output**; these costs include only substantive compliance costs. The main costs observed are the labour cost for managing/organising workers' safety requirements and procedures that include the management and attendance of training and information activities. Variance between companies as well as between regions is relatively high. This suggests that companies have a very different approach for implementing safety and health and general workplace safety requirements. Differences occur between geographic areas: whereas in NWE the costs are estimated to be €1.31/tonne of production output, in CEE the costs are estimated to be €0.40/tonne of production output and in SE to be €1.22/tonne of production output. The sector is characterised by a very high BAU factor (between 65% in SE and about 75% in NWE and CEE). These differences partially explain the higher cost estimate for SE. Another aspect explaining the differences is differing costs for labour, externals and equipment.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for flat glass producers in the area of general workers' safety and health and general workplace safety legislation.

Table 70. Flat glass: Regulatory costs generated by general workers' safety and health and general workplace safety legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	0	0	0
	Substantive compliance costs	1.31	0.40	1.22	1.07
	Direct charges	0	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		1.31	0.40	1.22	1.07

Source: Authors' own elaboration.

11.2 Special workers' safety and health

11.2.1 Description of the Acts

There are five EU legal acts which are of particular relevance to flat and hollow glass sectors regarding special workers' safety and health. These acts regulate the protection of health and safety of workers from the risks related to:

- **Physical agents :**
 - Noise: Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents.
 - Electromagnetic fields: Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC; Directive 2004/40/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents.
 - Artificial optical radiation: Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents.
- **Chemical agents:** Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work.

Regarding physical agents, all Directives provide minimum health and safety requirements which oblige the employer to assure a safe workplace. Hence, obligations of assessments and measurements allow the employer to determine the level of exposure to noise, electromagnetic fields and artificial optical radiation. This needs to be done in accordance to the obligations laid down in the Framework Directive on Workers' Safety, which is the legal basis for special workers' safety and health Directives (see above). Results of the risk assessment have to be recorded and updated on a regular basis, especially if there have been significant changes which could render it out of date. In addition, the employer shall ensure that workers who are exposed to risks from noise at work receive any necessary information and training relating to the outcome of the risk assessment provided for in Article 4 of the Directive.

Regarding the exposure of workers to the risks arising from chemical agents, Directive 98/24/EC obliges the employer to determine whether any hazardous chemical agents are present at the workplace as well as assess any risk to the safety and health arising from their presence. The employer has to make an assessment of the risk in accordance with Article 9 of Directive 89/391/EEC. This assessment needs to be regularly updated, especially if there have been significant changes or if the results of health surveillance show it to be necessary. In addition, the employer has to establish procedures, which can be implemented in case of an accident with hazardous chemical agents at the workplace. These activities can cause **substantive compliance costs** and **administrative burdens** for industry.

11.2.2 Categories of regulatory costs

The main regulatory costs can be classified in three categories: i) determination and assessment of risk of hazardous chemical agents; ii) avoiding and reducing exposure; and iii) workers information and training.

Based on the questionnaires, risks related to noise and chemical agents seem to create most of the regulatory costs to both flat and hollow glass sectors. The other types of risks

create costs when it comes to measuring the level of exposure. Even though most of the activities are performed internally, outsourcing remains important, especially regarding medical surveillance and, more marginally, the measurement of level of exposure. Risk assessment and documentation obligations also constitute a significant cost for companies, which sometimes requires a full-time employee. Therefore, the costs identified are **substantive compliance costs** (measuring the level of exposure and ensuring health surveillance related to identified risks in general, providing information and training regarding risks) and **administrative burden**, e.g. documentation and updating of the risk assessment. Finally, it was assessed by the companies and plants that most of the activities required by European legislation would in any case occur in the absence of legal obligations.

11.2.3 Methodological aspects

This section aims to measure the costs registered by companies to follow legislative prescriptions regarding health and safety procedures in specific areas, with a primary focus on the level of exposure to noise, electromagnetic fields, artificial optical radiation and hazardous chemical agents. As mentioned above when dealing with general workers' safety rules, these costs are expected to be rather stable over the years. Hence, the Research Team estimated costs incurred in a typical year.

Complying with this type of legislation primarily requires the involvement of employees, hence generating labour costs. The Research Team asked companies to provide information, for example, on how often employees work on measuring exposure levels, e.g. to noise or optical radiation, on establishing and implementing action plans and guidelines to prevent exposures exceeding limit values. Similarly, the Research Team requested data on how often employees are involved in training regarding risks generated by excessive exposure and how often companies consult and discuss with employees questions related to these issues.

For all the areas investigated, we asked companies to provide a breakdown of answers for activities individually related to **(a) noise, (b), electromagnetic fields, (c) artificial optical radiation and (d) chemical agents**. This breakdown serves to isolate costs components generated in each area and to allow companies to customise their answers according to the sector in which they operate, i.e. some companies did not report data on activities regarding the exposure to electromagnetic fields or optical radiation, as their type of industrial operations do not entail such risks.

Firms were also asked to provide additional information on the frequency of their operations, e.g. monthly, annually or every two years, on the professional qualification and the share of yearly working time of personnel involved in the form of person-days, e.g. two plant technicians dedicate one day each to the measure level of exposure to noise. Whenever such a detailed breakdown was not possible, firms delivered an estimate of the global stock of person-days registered for a task.

Based on collected evidence, the Research Team estimated the breakdown of workers that an average efficient firm would assign to the aforementioned operations. The standard scenarios served to refine the measurement of total labour costs. On the basis of firms' responses, it can be observed, for example that firms prefer to allocate a limited number of workers to organise H&S trainings or to monitor safety equipment, while ensuring that a broad range of the plant staff attend these activities.

Three scenarios were determined: if a company declares to involve a total of 10 days, a task is assumed to be carried out by an employee of managerial category (corresponding to level 1 of ISCO classification¹⁵⁴); if 30 or fewer days are indicated, it is reasonable to consider that the implementation of a task is shared by the higher panels (ISCO 1 and

¹⁵⁴ Ibid.

ISCO 3 worker categories, with a share of total work of 30% and 70%, respectively); if more than 30 days, then it can be considered as if a broad share of plant staff participate in the operation (ISCO 1, ISCO 3, ISCO 8 and ISCO 9, with shares of 10%, 30%, 50% and 10% of total time, respectively). Once the breakdown was applied to the number of total days specified by the company, we computed the total cost, by matching the information with average salary estimates for ISCO categories at country level, **to derive overall labour costs.**

In case the aforementioned operations are **outsourced to external providers**, firms were asked to provide an estimate of such outsourcing cost.

Firms also indicated operational costs (additional to staff and outsourcing costs) generated by special health and safety procedures, e.g. annual cost paid to purchase hearing protection wear. The Research Team asked companies to indicate their staff costs related to the **update of risk assessments** for safety and health of workers, the decisions on the protective measures to be taken **or the drafting of reports on occupational accidents** suffered by workers.

Also in this area of legislation, the Research Team collected information on the **BAU factor** by adopting a Likert scale from 1 to 5 (see Chapter 2.3 above). This information was specifically requested of different groups, in order to have a more accurate estimate of regulatory costs linked to specific obligations within a certain legal act. Additionally, the Research Team requested firms provide individual answers on the BAU factor for each type of exposure, i.e. a different answer on a Likert scale, for exposure to noise, electromagnetic fields, artificial optical radiation or chemical agents. Replies show an average of four for the BAU, i.e. companies claim that the costs would have been incurred in any case to a high extent, also in the case that the relevant legislation was not in place. This implies that companies consider the H&S of workers to be a compelling issue.

The cost items listed in this section of the cost assessment are considered to be either **substantive compliance costs**, incurred while ensuring the implementation of the legislative prescriptions, or **administrative burden**, incurred while complying with tasks directly generated by the legislation on an administrative level, e.g. data collection on communication and exposure levels.

This part of the questionnaire was the same across the considered sectors, as the legislation similarly applies to firms operating in the flat glass industry as well as in the hollow glass sectors.

11.2.4 Cost assessment – Packaging glass

Sample

Cost estimates for this area of legislation rely on a sample including the following number of plants in each of the three regions in this Study. Two plants were excluded as respondents were not able to provide a clear-cut estimation on cost items. However, the descriptive information in this section used as additional qualitative evidence to cross-check the validity of our conclusions.

Table 71. Packaging glass: Sample size by geographic region

Packaging glass: Special workers' safety and health legislation	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	6	8	19

Source: Authors' own elaboration.

Direct regulatory costs

Direct regulatory costs of special workers' health and safety legislation for hollow glass are estimated at **€0.17/tonne in a typical year at the EU level**. The variance between companies is limited. Also, the regional differences in terms of BAU are within a bandwidth of about 15% (NWE with 77% being the highest and SE with 65% the lowest). The BAU thus only partially explains regional differences. In NWE the costs are estimated to be €0.14/tonne, in CEE the costs are estimated to be €0.04/tonne of production output and in SE to be €0.29/tonne of production output. NWE is the region with the highest variance in responses.

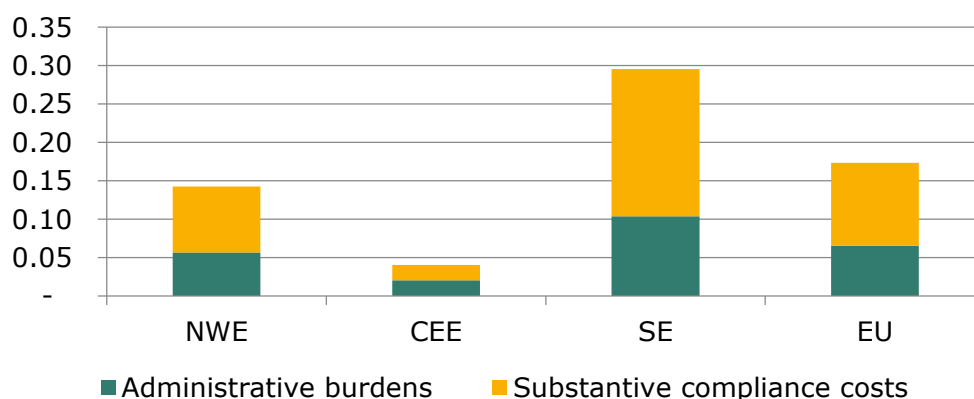
The direct regulatory costs can be broken down into substantive compliance costs and administrative burdens. The following figure shows a split between the two categories for the EU.

The direct regulatory costs mainly consist of:

- administrative burdens; and
- substantive compliance costs.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 68. Packaging glass: Regulatory costs generated by special workers' health and safety legislation by region (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Substantive compliance costs

Substantive compliance costs of special workers' health and safety legislation for hollow glass are estimated to be **€0.11/tonne of production output** at the EU level. Differences occur between geographic areas: in NWE the costs are estimated to be €0.08/tonne of production output, in CEE the costs are estimated to be €0.02/tonne of production output and in SE to be €0.19/tonne of production output.

SE plants display markedly higher costs in terms of number of employees assigned to tasks, as implementing practical guidelines to prevent excessive exposure of workers, e.g. to chemical agents, noise, artificial optical radiation, or as providing training and information on risks related to special activities. This is driven by plants in two Member States which tend to particularly influence the average upwards. Conversely, CEE plants display lower labour costs, a fact partially driven by the spread in salaries, recorded among the higher ISCO categories (as ISCO1 and ISCO3) usually associated with these tasks. This finding is in line with results for flat glass plants.

Administrative burden

Administrative burdens of special workers' health and safety legislation for hollow glass are estimated to be **€0.06/tonne of production output** for a typical year in the EU. Differences occur between geographic areas whereas in NWE the costs are estimated to be €0.06/tonne of production output, in CEE the costs are estimated to be €0.02/tonne of production output and in SE to be €0.10/tonne of production output.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated by EU special workers' health and safety legislation on packaging glass producers.

Table 72. Packaging glass: Regulatory costs generated by special workers' health and safety legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.06	0.02	0.10	0.06
	Substantive compliance costs	0.08	0.02	0.19	0.11
	Direct charges	0	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		0.14	0.04	0.29	0.17

Source: Authors' own elaboration.

11.2.5 Cost assessment – Glass tableware

Sample

The sample used for cost estimates for this area of legislation consists of the following number of plants across the EU.

Table 73. Glass tableware: Sample size

Glass tableware: Special workers' safety and health legislation	EU
Number of plants in the sample	5

Source: Authors' own elaboration.

Direct regulatory costs

Direct regulatory costs generated by special workers' health and safety legislation on glass tableware producers in the EU are estimated at **€0.66/tonne in a typical year**. Nonetheless, the variance in responses is quite high. This is not surprising due to the very heterogeneous forms of production and the high value production of glass tableware. Interestingly, the BAU factor covers about 50% of the costs generated through special workers requirements.

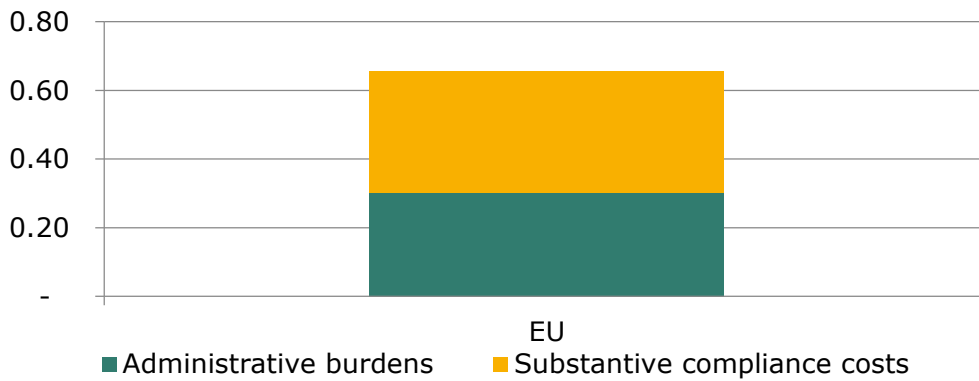
The direct regulatory costs can be broken down into administrative burdens and substantive compliance costs. The following figure shows a split between the two categories at the EU level.

The direct regulatory costs mainly consist of:

- administrative burdens; and
- substantive compliance costs.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 69. Glass tableware: Regulatory costs generated by special workers' health and safety legislation in the EU (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Substantive compliance costs

Substantive compliance costs of special workers' health and safety legislation for glass tableware are estimated to be **€0.36/tonne of production output** for a typical year in the EU.

Administrative burden

Administrative burdens of special workers' health and safety legislation for glass tableware are estimated to be **€0.30/tonne of production output** for a typical year in the EU.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for glass tableware in the area of special workers' health and safety legislation.

Table 74. Glass tableware: Regulatory costs generated by special workers' health and safety legislation (€/tonne, typical year, averages)

		EU
Direct regulatory costs	Administrative burdens	0.30
	Substantive compliance costs	0.36
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		0.66

Source: Authors' own elaboration.

11.2.6 Cost assessment – Flat glass

Sample

The sample adopted to estimate regulatory costs generated by this area of legislation on flat glass producers consists of the following number of plants split across the three defined regions.

Table 75. Flat glass: Sample size used for cost estimates per geographic region in flat glass for special workers' safety and health legislation

Flat glass: Special workers' safety and health legislation	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	5	5	15

Source: Authors' own elaboration.

Direct regulatory costs

Direct regulatory costs generated by special workers' health and safety legislation on EU flat glass manufacturers are estimated to be **€0.12/tonne of production output** for a

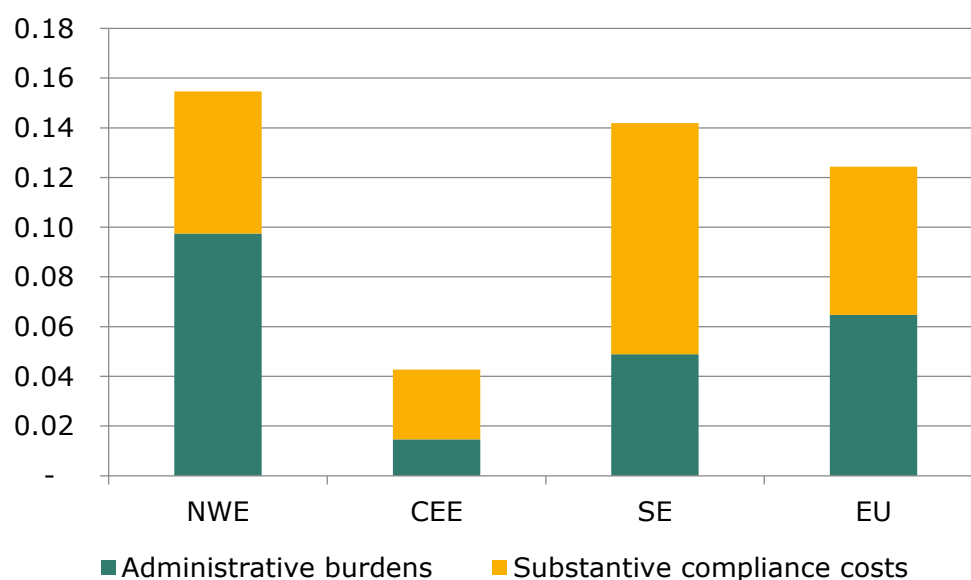
typical year in the EU. Differences between companies are very limited and variance across the EU is low. Variance is also low in the BAU factor, within a range of 62% (in SE) and 77% in (CE). This partially explains differences that occur between geographic areas: whereas in NWE the costs are estimated to be €0.15/tonne of production output, in CEE the costs are estimated to be €0.04/tonne of production output and in SE €0.14 €/tonne of production output.

The direct regulatory costs mainly consist of:

- administrative burdens; and
- substantive compliance costs.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

Figure 70. Flat glass: Regulatory costs generated by special workers' health and safety legislation per region (typical year, breakdown per cost category)



Source: Authors' own elaboration.

Substantive compliance costs

Substantive compliance costs for special workers' health and safety legislation in the flat glass sector are estimated to be **€0.05/tonne** in a typical year at the EU level; hence represent about 43% of total regulatory costs. Differences occur between geographic regions: whereas in NWE the costs are estimated to be €0.04/tonne, in CEE €0.03/tonne and in SE €0.09/tonne.

The difference in costs registered by CEE plants is primarily caused by the spread in labour costs. Tasks, such as the implementation of guidelines and action plans to prevent the exposure to noise or chemical agents above threshold limits, or procedures such as carrying out surveillance of risks from electromagnetic fields and artificial optical radiation, tend to be assigned to a limited number of workers, usually at higher or managerial level. Although the allocation of the number of person-days tends to be uniform across regions, the differences in salaries can produce the observed spread in total costs. In some cases, plants decided to allocate a comparable number of workers in coping with the preparation of guidelines to avoid excessive exposure to chemical agents, tasks which are likely to be

allocated to ISCO 1 and ISCO 3 salary categories. Costs tend, however, to differ at a ratio of one to six and one to four, respectively.

Administrative burdens

Administrative burdens generated by special workers' health and safety legislation on flat glass producers are estimated at **€0.07/tonne of production output** for a typical year in the EU; therefore, they represent some 57% of total regulatory costs. Differences exist between geographic areas: whereas in NWE the costs are estimated to be €0.11/tonne of production output, in CEE the costs are estimated to be €0.015/tonne of production output and in SE to be €0.05/tonne of production output.

The reason for the spread in costs experienced by CEE plants is similar to what is outlined for substantive compliance costs, in the differences recorded at the level of labour costs. The ratios observed in costs tend, however, to improve when the pool of workers involved increases. The more workers are carrying out a task, the more they are distributed across the different ISCO categories, which results in a more uniform structure of salary tables. Plants declare to involve a conspicuous number of employees in tasks updating the list of occupational accidents and drawing up reports on related statistics. Hence, the larger pool of employees participating in these type of tasks partially explains the lesser difference between CEE plants and their European counterparts, as compared to the difference observed for substantive compliance costs.

Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for flat glass producers in the area of special workers' health and safety legislation.

Table 76. Flat glass: Regulatory costs generated by special workers' health and safety legislation (€/tonne, typical year, averages)

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.1	0.015	0.05	0.06
	Substantive compliance costs	0.06	0.028	0.09	0.06
	Direct charges	0	0	0	0
Indirect regulatory costs		NA	NA	NA	NA
Total regulatory costs		0.15	0.04	0.14	0.12

Source: Authors' own elaboration.

12 Other areas of legislation

12.1 Trade legislation

12.1.1 Trade analysis

Overview

The European glass industry faced a **significant slowdown in the overall production** caused by the crisis (mainly led by a contraction in the flat glass sector), **but international trade flows subsequently regained and eclipsed pre-crisis levels**. More specifically, **exports** steadily grew after 2010 with a positive impact on trade balance, at least up to 2013; **imports** increased in the more recent years, thus reducing the positive net EU trade balance (Figure 71). For instance, between 2014 and 2015 extra-EU imports' value increased by €650 million and at a steeper pace than exports, leading to a significant contraction of the trade balance (–€427 million).

Figure 71. Extra-EU trade of the glass industry (left axis: exports and imports; right axis: trade balance; € billions)



Source: Authors' own elaboration on COMEXT (2016).

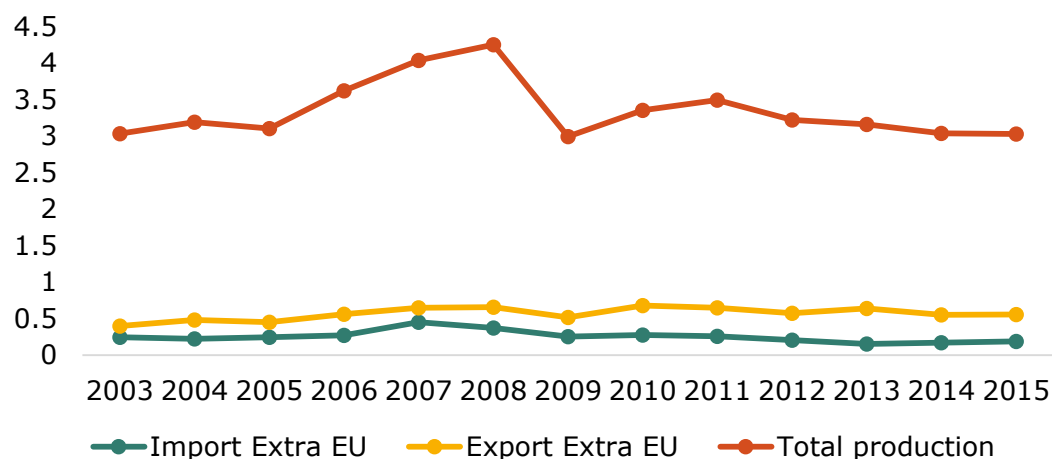
However, there are significant differences (due to product characteristics) between glass sectors when it comes to international trade. **Packaging glass**, in particular, is characterised by a very low value-to-weight ratio that reduces the transport distance for products included in this market segment. Compared to empty glass containers, in the **flat glass** and **glass tableware** segments, transportation costs play a less prominent role and do not represent an obstacle to trade. Indeed, in some cases, maritime transportation is still affordable and allows such products to be transported over long distances. From interviews with stakeholders, in fact, it emerged that the **average distance between plant and customer location** is more than 1,000 km for both flat glass and glass tableware producers. For glass packaging, the average distance is approximately 400 km.¹⁵⁵

¹⁵⁵ For further details, see the Chapter covering transport legislation.

Flat glass

As shown in Figure 72, only **a small fraction of the EU production of flat glass is traded outside EU borders**. After 2006, almost 80% of trade flows in flat glass took place in the EU Internal Market, the remaining 20% with third countries. Figure 72 shows that external trade was quite stable over time compared to the overall value of production, which in 2015 was significantly below the pre-crisis level. Exports in 2015 reached €500 million, while in the same year the production was at around €3 billion. Throughout the entire period under study, the **EU was a net exporter of flat glass**.

Figure 72. Extra EU-28 trade and total production of flat glass (€ billions)



Note: The NACE "Manufacture of flat glass" category (C2311 NACE Rev.2) corresponds to the sum of the following HS categories: 70.03; 70.04; 70.05.
Source: Authors' own elaboration on COMEXT (2016).

As shown in Table 77, in 2015 **Japanese producers were the main exporters of flat glass to the EU**, accounting for 19.5% of EU total import volume, followed by China (13.7%), Turkey (12%) and the United States (11.8%). **The top 10 destination countries include the United States (22.8%), followed by Turkey (10.5%) and Switzerland (10.2%).**

Table 77. Top 10 trading partners for flat glass in 2015 (% of overall export/import values)

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	22.8%	Japan	19.5%
Turkey	10.5%	China	13.7%
Switzerland	10.2%	Turkey	12.0%
China	4.0%	United States	11.8%
Japan	3.8%	Belarus	7.5%
Hong Kong	3.3%	Israel	7.1%
Thailand	3.1%	Switzerland	6.9%
Norway	3.1%	Thailand	5.6%
United Arab Emirates	3.0%	Russia	5.2%
Morocco	2.4%	South Africa	2.7%

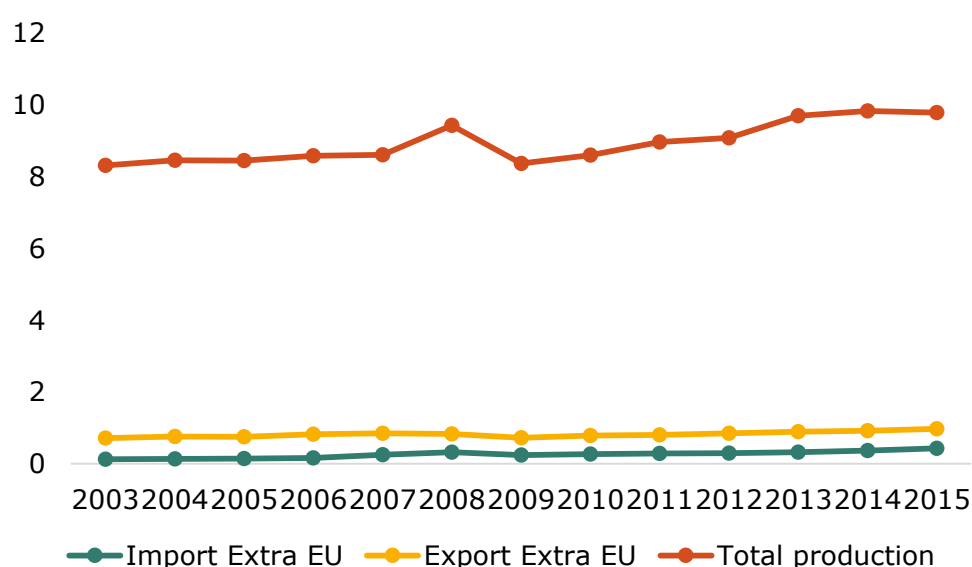
Note: The NACE category "Manufacture of flat glass" (C2311 NACE Rev.2) corresponds to the sum of the following HS categories: 70.03; 70.04; 70.05.

Source: Authors' own elaboration on COMEXT (2016).

Hollow glass

As mentioned above, considering the low value-to-weight ratio, it is no surprise that in the **packaging glass segment**, intra-EU trade also dominated over external trade (by a ratio of five to one). Again, the value of packaging glass traded outside EU borders was quite stable during the period under investigation (Figure 73). The percentage share **of the value traded outside EU borders (cumulating exports and imports) represented less than 20% of the overall production**. Interestingly, packaging glass production grew after 2009.

Figure 73. Extra-EU-28 trade and total production of packaging glass (€ billions)



Note: The NACE category "Manufacture of hollow glass packaging" (C2313 NACE Rev.2) corresponds to HS 7010. Total production includes outputs of the entire packaging glass sector to ensure a meaningful comparison with trade figures.¹⁵⁶
 Source: Authors' own elaboration on COMEXT (2016).

Table 78 identifies **China** as the country with the highest share of exports to the EU (28.1%) followed by Switzerland (12) and India (7.8%). The **United States** was the main destination market (25.7%), followed by Switzerland (13.7%) and Canada (4.8%).

Table 78. Top 10 trading partners for packaging glass in 2015 (% of overall export/import values)

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	25.7%	China	28.6%
Switzerland	13.7%	Switzerland	12.0%
Canada	4.8%	India	7.8%
Russia	3.9%	United Arab Emirates	7.7%

¹⁵⁶ Note that production values presented in section 3.4 cover only those NACE Rev.2 eight-digit codes under examination in this CCA, i.e. 23.13.11.10/20/30/40/50/60/80.

Cumulative Cost Assessment of the EU Glass Industry

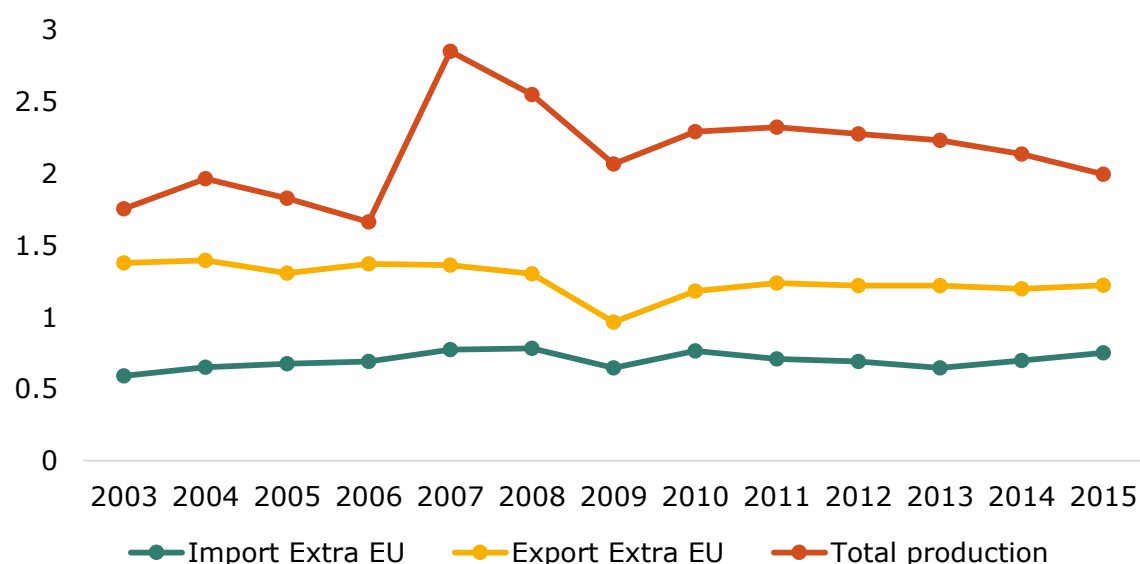
Turkey	3.5%	United States	5.6%
Serbia	3.1%	Moldova	4.1%
Israel	2.7%	Turkey	4.0%
China	2.5%	Taiwan	3.5%
Norway	2.4%	Russia	2.4%
Algeria	2.3%	South Korea	1.9%

Note: The NACE category "Manufacture of hollow glass packaging" (C2313 NACE Rev.2) corresponds to HS 7010.

Source: Authors' own elaboration on COMEXT (2016).

Figure 74 shows the **central role that extra-EU trade** played in the **glass tableware segment**, especially when compared to the overall EU production in this segment. In fact, with the beginning of the financial crisis in 2008, overall production drastically decreased. For instance, in 2015, European exports accounted for 60% of overall production. **The EU was a net exporter of glass tableware**; yet, the net positive trade balance shrunk by €200 million after 2006, falling to €470 million in 2015.

Figure 74. Extra-EU-28 trade and total production of glass tableware (€ billions)



Note: The NACE category "Manufacture of hollow glass tableware" (C2313 NACE Rev.2) corresponds to HS 7013. Total production includes outputs of the entire glass tableware sector to ensure a meaningful comparison with trade figures.¹⁵⁷ Low production value for 2006 is due to missing information for the NACE code 23.13.12.90 "Other drinking glasses".

Source: Authors' own elaboration on COMEXT (2016).

Once again, **China was the top exporter to the EU**, accounting for almost two-thirds of all European imports, followed by Turkey with a 20.5% market share. The United States was the main destination market for EU exports, accounting for 23.2% of total EU exports in 2015. Russia and China followed with 7% and 5.9%, respectively.

¹⁵⁷ Note that the production values presented in section 3.4 cover only those NACE Rev.2 eight-digit codes under examination in this CCA, i.e. 23.13.12.20/40/60 and 23.13.13.50/90.

Table 79. Top 10 trading partners for glass tableware in 2015 (% of overall export/import values)

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	23.2%	China	60.7%
Russia	7.0%	Turkey	20.5%
China	5.9%	India	3.6%
Switzerland	5.5%	Switzerland	2.9%
Japan	5.4%	United States	2.1%
United Arab Emirates	4.3%	Liechtenstein	1.9%
Liechtenstein	3.5%	Egypt	1.1%
Norway	3.1%	Taiwan	0.8%
Australia	3.1%	South Korea	0.7%
Turkey	2.3%	Vietnam	0.6%

Note: The NACE category "Manufacture of hollow glass tableware" (C2313 NACE Rev.2) corresponds to HS 7013.

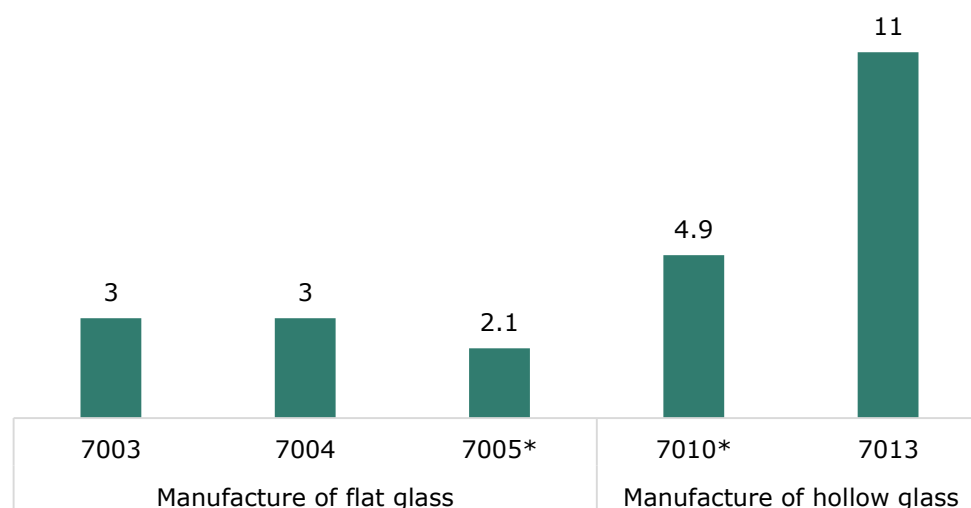
Source: Authors' own elaboration on COMEXT (2016).

12.1.2 Trade policy

Due to the relatively small exposure of the industry to international trade, **no major trade policy initiatives have been taken in the glass sectors covered by the CCA.** Nonetheless, specific sectors that are more exposed to international competition, such as glass tableware, could be subject of future initiatives.

Custom Union tariffs of finished products manufactured by the EU glass industry are quite low (in the range of 2% to 5%). As Figure 75 shows, only glass tableware (category 7013), which is indeed traded all around the world, still faces tariffs equal to 11%.

Figure 75. EU Common Custom Tariffs in the glass industry by subsector, HS Code (%)



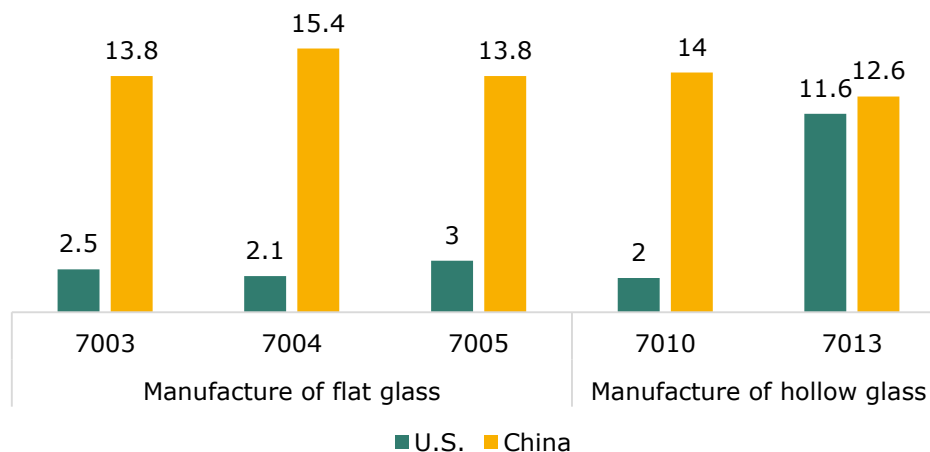
Note: *Average tariff.

Source: Authors' own elaboration on Official Journal of the EU, Volume 56, 31 October 2013.

As shown in Figure 76, the **United States** (main destination market) has a **tariff structure comparable** to the one applied by the EU. In contrast, in **China** (top exporter to EU) **duty rates are considerably higher** for both flat glass and packaging glass; the

only exception is represented by the glass tableware segment (7013) for which the three regions apply similar tariffs in the range of 11% to 12.6%.

Figure 76. Most favoured nation tariffs applied by the US and China in the glass industry by subsector, HS Code (%)



Note: Average tariffs at six-digit level.

Source: Authors' own elaboration based on Market Access Database (MADB).

The legislation affecting trade in glass products mainly consists of the **trade defence package**,¹⁵⁸ whose ultimate purpose is to ensure a fair trade environment. In a nutshell, when harmed by distortive practices, EU companies may consider trade defence instruments and request the EU to start an investigation, targeting specific countries and companies (and products) with *ad hoc* measures. The impact of trade defence measures on total flows of goods between the country starting the investigation and the one under investigation is usually limited; in fact, anti-dumping and anti-subsidy measures target for a limited period a highly specific group of companies in a specific country to preserve an undistorted competitive environment in a specific product category.¹⁵⁹ The situation

¹⁵⁸ EU legislation in the field of trade defence can be broadly classified in two main groups:

1. Anti-Dumping and Anti-Subsidy measures:

- Council Regulation (EC) No 1225/2009 of 30 November 2009 on protection against dumped imports from countries not members of the European Community;
- Regulation (EU) 2016/1036 of the European Parliament and of the Council of 8 June 2016 on protection against dumped imports from countries not members of the European Union (out of the time span covered by this CCA);
- Council Regulation (EC) No 597/2009 of 11 June 2009 on protection against subsidized imports from countries not members of the European Community;
- Regulation (EU) 2016/1037 of the European Parliament and of the Council of 8 June 2016 on protection against subsidised imports from countries not members of the European Union (out of the time span covered by this CCA).

2. Safeguard measures:

- Council Regulation (EC) No 260/2009 of 26 February 2009 on the common rules for imports;
- Council Regulation (EC) No 625/2009 of 7 July 2009 on the common rules for imports from certain third countries;
- Council Regulation (EC) No 427/2003 of 3 March 2003 on a transitional product-specific safeguard mechanism for imports originating in the People's Republic of China and amending Regulation (EC) No 519/94 on common rules for imports from certain third countries.

¹⁵⁹ According to the "Evaluation of the European Union's Trade Instruments" (DG Trade 2012), the impact on bilateral flows hit by dumping (or the anti-dumping procedure) is not great; yet the effect on the specific product category can be noticeable, as it temporarily reduces 'dumped' imports.

slightly changes for **safeguard Regulations**, which, however, are very rarely used by the EU.

Anti-dumping and anti-subsidy measures

Council Regulation 1225/2009 is the main Regulation on **protection against dumped imports** that was in force in the time span covered by the Study (2006-15).¹⁶⁰ This Regulation, in compliance with the WTO anti-dumping agreement,¹⁶¹ allows the EU to set an *ad valorem* duty to offset dumping, once there is sufficient evidence that a dumped price has been applied causing injury to some specific EU companies. There are **several elements to be proved** such as the link between the dumping and the injury and the fact that the potential anti-dumping measure should not go against the interest of the Union.

The setting of the EU anti-dumping duty follows the **lesser duty rule** (LDR). Based on this rule, anti-dumping measures are computed by taking into account the smallest difference between 'dumping margin' and 'injury margin'. More specifically, the **dumping margin** is the difference between the 'normal value', e.g. market price in the exporting country, of the good produced in the exporting country and the import price; whereas the **injury margin** is the difference between the domestic price in the importing country, e.g. EU, and the import price.¹⁶² As the estimate of the injury margin is necessary to set the EU anti-dumping duty, the methodology behind its calculation is crucial to offsetting the negative effect caused by dumped imports.¹⁶³ **The investigation usually lasts 15 months**, during which (nine months after the start of the investigation) provisional measures can be imposed and then definitively collected at the end of the period, when the implementing Regulation confirms or eventually modifies the conditions set in the provisional act. Definitive measures can be in force for five years, after which the measure has to be reviewed and is possibly prolonged.

The procedure to impose **anti-subsidy measures (Council Regulation 597/2009)** does not differ substantially from the anti-dumping procedure, and this explains why the two procedures can be initiated together (see for instance the solar glass cases, AD 598 and AS599, which will be discussed later).¹⁶⁴ It sometimes happens that a market distortion may arise as a result of export subsidies, allowing the exporters to set lower

Moreover, Trade Defence Instruments (TDIs) may affect entry decisions and alter the probability of exit from the market, since they ensure a provisional protection against unfair competitors. As noticed in past studies, the effectiveness of TDIs is not only motivated by the possibility of restoring competitiveness, but also in terms of threat. If TDIs are used in a credible and thorough way, the commercial counterpart will have a higher incentive to abide by trade rules.

¹⁶⁰ It is worth remarking that Council Regulation 1225/2009 was recently repealed by Regulation 2016/1036 of the European Parliament and of the Council of 8 June 2016. Moreover, important changes are expected to be introduced by Commission proposal 2016/0351 of 9 November 2016, which establishes new rules concerning the methodology used to determine the 'normal value' of the dumped product in the exporting country. More specifically, the proposal: i) eliminates the 'analogue country' approach for WTO members; and ii) requires that costs of production and sale reflecting undistorted prices must be used to construct the 'normal value' of the good under examination in WTO members for which serious market distortions are present in the economic sector under investigation, e.g. government intervention influencing prices or costs, and/or defining policies discriminating in favour of domestic producers.

¹⁶¹ www.wto.org/english/docs_e/legal_e/19-adp.pdf.

¹⁶² http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_151016.pdf.

¹⁶³ See note 160.

¹⁶⁴ It should be noted that the Council Regulation 597/2009 was repealed by the Council Regulation 2016/1037 of the European Parliament and of the Council of 8 June 2016. Moreover, through the proposal 2016/0351 of 9 November 2016, the latter Regulation would impose further consultations between the Commission and the country of origin to better capture the effect of subsidies (that might have been found in the course of an investigation).

prices. In this respect, as for anti-dumping procedures, the EU can start an investigation, after receiving a complaint from a trade association. The investigation may prove that the distortive subsidy creates an injury. Once the injury is proved, the EU can impose a countervailing duty that can take the form either of a percentage of the price or of a fixed amount in euros.

Reportedly, in some circumstances, the trade defence instruments package has proven to be too soft on unfair trading practices. Moreover, the 15-month investigation period used by the EU authorities to retrieve relevant information may be too long, leading to increasing uncertainty for businesses.

These are among the reasons why the European Commission launched a public consultation in 2012 to support the modernisation of the trade defence package formulated in 2013,¹⁶⁵ which still awaits legislation.¹⁶⁶ The main changes in the legislative proposal include: i) more predictability for businesses by informing them about any provisional anti-dumping or anti-subsidy measures two weeks before the duties are imposed; and ii) reimbursement of duties collected from importers, when the conclusion of the investigation after the provisional measures shows that there is no reason to maintain the measure. Another element of the proposal consists of the possibility to initiate an investigation *ex officio* rather than following a business complaint, especially in case there is a risk of retaliation. Finally, and most important, anti-dumping duties and countervailing measures may be set in a more flexible way to discourage structural distortions.

Box 17. The debate on Market Economy Status: is it about law, economics or politics?

Debate over granting China MES (Market Economy Status) in anti-dumping and anti-subsidy procedures intensified in 2016. It focused on the unclear interpretation of Article 15 of the WTO Accession Protocol that China and other WTO members agreed upon at the time of its accession in 2001. The article and its sub-paragraphs assumed that in 15 years China would be granted the MES automatically; nonetheless, in the same article, a clause states that this can be done only if the sector under analysis is compliant with the definition of market economy as defined by the country suffering from the unfair practice. Providing a straightforward definition of MES is not an easy task. The EU has set five criteria recognised in the basic anti-dumping Regulation that must be respected to grant the status according to Article 15:

1. Low degree of government influence over the allocation of resources and decisions of enterprises, whether directly or indirectly, e.g. public bodies, for example, through the use of state-fixed prices, or discrimination in the tax, trade or currency regimes.
2. Absence of state-induced distortions in the operation of enterprises linked to privatisation; absence of use of non-market trading or compensation systems (such as barter trade).
3. Existence and implementation of transparent and non-discriminatory company law, which ensures adequate corporate governance (application of international accounting standards, protection of shareholders, public availability of accurate company information).

¹⁶⁵ http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_150837.pdf.

¹⁶⁶ Note that the proposal 2016/0351 of 9 November 2016 only focuses on the methodology to determine anti-dumping and anti-subsidies measures and does not replace the 2013 proposal, as stated in the press release of the Commission. For further information see: http://europa.eu/rapid/press-release_IP-16-3604_en.htm.

4. Existence and implementation of a coherent, effective and transparent set of laws, which ensure the respect of property rights and the operation of a functioning bankruptcy regime.
5. Existence of a genuine financial sector, which operates independently from the State and which, in law and practice, is subject to sufficient guarantee provisions and adequate supervision.

The last assessment of the Commission based on these five criteria goes back to 2008 when the working document¹⁶⁷ stated that only criterion 2 was actually met by China. Although considerable progress had been achieved by China, the other four criteria were not met, thus granting the status was not justified.¹⁶⁸ The economic assessment was also accompanied by the legal interpretation of the article acknowledging the automatic granting after 15 years from the entry into force of the accession protocol.

Granting MES to a country such as China would mean anti-dumping duties would be calculated according to the reference price set by the exporting country, whose companies dumped the products. However, in a country with strong state intervention, the price is kept artificially low, reducing the compensating anti-dumping duties that can be set. China has strongly advocated against the European industry perception that its economy is not driven by market forces and therefore must not be granted the MES; China also referred not only to the legal interpretation but also to a political compromise that can deepen into a fruitful cooperation between the two governments in the future. They nevertheless admit that overcapacity accumulated in some sectors, such as steel and ceramics, affects the global supply and its price; yet, the overcapacity issue cannot be solved in the short term due to the politically charged impact on the workforce employed in these sectors.

Before the final decision, the Commission, taking stock of the call to action by the European Parliament in supporting EU industries,¹⁶⁹ issued a July 2016 press release.¹⁷⁰ During the press conference, Commissioner Malmström admitted that although the EU will keep promoting free trade, it must also ensure a 'fair' trade environment in which trade defence instruments play a role to protect EU industry from structurally distorted low export prices. Commissioner Malmström reiterated in her speech the need for China to cut the overcapacity in some sectors that distort the price at global level and force importing countries such as those in the EU to take action to protect their production.

To account for all the potential consequences of its decision, the Commission also assessed the impacts of three different options: i) not granting MES to China; ii) granting the status and then adopting the same calculation as for other market economies; and iii) granting the status in order to comply with the WTO obligations, but changing the underlying anti-dumping methodology by allowing more flexibility in case of structurally distorted sectors.

As noticed in a recent paper published by the European Parliament,¹⁷¹ other countries have often granted MES to China for political reasons, without an effective use of it in the anti-dumping investigations. In this specific case, if the EU grants the status without being followed by other important players (such as the United States), the effect will be more intense, even if extremely difficult to quantify.

¹⁶⁷ http://trade.ec.europa.eu/doclib/docs/2009/june/tradoc_143599.pdf.

¹⁶⁸ Pelkmans, J. et al. (2016), "Tomorrow's Silk Road: Assessing the EU-China FTA", CEPS Book.

¹⁶⁹ www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2016-0223+0+DOC+XML+V0//EN.

¹⁷⁰ http://europa.eu/rapid/press-release_IP-16-2567_en.htm.

¹⁷¹ [www.europarl.europa.eu/RegData/etudes/STUD/2016/535021/EXPO_STU\(2016\)535021_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/535021/EXPO_STU(2016)535021_EN.pdf)

On 11 December 2016, the date on which the China should have obtained the MES as a WTO member for 15 years, neither the United States nor the EU officially granted the status to China. In reaction, China brought the case to the WTO court.

However, the EU had already proposed a new methodology (Proposal 2016/0351 of 9 November 2016) to define anti-dumping measures that eliminates the (non)market-status approach and repeals it with a country-neutral approach for all WTO members. Nonetheless, the new methodology also sets rules on how to define the 'normal-value' of a dumped product for WTO members that are characterised by significant market distortions. In a nutshell, the proposed provision, i.e. Article 2(6)a, states that, for WTO economies with significant market distortions, costs of production and sales reflecting undistorted prices must be used to construct the 'normal value' of the good under examination in the investigated economy.

Source: Authors' own elaboration.

Categories of regulatory costs generated by the acts

Regulatory costs generated on companies by trade defence instruments such as anti-dumping and anti-subsidy tend to be very low and negligible compared to costs generated by other policy areas. In addition, as trade complaints are not an obligation, but an opportunity, companies will undertake them only insofar as benefits outweigh costs in the case at hand. In this respect, it is worth stressing that a substantive part of the procedure is coordinated by trade associations, which incur the bulk of regulatory costs. According to the DG Trade Evaluation report,¹⁷² the estimated average costs of complaints for an association (across all sectors) is around €60,000 (ranging from less than €10,000 to more than €200,000). On top of internal costs, this amount may also include external costs, e.g. the costs of external consultants or legal support. The report also shows that the costs of making a complaint in the EU are lower than complaint costs incurred by US and Canadian companies. It is worth remarking that companies also may incur some **enforcement costs** for having complained. Indeed, the investigation requires the company to devote a team for collecting and providing information to the relevant trade association, e.g. by filling a questionnaire, on request by the Commission. In this context, DG TRADE offers an online SME TDI Helpdesk¹⁷³ that provides information and advice to reduce the costs for SMEs affected by trade defence investigations abroad and in the EU. Finally, it should be noted that the length of the procedure might generate an additional cost for companies. From the start of the data collection to the imposition of provisional measures, companies may have to suffer alleged dumping for about 15 months, thus experiencing indirect costs in the form of inefficient resource allocation.

Relevance for the EU glass industry

While part of the enforcement costs are included in the annual fee paid by companies to trade associations, as previously mentioned glass companies may incur enforcement costs to provide evidence for the investigation; such costs tend to be relatively higher for SMEs, which at any rate play a minor role in the EU glass sectors covered by this CCA. On a more general note, the unfair trade practices and related inefficient resource allocation usually have a greater impact on SMEs. Nonetheless, as mentioned above, DG TRADE offers an

¹⁷² European Commission (2012), "Evaluation of the European Union's Trade Defence Instruments" (http://trade.ec.europa.eu/doclib/docs/2012/august/tradoc_149882.pdf).

¹⁷³ http://ec.europa.eu/trade/trade-policy-and-you/contacts/#_trade-defence.

online SME TDI Helpdesk,¹⁷⁴ which provides information and advice to reduce the costs for SMEs affected by trade defence investigations (TDI).

When it comes to the glass industry, very recently, the European Commission concluded a successful **investigation against dumped and subsidised imports from China of solar glass**, setting provisional (and definitive) anti-dumping duties in 2013 (AD 598).¹⁷⁵ One year later, it also imposed countervailing duties after the conclusion of the anti-subsidy investigation (AS 599).¹⁷⁶

Besides the solar panels case, which had an effect on the production of flat glass products (although this specific product category is not in the scope of this Study), no other trade defence instrument was used in the sectors under assessment. This was to some extent because of the limited exposure to international trade of the sectors covered by the Study (with the exception of glass tableware, whose exposure to international competition appears to be substantial). However, this may not be the case in the long term, as shown by growth in imports from third countries. There is a broad perception among stakeholders that rising imports, mainly from China, may lead in coming years to issues similar to those affecting sectors such as steel and ceramics.

EU glass tableware producers expressed their concerns with regard to checking the level of compliance of Chinese products with European health and safety rules. Food contact legislation clearly is the first candidate as: i) glass is not listed among the specific material groups under examination; and ii) unlike in Europe, Good Manufacturing Practice (GMP) is not compulsory for food contact materials in China.¹⁷⁷ Mechanisms to assess both **non-preferential and preferential origin** are another significant source of concerns for EU glass tableware producers, especially when the value added rule is applied. Reportedly, there are some doubts about the effectiveness in assessing proper shares of value added of products that underwent a final transformation in a third country. In fact, in the case of preferential origin, the good must have undergone a certain amount of working or processing in the beneficiary country.¹⁷⁸ The fear is that if the share of value added of intermediate and/or final Chinese goods is underestimated, misleading EU origin certifications could be released; as a result, some products would unfairly benefit from reduced or zero rates. On a more general note, EU glass tableware producers stressed that for policy purposes their production is generally included in the same category (hollow glass) that encompasses packaging glass. As shown above, the two subsectors are differently exposed to international trade and overlooking this difference may lead to devising inadequate trade policy for glass tableware.

Safeguard measures

Safeguard measures can be imposed when the EU experiences a sharp increase of imports from non-EU countries that cause severe injury in the domestic market. The imposition of safeguard measures is regulated by acts, distinguishing either WTO (**Council Regulation (EC) No 260/2009**) or non-WTO countries (**Council Regulation (EC) No 625/2009**).

¹⁷⁴ Ibid.

¹⁷⁵ Commission Implementing Regulation (EU) 2015/1394 of 13 August 2015 amending Regulation (EU) No 470/2014, as amended by Regulation (EU) 2015/588, imposing a definitive anti-dumping duty and collecting definitively the provisional duty imposed on imports of solar glass originating in the People's Republic of China following an absorption reinvestigation pursuant to Article 12 of Council Regulation (EC) No 1225/2009.

¹⁷⁶ Commission Implementing Regulation (EU) No 471/2014 of 13 May 2014 imposing definitive countervailing duties on imports of solar glass originating in the People's Republic of China.

¹⁷⁷ www.cirs-

reach.com/China_Chemical_Regulation/Food_Contact_Regulations_Food_Contact_Materials_in_China.html.

¹⁷⁸ www.europarl.europa.eu/thinktank/en/document.html?reference=LDM_BRI(2013)130513.

A third act on the transitional product-specific mechanism was an exception that expired in 2013: it was negotiated for products coming from China at the time of its WTO accession (**Council Regulation (EC) No 427/2003**). Compared to Regulation No 260/2009, the criteria to establish safeguard measures were less stringent.

The investigation period usually lasts nine months, and afterwards the EU can impose import or tariff quota for 200 days, and then for four years in case of definitive measures. The import quota is generally equal to the average level of imports over the last three representative years (EC 2013).¹⁷⁹

Categories of regulatory costs generated by the acts

Safeguard complaints against third countries can be initiated by either a Member State or the Commission itself. In the first case, the industry that is injured by the import's sharp increase must provide sufficient information. Although, no evidence has been collected in the context of this Study, it is reasonable to assume that the EU business may incur some **enforcement costs** when providing information to trade associations.

Relevance for the EU glass industry

The European Union does not have any safeguard measures in place in the glass industry, so no costs for EU businesses were generated by EU rules on safeguard measures. This applies to the entire period under observation.

However, it is worth noticing that there are two safeguard measures against EU Member States affecting the glass industry:

- Safeguard measure (definitive in August 2011) on glass block exported to Thailand;
- Safeguard measure (investigation initiated in September 2014) on glass bottles exported to Tunisia.

¹⁷⁹ http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_151031.pdf.

12.2 Competition legislation

Competition policy is a crucial **factor shaping the environment** where European companies operate and affecting the competitiveness of EU businesses *vis-à-vis* their international competitors. EU competition law covers the following aspects: i) agreements/concerted practices; ii) abuses of dominant position; iii) mergers; and iv) state aid. A qualitative assessment of the regulatory costs generated by the most relevant EU competition legislation follows. More specifically, legislation is divided into two main groups based on the nature of the related regulatory costs:

- **Antitrust legislation and merger control:**
 - Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty;
 - Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings (the EC Merger Regulation);
- **State aid control:**
 - Council Regulation (EC) No 659/1999 of 22 March 1999 laying down detailed rules for the application of Article 93 of the EC Treaty;
 - Commission Regulation (EC) No 794/2004 of 21 April 2004 implementing Council Regulation (EC) No 659/1999 laying down detailed rules for the application of Article 93 of the EC Treaty;
 - Council Regulation (EU) No 734/2013 of 22 July 2013 amending Regulation (EC) No 659/1999 laying down detailed rules for the application of Article 93 of the EC Treaty;
 - Community guidelines on state aid for environmental protection (2008/C 82/01);
 - Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01);
 - Guidelines on certain state aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04).

12.2.1 Antitrust legislation and merger control

Antitrust law in the EU is mainly based on the provisions included in two articles of the Treaty on the Functioning of the European Union (TFEU): i) **Article 101 TFEU** prohibiting agreements (both horizontal and vertical), concerted practices and decisions by associations of undertakings that restrict competition; ii) **Article 102 TFEU** prohibiting abuses of dominant position. The enforcement of these articles is governed by **Council Regulation (EC) No 1/2003**. This Regulation, *inter alia*, provides procedural rules and defines powers of the Commission, national courts and national competition authorities. More specifically, it obliges national bodies to apply Articles 101 and 102 TFEU whenever they deal with cases which may affect trade between Member States.

Merger control in the EU is governed by **Council Regulation (EC) No 139/2004** that applies to mergers and acquisitions with a community dimension¹⁸⁰ and aims to avoid that

¹⁸⁰ The EU dimension is met in two different cases: i) the combined worldwide turnover of the merging companies is higher than €5 billion and at least two companies have an EU-wide turnover greater than €250 million; ii) the combined worldwide turnover of the merging companies is greater than €2.5 billion, and the combined turnover of such companies is greater than €100 million in at least three Member States, and at least two companies have a turnover greater than €25 million in each of the above-mentioned Member States, and at least two companies have an EU-wide turnover greater than €100 million. At any rate, the EU dimension is not met if each of the firms archives more than two-thirds of its EU-wide turnover within one and the same Member State.

concentrations between undertakings hamper effective competition in the Internal Market or in a substantial part of it. Prior notification of concentrations above a certain turnover threshold is required, and the Commission is in charge of assessing the compatibility of the notified cases with the good functioning of the Internal Market.

Categories of regulatory costs

As mentioned, antitrust law sets the 'rules of the game' for businesses operating in the Internal Market. In this respect, Articles 101 and 102 TFEU as well as Council Regulation (EC) No 1/2003 are not expected to trigger any regulatory cost for companies that comply with antitrust legislation. Yet, companies involved in competition cases may incur both **administrative burdens** insofar as they are called to provide evidence to the Commission and **enforcement costs** in the form of litigation costs. Any quantification of such regulatory costs based on specific cases cannot be extended to the entire population of EU companies. In fact, it is fair to assume that entities undergoing antitrust investigation are not representative as the majority of market players abide by relevant antitrust rules.

Conversely, merger control applies to all merging companies reaching certain turnover thresholds, irrespective of their compliance with legislation covering anti-competitive agreements and abuse of dominant position. More specifically, such companies have to notify mergers and acquisitions to the Commission by following a specific procedure. In addition, in case their combined market share is higher than 15% on any relevant market where they both compete or 25% on vertically related markets, merging companies undergo a full investigation by the Commission and are obliged to provide further evidence. In this context, compliance with Council Regulation (EC) No 139/2004 requires large companies operating in the EU to incur both **administrative burdens** and **litigation costs** in case they decide to merge one another. At any rate, such costs are linked to a specific event in the 'life' of a company and their impact on overall costs and international cost competitiveness is expected to be very limited.

Relevance for the EU glass industry

In the context of EU competition legislation, over the period 2006-15 **the glass industry faced no sector-specific rules**. In the same way as any other sector, they were bound by antitrust legislation covering cartels, abuse of dominant position and mergers.

The Commission online tool "Search Competition Cases" allows to identify **antitrust cases and merger notifications** under scrutiny by the Commission during the period 2005-16 (Table 80).¹⁸¹ In the selected timespan, two cartels were detected in the glass industry (flat glass – 23.11; and glass bulbs – 23.19). In addition, glass manufacturers notified 15 mergers to the Commission, many of them involving several glass subsectors (23.1); the majority of mergers were approved via a simplified procedure as per Commission Notice 2005/C 56/04.¹⁸² This simplified approach is expected to streamline merger approval and reduce the administrative burden and litigation costs for merging companies. Against this background, over the period 2006-15, it is likely that Council Regulation (EC) No 139/2004 generated some **minor regulatory costs** only **on specific companies** operating in selected subsectors of the glass industry.

¹⁸¹ "Search Competition Cases" by the European Commission (http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3).

¹⁸² Commission Notice on a simplified procedure for treatment of certain concentrations under Council Regulation (EC) No 139/2004 (2005/C 56/04).

Table 80. List of antitrust cases and merger under the scrutiny of the Commission in the glass industry (2006-15)

Policy area	Case Number	Title	NACE
Cartel	39165	Flat Glass	23.11
Cartel	39605	CRT glass bulbs	23.19
Merger	M.4173	NIPPON SHEET GLAS / PILKINGTON	23.11
Merger*	M.4306	SHELL / SAINT-GOBAIN / AVANCIS JV	23.1
Merger*	M.4598	SAGARD / COGNETAS / GROUPE SAINT-GOBAIN DESJONCQUERES	23.1
Merger*	M.4708	GERRESHEIMER / CHASE / JV	23.19
Merger*	M.5642	SGGF / TRAKYA / SGGE	23.1
Merger*	M.5719	OAKTREE / SGD	23.1
Merger	M.5737	SG VETRI / ZIGNAGO VETRO / ARDAGH GLASS / ECOSUD	23.1
Merger	M.6025	ARDAGH / IMPRESS	23.1
Merger*	M.6049	COMPAGNIE DE SAINT-GOBAIN / TRAKYA / JV	23.1
Merger*	M.6489	SAINT-GOBAIN / TRAKYA / SISECAM / JV	23.1
Merger*	M.6532	SAMSUNG GROUP / CORNING GROUP	23.1
Merger	M.6557	AGC GLASS EUROPE / INTERPANE INTERNATIONAL GLAS	23.11 – 23.12
Merger*	M.6734	KOCH INDUSTRIES / GUARDIAN	23.1
Merger*	M.6893	CARL ZEISS / CARL ZEISS VISION	23.19
Merger*	M.7693	APOLLO / VERALLIA GROUP	23.1

Note: * Simplified procedure; cases were retrieved by setting as search parameters: i) a decision date between ^t January 2006 and 31 December 2015; and ii) NACE rev.2 Code 23.1, 23.11 or 23.13.

Source: Authors' own elaboration on European Commission.

12.2.2 State aid control

The **legal regime of state aid** in the EU aims to avoid distortions of competition and trade among Member States, due to direct or indirect government interventions in the market. The basic principles are laid down in **Article 107 TFEU**. The first paragraph of this article provides a definition of state aid deemed **incompatible with the EU Internal Market**. In particular, aid measures granted by Member States which are able to distort competition and trade in the EU by favouring certain undertakings or the production of certain goods are generally prohibited. Based on **Article 108 TFEU**, to ensure that the general prohibition is respected and exemptions are applied equally across the EU, the European Commission is responsible for monitoring the existing national state aid systems. Procedural rules are laid down in **Council Regulation (EC) No 659/1999** – implemented by **Commission Regulation (EC) No 794/2004** – which sets the obligations of Member States to notify aid measures and to provide annual reports, as well as the powers of the Commission to carry out investigations and make decisions – and amended by **Council Regulation (EU) No 734/2013** – which introduced the possibility of conducting state aid sector inquiries.

On the ground of Article 107(3) TFEU, several **horizontal non-binding guidelines** are set to define the Commission position towards certain categories of aid. Horizontal environmental aid measures were covered by **Community Guidelines on State Aid for Environmental protection (2008/C 82/01)** that were replaced by the **2014-20 Guidelines on State Aid for Environmental Protection and Energy (2014/C 200/01)**. The new guidance document extends the scope of the previous guidelines to the energy field and covers state aid to energy infrastructure projects, generation

adequacy measures and energy intensive users. These guidelines, which are included in the TOR within Competition legislation, are relevant to assess the cost impact of the Renewable Energy Directive and are therefore further discussed in the Chapter covering EU energy legislation. At any rate, they are **applicable from 1 July 2014** and have a rather limited impact on the timespan covered by this Study. In addition, state aid in the context of the EU Emissions Trading Scheme are covered by **Guidelines on certain state aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04)**.

Categories of regulatory costs

In principle, the EU state aid control does not generate regulatory costs for businesses. In fact, Member States are in charge of notifying the measures they intend to adopt. Still, some minor **administrative burdens** and **litigation costs** may affect companies that are targeted by specific state aid intervention and have to provide relevant information to the Member State in order to file the notification. In addition, companies might be called to share additional evidence with the European Commission in case there are serious doubts as regards the compatibility of the notified measure with EU state aid rules and an in-depth investigation is required.

A formal investigation is opened also when the Commission receive information on alleged unlawful aid, i.e. aid granted without prior Commission authorisation. More recently, after the entry into force of Council Regulation (EU) No 734/2013, administrative burdens and litigation costs may stem from state aid sector inquiries where the Commission can use its market investigation tools to **gather information** from public authorities and market participants.

Finally, horizontal guidelines issued by the Commission generally aim at streamline the process to grant aids, simplify notification procedures and increase certainty in the application of state aid rules. In this respect, **no regulatory costs** are expected to stem from the guidelines in the scope of the CCA. Nonetheless, their impacts on costs generated by EU energy, climate and environmental legislation are considered in the Chapters covering the relevant legislation.

Relevance for the glass industry

In the context of EU state aid control, companies operating in the EU glass industry, like the majority of companies operating in other sectors, were entitled to benefit from, *inter alia*, state support measures contributing to the EU 2020 objectives, e.g. R&D and innovation, training and employment aid, SME aid, aid to increase environmental protection and aid under the *de minimis* exemptions. More specifically, based on rules established by Guidelines on State Aid for Environmental Protection (2008/C 82/01), in principle glass producers were able to **access to aid measures aiming to promote environmental protection** - without adversely affecting trade between Member States to an extent contrary to the EU common interest. The possibility to grant environmental aid allowed balancing the requirements of environmental protection with competition rules, thus promoting sustainable development. The glass industry is also covered by the 2014-20 new Guidelines on State Aid for Environmental Protection and Energy that have been applied since 1 July 2014 and provide *inter alia* criteria on how Member States can **exempt energy intensive companies that are particularly exposed to**

international competition from charges levied for the support of renewables (see Annex 3 of the guidelines).¹⁸³

As previously mentioned, detailed rules on state aid permissible under the ETS Directive were laid down in the Commission Guidelines on certain state aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04), generally applicable to costs incurred by undertakings as from January 2013. These guidelines include an **explicit list of sectors** to which state aid for indirect ETS cost could be considered applicable (Annex II), and **none of the glass subsectors of interest are mentioned** therewith.¹⁸⁴ Additionally, all EU Member State notifications to DG Competition on the European Commission of their intent to provide state aid for indirect ETS costs have explicitly included a statement reiterating the list of sectors from Annex II.

Finally, the Commission online tool "Search Competition Cases" provides a list of state aid notified to/registered by the Commission over the period 2006-15 and affecting individual companies in the glass industry. The Commission approved the majority of notified measures without starting a formal investigation (Table 81). As mentioned above and in light of this qualitative analysis, it appears that state aid rules did not generate substantial regulatory costs on glass companies over the timespan covered by the CCA.

Table 81. List of state aid cases notified to/registered by the Commission in the glass industry (decision date between 2006 and 2016)

Policy area	Case Number	Member State	Title	NACE
State Aid (A)	C15/2006	France	MSF 98 - Pilkington/Interpane	23.1
State Aid (A)	N191/2008	Germany	LIP - DE - F glass	23.1
State Aid (A)	SA.34756	Poland	Program wieloletni pomocy - dotacja celowa na inwestycję Pittsburgh Glass Works (Poland) Sp. z o.o.	23.11
State Aid (A)	SA.36510	Poland	Poland - LIP - Euroglas Polska Sp. z o.o.	23.11 - 23.12
State Aid (F)	SA.39990	Belgium	Alleged aid to Ducatt NV	23.11

Note: A: approved without investigation – F: Formal investigation ongoing; cases were retrieved by setting as search parameters: i) a decision date between 1 January 2005 and 31 December 2016; and ii) NACE rev.2 Code 23.1, 23.11 or 23.13.

Source: Authors' own elaboration on European Commission.

¹⁸³ The majority of subsectors covered by the CCA are included in Annex 3 and therefore eligible for aid in the form of reductions in the funding of support for energy from renewable sources. By reason of the high extra-EU trade intensity registered in these subsectors (Annex 5 of the guidelines), individual companies can still be eligible for this aid in case their electricity-intensity is at least 20%.

¹⁸⁴ According to some stakeholders interviewed for this Study, this may penalise producers of hollow glass for packaging *vis-à-vis* producers of competing packaging materials such as aluminium and, to a minor extent, steel.

12.3 Transport legislation

12.3.1 Description of the Acts

Directive 2002/15/EC on the organisation of the working time of persons performing mobile road transport activities entered into force in March 2002. This Directive includes **specific provisions concerning the hours of work in road transport** in order to ensure both the safety of transport and the health and safety of the persons involved.

Similarly to the Directive above, **Regulation 561/2006/EC** on the harmonisation of certain social legislation relating to road transport gives an overview of a common set of EU rules for maximum daily and fortnightly driving times, and daily and weekly minimum rest periods for all drivers of road haulage and passenger transport vehicles, subject to specified exceptions and national derogations.¹⁸⁵ **Transport companies are obliged to put in place continuous monitoring and control systems**, which are carried out on national and international level via checking tachograph records.

Through the **Directive 2006/22/EC** on minimum conditions for the implementation of Council Regulations (EEC) No 3820/85 and (EEC) No 3821/85 concerning social legislation relating to road transport activities and repealing Council Directive 88/599/EEC, the EU has **developed a comprehensive policy on inspecting and checking compliance with social road transport legislation**. This Directive sets technical standards, establishes the rules on the use, type of approval, installation and inspection of tachographs. It therefore creates a range of legal obligations for manufacturers, authorities, transport operators and drivers.

12.3.2 Categories of regulatory costs

Based on the above legislation the average weekly working time in road transport should not exceed 48 hours. Member States have to ensure that daily working time may not exceed eight hours (10 hours only if an average of eight hours a day is not exceeded within two months) for night workers. EU rules require keeping records of the workers' working time, thus generating **administrative burdens** for the transport companies.

Transport Regulation might cause direct costs for companies, which have transport integrated in their activities, and (depending on the market power) indirect costs if not integrated. In fact, glass producers might have agreements with transport providers to move their products and this can lead to **indirect regulatory costs**.

Based on this, more strictly enforced and reduced working hours can generate also **substantive compliance costs**. In fact, glass producers or they transport service providers might have to hire more drivers in order to transport the same amount of resources/products during the same time. More drivers are equivalent to direct costs for those glass companies whose upstream and/or downstream logistics are integrated, and indirect costs for those glass companies that outsource road transportation of raw materials or finished products.

12.3.3 Relevance for the sectors

Transport logistics constitutes an important activity and source of costs for the glass industry, especially for products that are transported over long distances. Interestingly, the lion's share of interviewed glass manufacturers outsource their transport activities; hence, it was not possible to collect data on costs generated by the relevant EU legislation.

¹⁸⁵ European Commission, Mobility and Transport (http://ec.europa.eu/transport/modes/road/social_provisions/driving_time/index_en.htm).

Figure 77. Average distance between plant and customer’s location and between plant and main materials (transport legislation)



Source: Authors’ own elaboration.

The figure above outlines the average distance by sector for the plants considered. Variations across sectors can be explained by the differences in the types of production as well as in the structure of the market. Whereas distance between the plant and source of raw material is more or less constant across the three type of products, the distance from customers is considerably lower in packaging glass than in both flat glass and glass tableware.

At any rate, based on interviews with EU associations and information collected via the scoping questionnaire, transport legislation is not seen to be a major source or regulatory costs for the industry. Overall feedback from industry suggests that the Directives are of low relevance for their industry. The interviewed companies did not experience **any increase of transportation costs** due to changes in the European legislation. That means that even if the legislative changes caused some additional costs for transport providers, the pass-on of such costs might have been quite limited.

According to some glass producers, regulatory costs are not generated by EU rules but rather by **differences in national legislation across the EU**. For instance, costs stem from differences in legislation regarding technical dimensions of vehicles and trailers. In addition, some Member States limit the circulation of heavy vehicles during the weekend, thus making cross-border deliveries more complex. Finally, any reintroduction of checkpoints at national borders would further impinge on the efficiency of pan-European transport networks.

Part C. Cumulative Cost Assessment

13 Cumulative cost assessment

Part C of the Study presents **cumulative regulatory costs** generated by EU rules for the EU glass industry between 2006 and 2015. More specifically, for each sector and subsector in the scope of the assessment, i.e. hollow glass, including packaging glass and glass tableware; and flat glass, the following information over the period 2006-2015 is provided:

- **Cumulative regulatory costs per category of costs**, i.e. i) administrative burdens (AB), ii) substantive compliance costs (SCC), iii) direct charges (DC), and iv) indirect costs (IC).
- **Cumulative regulatory costs per piece/area of legislation**, i.e. i) Internal Market for chemicals, ii) Internal Market for construction products, iii) electricity, iv) gas, v) energy efficiency, vi) climate, vii) environment, viii) waste, ix) packaging waste, x) general worker's health and safety and workplace safety, xi) special worker's health and safety, xii) consumers and health and xiii) the Measuring Instruments Directive.
- **Cumulative cost versus production costs**¹⁸⁶ incurred by EU glass producers.
- **Cumulative cost versus EBITDA** registered by EU glass producers; EBITDA (earnings before interest, taxes, depreciation and amortisation) measure the profitability of a company before covering yearly depreciation and amortisation of CAPEX, financial costs and national taxes.¹⁸⁷
- **Cumulative cost versus EBIT** registered by EU glass producers; EBIT (Earnings Before Interest and Taxes) measure the profitability of a company before covering financial costs and national taxes.¹⁸⁸

As mentioned in Chapter 2, margins measured in this Study are expected to be higher than average margins experienced by the EU glass industry across the period under observation. This is mainly due to sample selection (see Chapter 3). In fact, all samples include only installations that were already operating in 2006 and are still operating today; therefore, all sampled plants survived the 2008 economic and financial crisis. It is reasonable to assume that these plants are more efficient and profitable than those that shut down between 2006 and 2015.

Before presenting cumulative regulatory costs, it is worth reiterating some methodological aspects detailed in Part A and B of this Study:

- Regulatory costs generated by electricity, gas, energy efficiency and climate legislation as well as key performance indicators, production costs and quantities of output were **collected for each year of the time span covered by the CCA**. Therefore, in the analysis below, such costs and margins vary across years in both absolute value and €/tonne (by reflecting variations in the production output of sampled plants).

¹⁸⁶ Production costs include all costs, both OPEX, CAPEX and other expenses, borne by the plant and directly relating to the manufacturing process.

¹⁸⁷ EBITDA are a proxy of the plant's current operating profitability. Positive EBITDA indicate that operating revenues are higher than variable costs, i.e. labour costs, energy costs, raw material costs, etc. By contrast, negative EBITDA show that the plant is not able to fully cover such variable costs nor to cover yearly depreciation and amortisation of CAPEX as well as financial interest and income tax expenses.

¹⁸⁸ The only exception is represented by glass tableware, as EBIT of sampled plants are very different and no meaningful average can be presented. EBIT are a proxy of the plant's operating income. Positive EBIT indicate that operating revenues are high enough to cover all variable costs as well as yearly depreciation and amortisation of CAPEX. By contrast, negative EBIT show that the plant is not able to cover such costs nor to cover financial interest and national taxes.

- Regulatory costs generated by legislation in the field of Internal Market for chemicals, Internal Market for construction products,¹⁸⁹ the Measuring Instruments Directive, waste (including packaging waste), general workers' health and safety and workplace safety, special worker's health and safety and consumers and health were **quantified for a 'typical year'**. In fact, such cost data are less sensitive to variations in production output. Therefore, over the period under observation, such cost items vary only in terms of €/tonne, reflecting changes in production outputs of sampled plants.
- With regard to regulatory costs generated by environmental legislation, a **cumulated approach** was adopted as, in any given year, each plant incurs costs related to investments made in the same year as well as costs linked to investments made in previous years. As the Research Team did not collect investment costs incurred before 2006, a realistic cost estimate is possible only for the last year of the period under analysis, i.e. 2015. In practice, 2015 cumulated compliance costs include: i) the depreciation for investments made that year as well as depreciation for all the investments made since 2006; ii) the operating costs linked to the investments between 2006 and 2015; and iii) the financial costs incurred for the financing of all investments made since 2006. Therefore, **year 2015 was selected as a 'typical year'** and in the analysis below costs generated by environmental legislation vary across years only in terms of €/tonne as a result of changes in quantities produced by sampled plants.
- **EU averages are weighted averages of regional averages** and are computed by adopting as weights the regional turnover in the specific sector. This approach allows capturing the uneven distribution of production across the EU. Therefore, changes across years in the share of turnover produced in each region affect EU averages.
- **Regional averages are weighted averages of plant level regulatory costs**, adopting as weights the yearly plant production in tonnes; hence, yearly changes in production output of sampled plants are reflected in both regional and EU averages.

In what follows, **data for packaging glass and flat glass are provided both at the EU and regional level**. Conversely, as discussed in Chapter 3, **data for glass tableware are available only at the EU level**.

¹⁸⁹ Regulatory costs generated by legislation in the field of Internal Market for construction were collected for two different 'typical years', i.e. before and after the entry into force of CPR. Data for a 'typical year' before the introduction of CPR capture cost impacts of CPD.

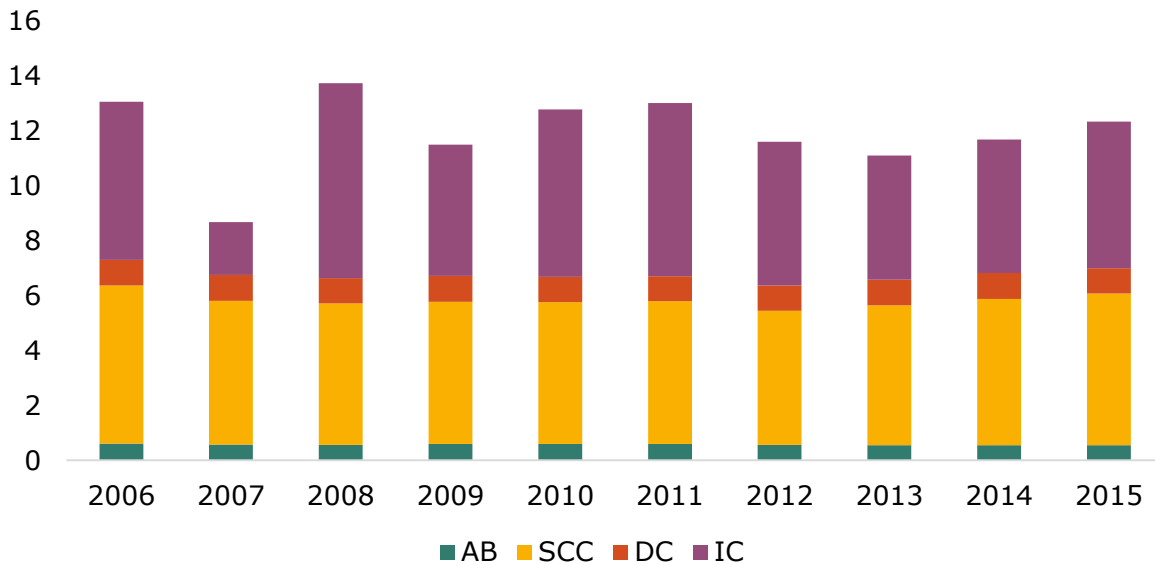
13.1 Hollow glass: packaging glass

13.1.1 EU

The EU rules in the scope of the CCA generated regulatory costs for the EU packaging glass subsector ranging from **€8 to €14 per tonne of output** (Figure 78). Substantive compliance costs and indirect costs were the bulk of regulatory costs in all the years under observation, with the exception of 2007 when indirect costs triggered by climate legislation collapsed as a result of low prices for EUAs. Over the entire period, **climate legislation and legislation in the field of electricity were the most burdensome areas of legislation, each generating costs of €2.6/tonne**. Environmental legislation and waste legislation followed, each with an average of about €2.4/tonne (Figure 79).

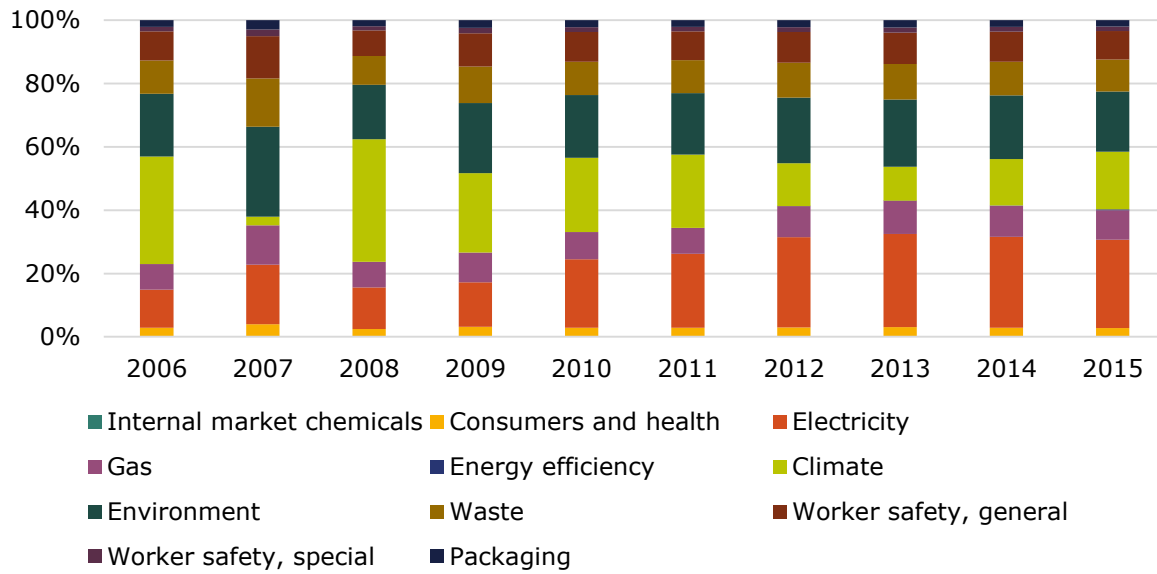
In 2015, the cumulative regulatory costs were equal to €12.31/tonne, including €0.55/tonne of administrative burdens, €5.51/tonne of substantive compliance costs, €0.92/tonne of direct charges and €5.33/tonne of indirect costs (mainly generated by energy and climate legislation). Rules affecting the electricity price generated 28% of total regulatory costs followed by environmental legislation (19%) and climate legislation (18%).

Figure 78. Packaging glass: Cumulative cost by category of regulatory costs (€/tonne, EU)



Source: Authors' own elaboration.

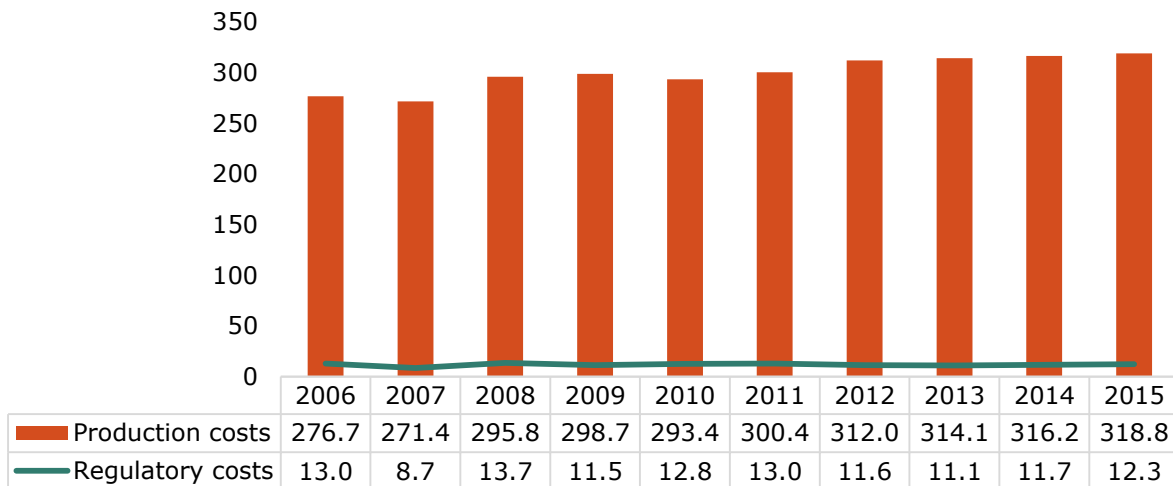
Figure 79. Packaging glass: Cumulative cost by area of legislation (% , EU)



Source: Authors' own elaboration.

Cumulative regulatory costs are in the area of **3.2% to 4.7% of production costs** incurred by producers of packaging glass during the period under investigation (Figure 80).¹⁹⁰ **EBITDA** of the subsector were stable at more than 70€/tonne; hence, regulatory costs represented on average **15% of this key performance indicator** (Figure 81).

Figure 80. Packaging glass: Cumulative cost versus production costs (€/tonne, EU)

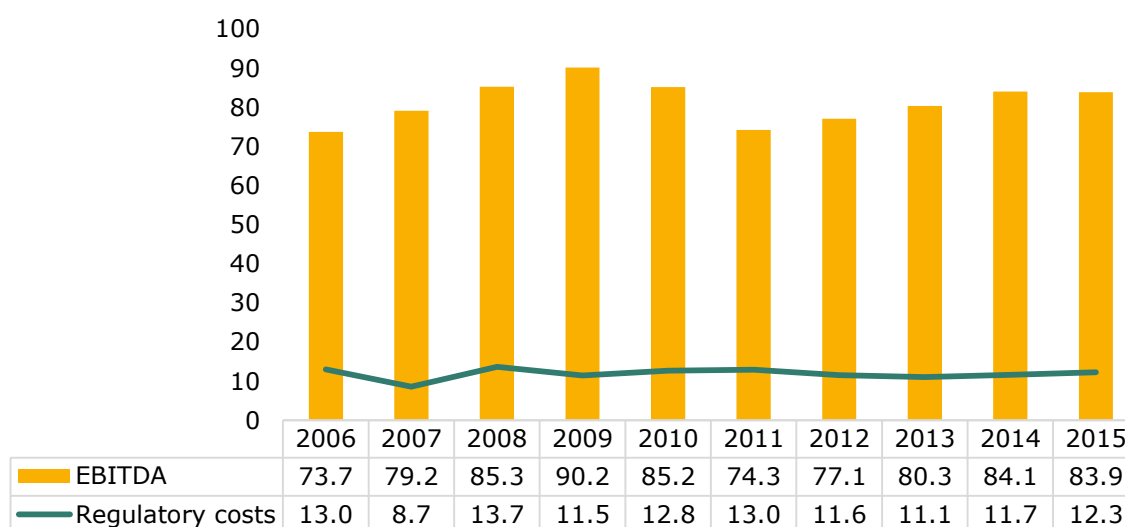


Note: Production costs are estimated on a sample of 19 plants in 2006, 20 between 2007 and 2010 and 21 plants between 2011 and 2015.

Source: Authors' own elaboration.

¹⁹⁰ The EU sectoral turnover per tonne of output ranged between €368 (in 2006) and €438 (in 2015). Cumulative regulatory costs represented between 2.3% and 3.5% of the turnover per tonne of packaging glass.

Figure 81. Packaging glass: Cumulative cost versus EBITDA (€/tonne, EU)

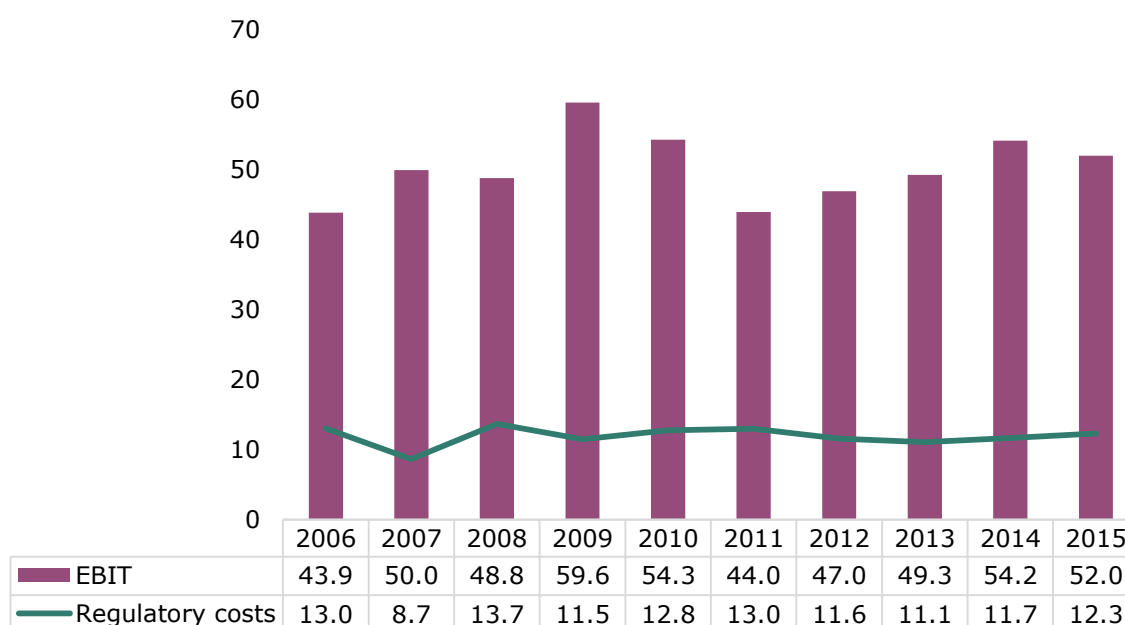


Note: EBITDA are estimated on a sample of 19 plants in 2006, 20 between 2007 and 2010 and 21 plants between 2011 and 2015.

Source: Authors' own elaboration.

The EBIT trend over the period 2006-15 follows closely the trend registered by EBITDA. On average, **cumulative regulatory costs were 24% of EBIT**; a peak was reached in 2011, when regulatory costs represented 29.5% of EBIT due to a dramatic drop of this indicator.

Figure 82. Packaging glass: Cumulative cost versus EBIT (€/tonne, EU)



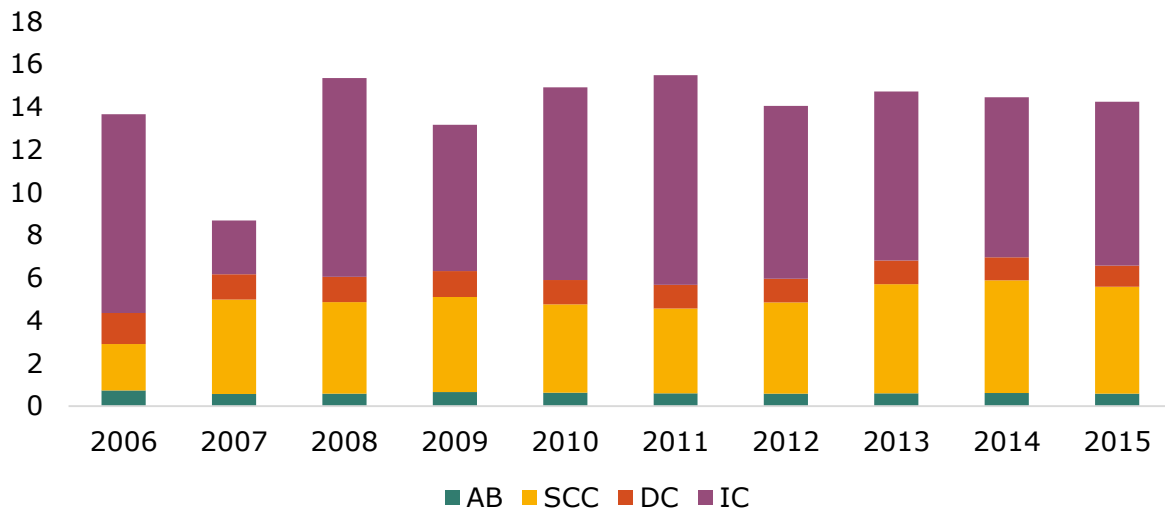
Note: EBIT are estimated on a sample of 19 plants in 2006, 20 between 2007 and 2010 and 21 plants between 2011 and 2015.

Source: Authors' own elaboration.

13.1.2 Central-Eastern Europe

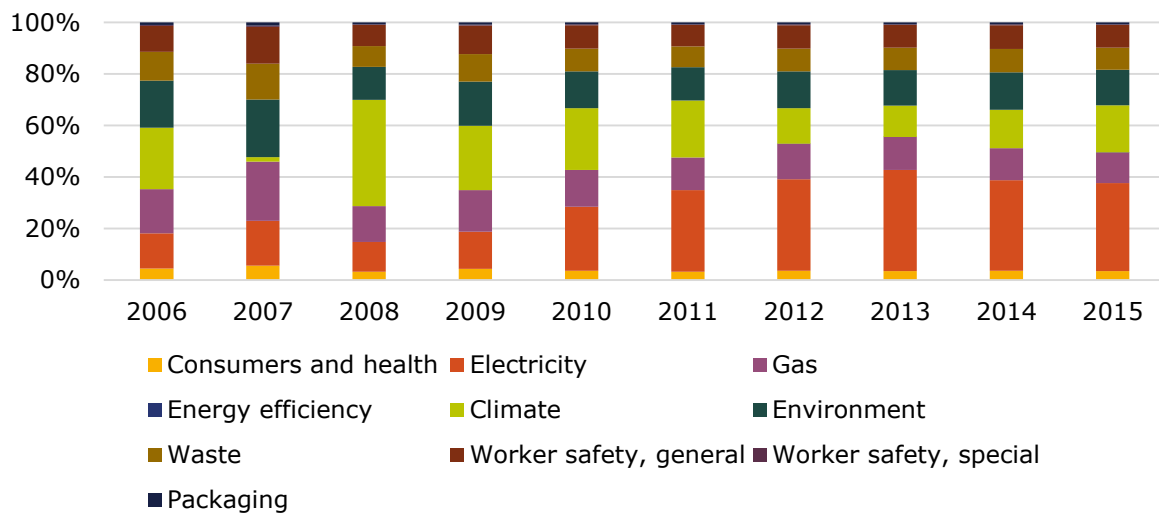
The CEE region registered the highest regulatory costs; the most prominent share was represented by indirect costs (energy and climate legislation). Regulatory costs were on average €13.86/tonne (Figure 83). Overall, rules affecting the electricity price and climate legislation were the first two cost components with an average share of 25.8% and 19.7%, respectively, followed by environmental legislation (15.4%) and rules affecting the gas price (14.8%; Figure 84).

Figure 83. Packaging glass: Cumulative cost by category of regulatory costs (€/tonne, Central-Eastern Europe)



Source: Authors' own elaboration.

Figure 84. Packaging glass: Cumulative cost by area of legislation (% , Central-Eastern Europe)

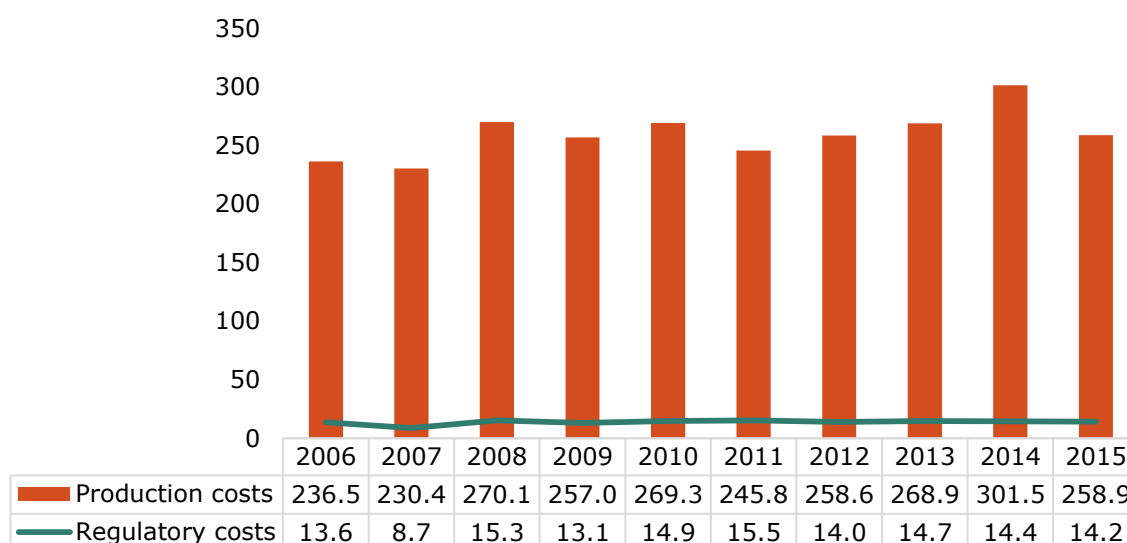


Note: Costs for "Internal Market for chemicals" cannot be shown for this region due to confidentiality reasons.

Source: Authors' own elaboration.

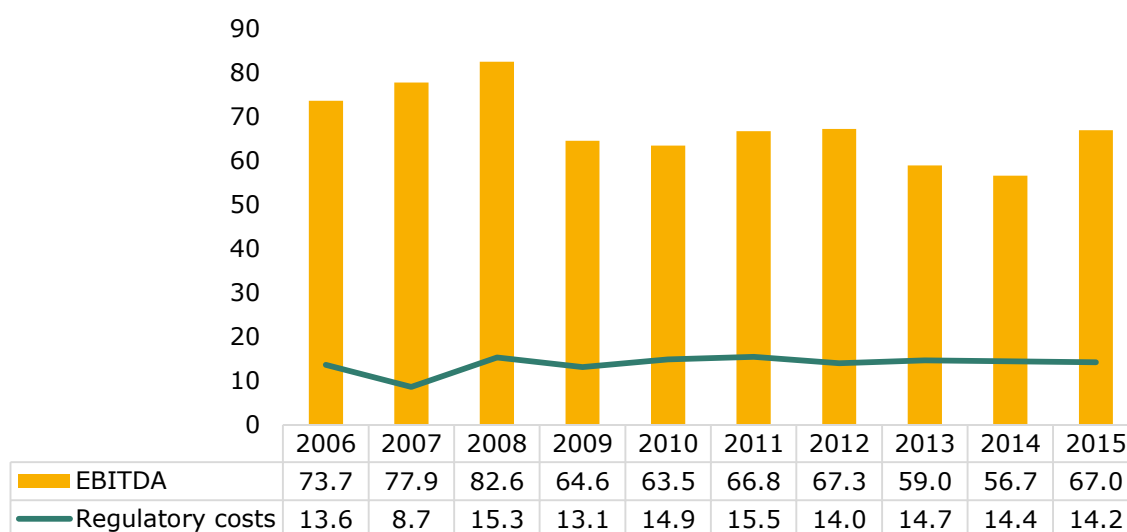
Regulatory costs as a share of production costs and margins in Central Eastern Europe appeared to be higher than the EU average. In fact, whereas the share of regulatory costs out of total production costs was slightly above the EU average (5% against 4% in the entire period), regulatory costs represented a notably larger share of EBITDA and EBIT than the EU average (21% versus 15% for EBITDA, and 34% versus 24% for EBIT). The reason for such difference was twofold: i) regulatory costs were €2/tonne higher in the region compared to the EU average; ii) production costs, EBITDA and EBIT were respectively about €40/tonne, €13/tonne and €7/tonne lower than the EU average.

Figure 85. Packaging glass: Cumulative cost versus production costs (€/tonne, Central-Eastern Europe)



*Note: Production costs are estimated on a sample of five plants between 2006 and 2010 and six plants between 2011 and 2015.
Source: Authors' own elaboration.*

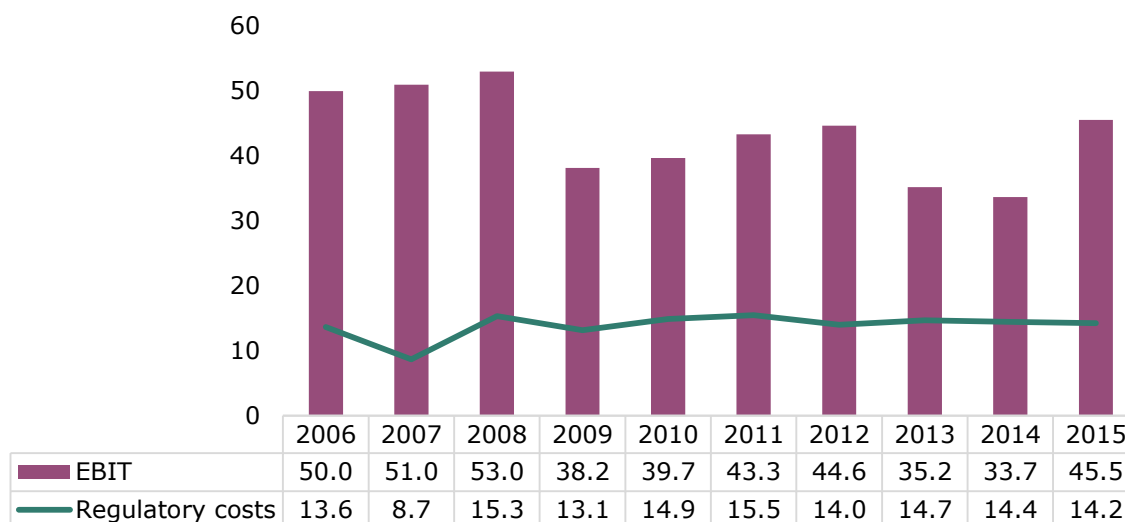
Figure 86. Packaging glass: Cumulative cost versus EBITDA (€/tonne, Central-Eastern Europe)



Note: EBITDA are estimated on a sample of five plants between 2006 and 2010 and six plants between 2011 and 2015.

Source: Authors' own elaboration.

Figure 87. Packaging glass: Cumulative cost versus EBIT (€/tonne, Central-Eastern Europe)



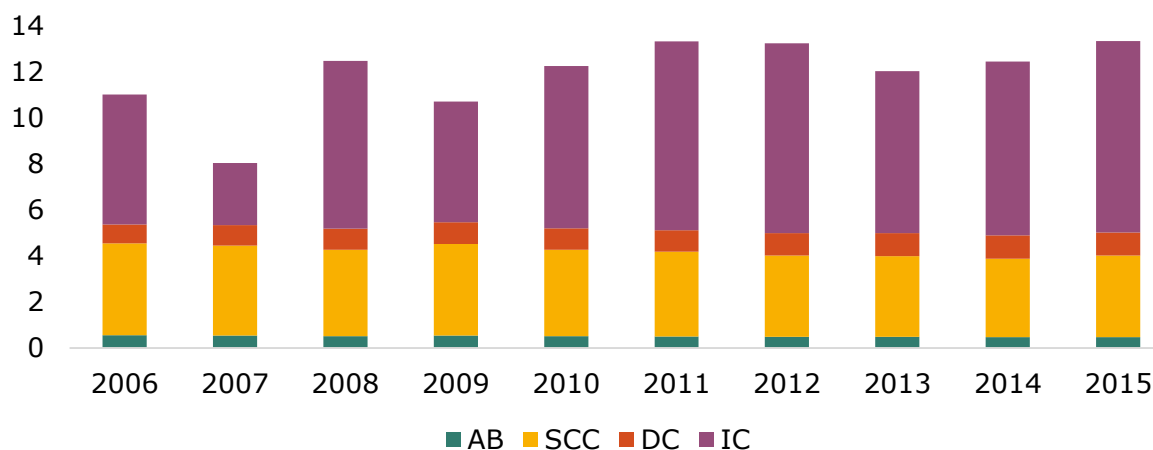
Note: EBITDA are estimated on a sample of five plants between 2006 and 2010 and six plants between 2011 and 2015.

Source: Authors' own elaboration.

13.1.3 Southern Europe

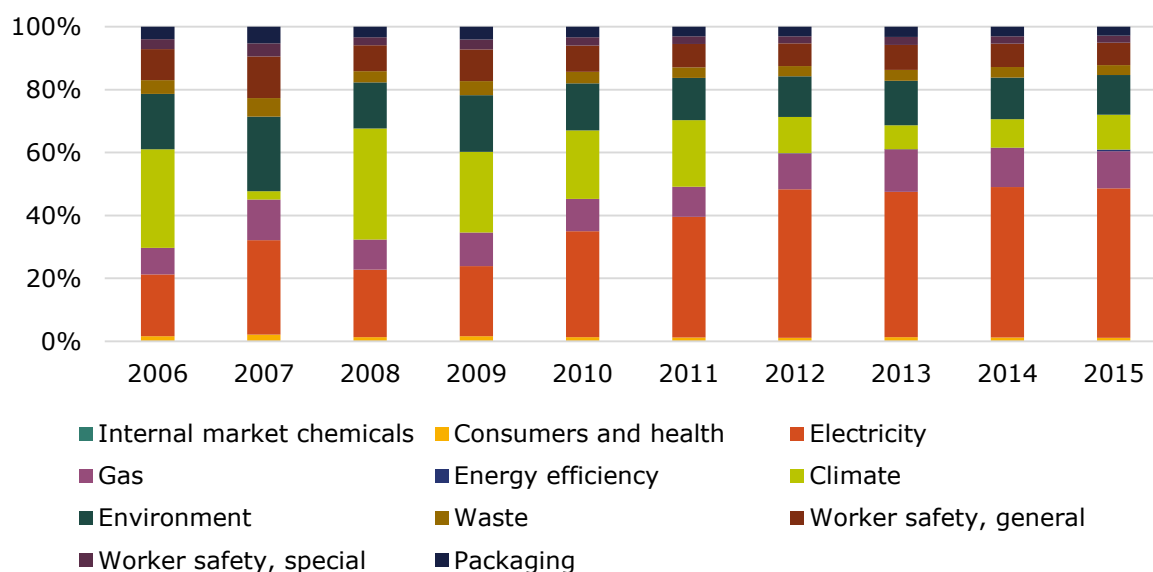
Regulatory costs in the Southern region were aligned with the EU average. In 2015, total regulatory costs were equal to €13.32/tonne and, again, **indirect costs represented the lion's share** with €8.31/tonne, mostly driven by rules affecting the price of electricity. In fact, in this region, **regulatory costs linked to electricity legislation were on average equal to 35.4% of total regulatory costs**, reaching 47.5% in 2015. Regulatory costs were also generated by climate legislation, environmental legislation and rules affecting the price of gas, representing respectively 17.7%, 15.5% and 11.1% of total regulatory costs over the entire period (Figure 89).

Figure 88. Packaging glass: Cumulative cost by category of regulatory costs (€/tonne, Southern Europe)



Source: Authors' own elaboration.

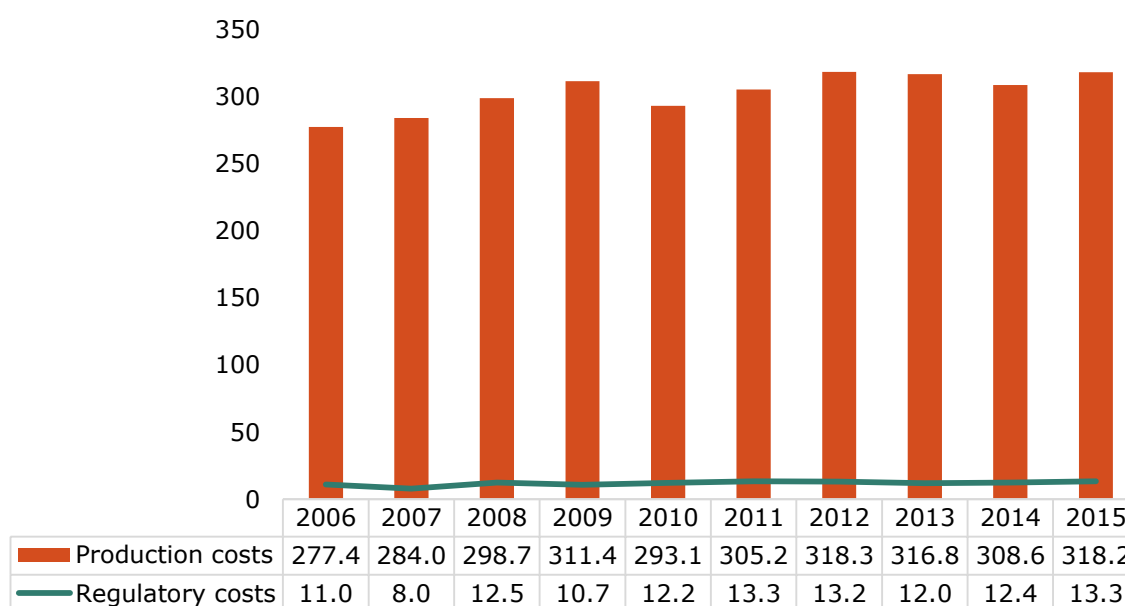
Figure 89. Packaging glass: Cumulative cost by area of legislation (% , Southern Europe)



Source: Authors' own elaboration.

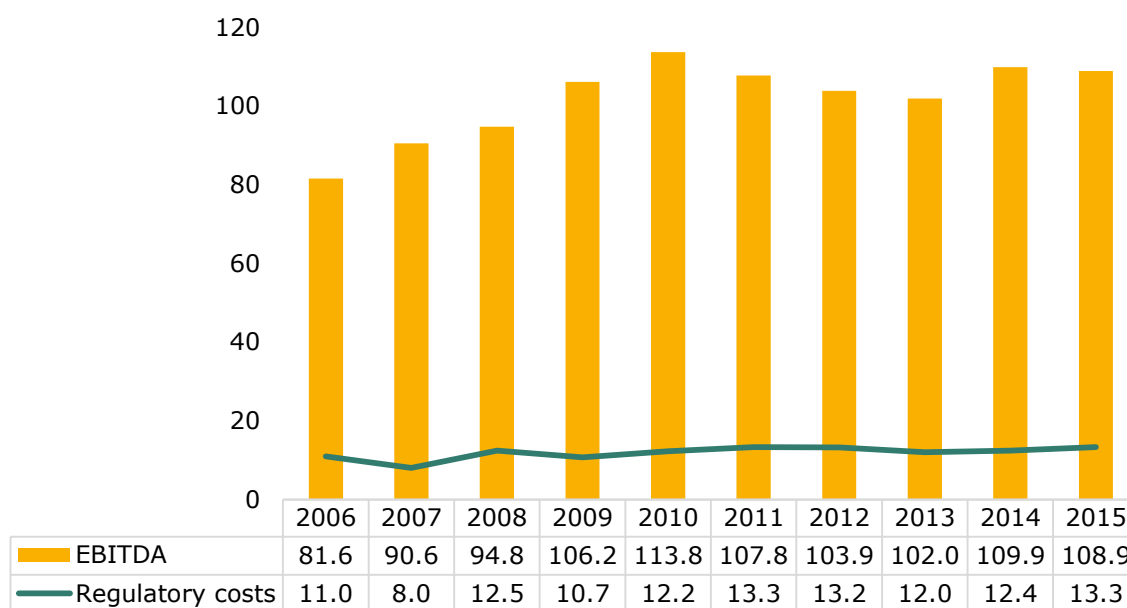
The average share of total regulatory costs out of production costs was about 4% over the period under observation, in line with EU level figures (Figure 90). However, SE registered higher value for both EBITDA and EBIT compared to the other two regions; accordingly, regulatory costs represented a smaller share of margins registered by SE producers of packaging glass *vis-à-vis* producers based in other regions. In 2015, regulatory costs were **12.2% of EBTIDA and 17.5% of EBIT**.

Figure 90. Packaging glass: Cumulative cost versus production costs (€/tonne, Southern Europe)



Note: Production costs are estimated on a sample of eight plants.
Source: Authors' own elaboration.

Figure 91. Packaging glass: Cumulative cost versus EBITDA (€/tonne, Southern Europe)



Note: EBITDA are estimated on a sample of eight plants.
Source: Authors' own elaboration.

Figure 92. Packaging glass: Cumulative cost versus EBIT (€/tonne, Southern Europe)



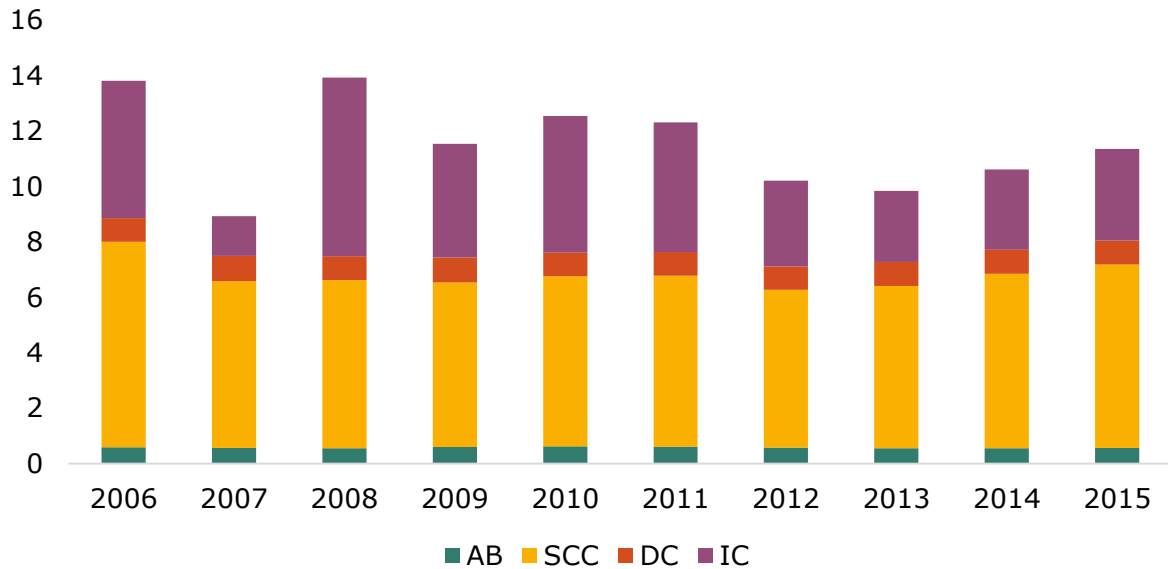
Note: EBIT are estimated on a sample of eight plants.
Source: Authors' own elaboration.

13.1.4 Northern-Western Europe

In 2015, **regulatory costs incurred by manufacturers of packaging glass based in NWE were equal to €11.35/tonne** (Figure 93). The main difference compared with the other two geographic regions was the more limited role played by indirect costs in total regulatory costs. This was mainly because **in NWE rules affecting the price of electricity had a relatively lower impact**. Electricity legislation, in fact, accounted on

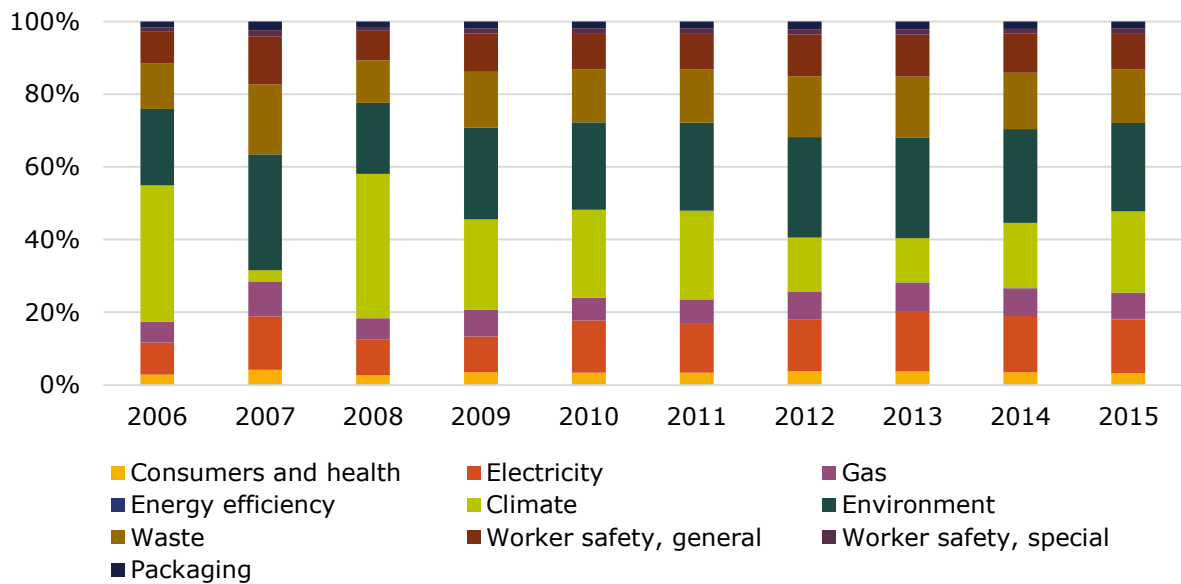
average for only 13.2% of total regulatory costs. By contrast, environmental legislation was the most burdensome area, at 25.1% of total costs, i.e. €2.84/tonne on average, followed by climate legislation, at 22.1%, i.e. €2.71/tonne on average. Interestingly, legislation in the field of waste also played a prominent role in this region and accounted on average for more than 15% of regulatory costs, i.e. €1.71/tonne over the entire period under observation (Figure 94).

Figure 93. Packaging glass: Cumulative cost by category of regulatory costs (€/tonne, Northern-Western Europe)



Source: Authors' own elaboration.

Figure 94. Packaging glass: Cumulative cost by area of legislation (% , Northern-Western Europe)

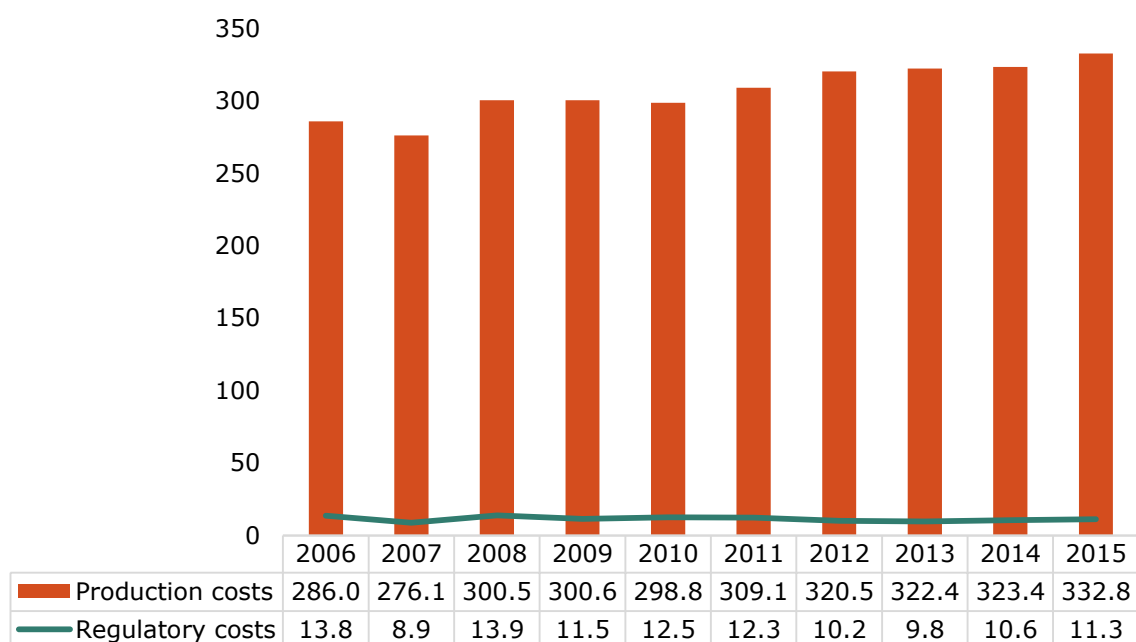


Note: Costs for "Internal Market for chemicals" cannot be shown for this region due to confidentiality reasons.

Source: Authors' own elaboration.

When it comes to key performance indicators, regulatory costs represented shares of production costs and EBITDA that were comparable to those registered at the EU level; this was not the case for regulatory costs versus EBIT as this margin was well below the EU average for NWE producers. Accordingly, regulatory costs were on average **4% of production costs, 16% of the EBITDA and 29% of the EBIT.**

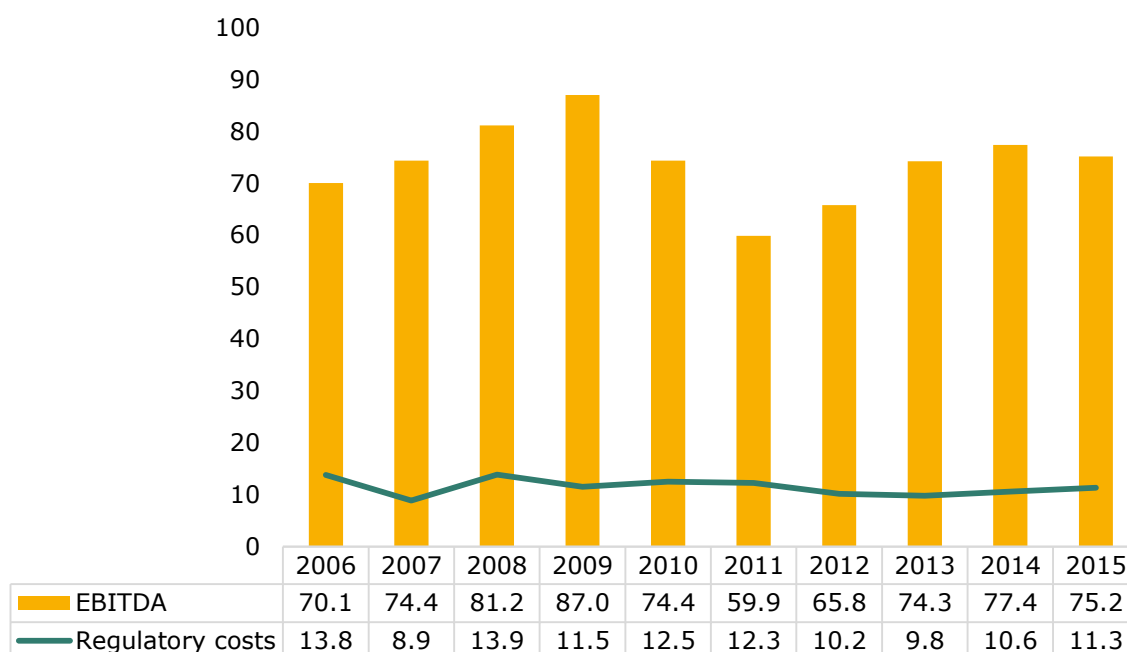
Figure 95. Packaging glass: Cumulative cost versus production costs (€/tonne, Northern-Western Europe)



Note: Production costs are estimated on a sample of six plants in 2006 and seven plants between 2007 and 2015.

Source: Authors' own elaboration.

Figure 96. Packaging glass: Cumulative cost versus EBITDA (€/tonne, Northern-Western Europe)



Note: EBITDA are estimated on a sample of six plants in 2006 and seven plants between 2007 and 2015.

Source: Authors' own elaboration.

Figure 97. Packaging glass: Cumulative cost versus EBIT (€/tonne, Northern-Western Europe)



Note: EBIT are estimated on a sample of six plants in 2006 and seven plants between 2007 and 2015.

Source: Authors' own elaboration.

13.2 Hollow glass: Glass tableware

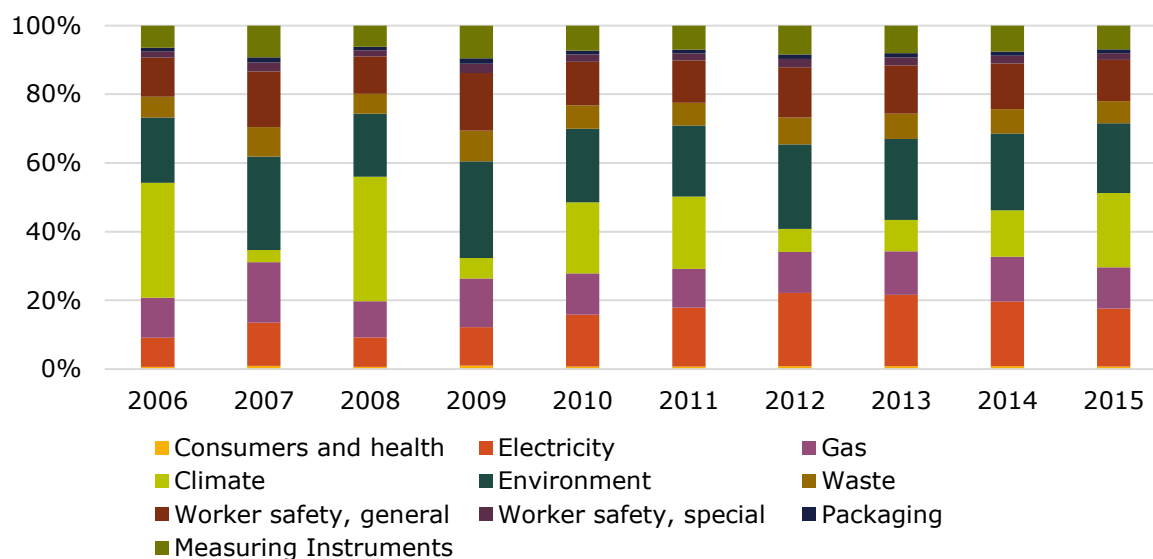
The EU rules in the scope of the CCA generated regulatory costs for the EU glass tableware subsector of between **€20 and €34 per tonne of output** (Figure 98). In the same way as for packaging glass, substantive compliance costs and indirect costs represented the bulk of regulatory costs in all the years under observation, with the exception of 2007 when indirect costs triggered by climate legislation collapsed as a result of low prices for EUAs. **In 2015, the cumulative regulatory costs were equal to €33.19/tonne**, including €3.92/tonne of administrative burdens, €13.30/tonne of substantive compliance costs, €3.46/tonne of direct charges and €12.51/tonne of indirect costs (mainly generated by energy and climate legislation). Over the period under observation, environmental legislation represented the most burdensome area with regulatory costs of €6.88/tonne, followed by climate legislation (€5.54/tonne), legislation in the field of electricity (€4.67/tonne) and general workers' health and safety and workplace safety (€4.09/tonne; Figure 99). Interestingly, climate legislation became the most burdensome area in 2015, accounting for 22% of regulatory costs.

Figure 98. Glass tableware: Cumulative cost by category of regulatory costs (€/tonne, EU)



Source: Authors' own elaboration.

Figure 99. Glass tableware: Cumulative cost by area of legislation (% , EU)



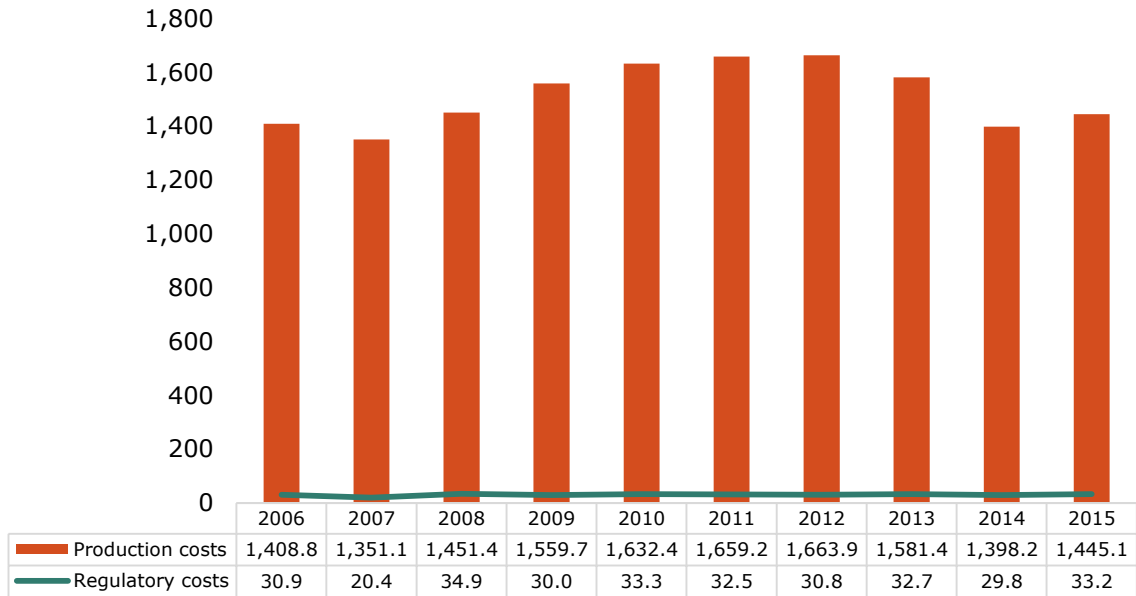
Note: Costs for "Internal Market for chemicals" and "energy efficiency" cannot be shown due to confidentiality reasons.

Source: Authors' own elaboration.

Cumulative regulatory costs were in the area of **1.5% to 2.4% of production costs** incurred by producers of glass tableware over the period under investigation (Figure 100); production costs per tonne of output were substantially higher than those incurred by packaging glass manufacturers.¹⁹¹ EBITDA in the tableware subsector recorded a volatile trend (Figure 101). Therefore, while in most of the years covered by this Study regulatory costs were in the region of **15% to 25% of this key performance indicator**, in 2009 and 2013 they represented more than 50% of the EBITDA. Interestingly, **in 2015 regulatory costs were even higher than EBITDA**, which registered a negative value. Apparently, this bad performance was due to the overall slowdown of EU demand for glass tableware (see Chapter 3 for trends in the value of the production sold by EU producers) coupled with some plant-level problems, e.g. interruption of the production to rebuild the furnace, shortage in inventories detected by the introduction of new stock-taking technologies, etc.). Finally, due to the limited number of sampled plants and volatile trends, data for EBIT cannot be presented as no meaningful average can be computed.

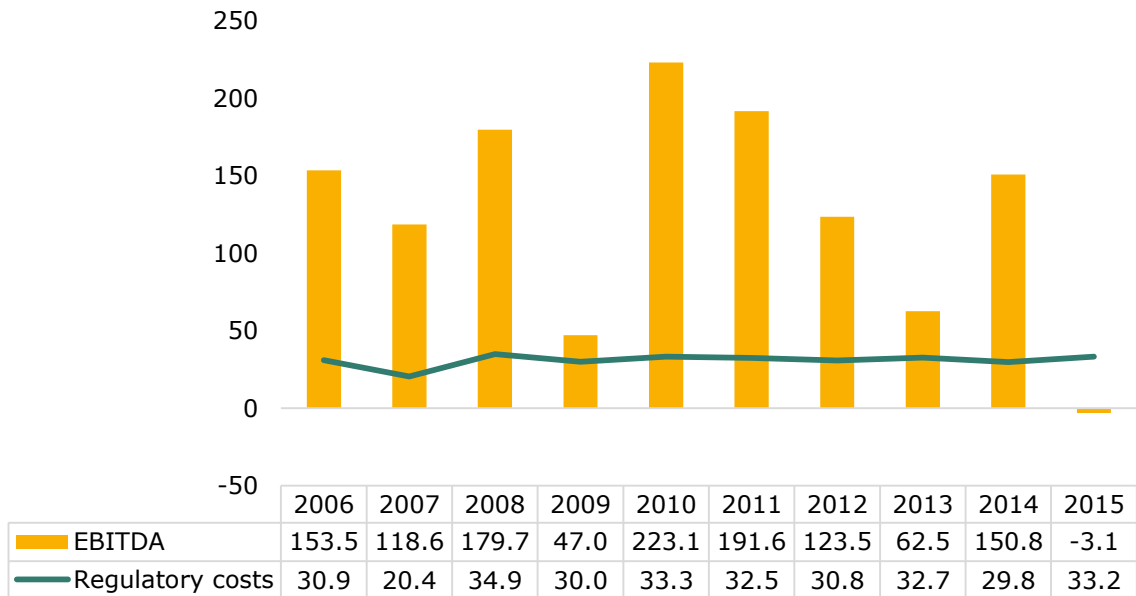
¹⁹¹ Over the period 2006-15, the EU sectoral turnover was quite volatile; on average, it was equal to €2,061 per tonne of output. In the same period, cumulative regulatory costs represented on average 1.5% of the turnover per tonne of glass tableware.

Figure 100. Glass tableware: Cumulative cost versus production costs (€/tonne, EU)



Note: Production costs are estimated on a sample of five plants.
Source: Authors' own elaboration.

Figure 101. Glass tableware: Cumulative cost versus EBITDA (€/tonne, EU)



Note: EBITDA are estimated on a sample of five plants.
Source: Authors' own elaboration.

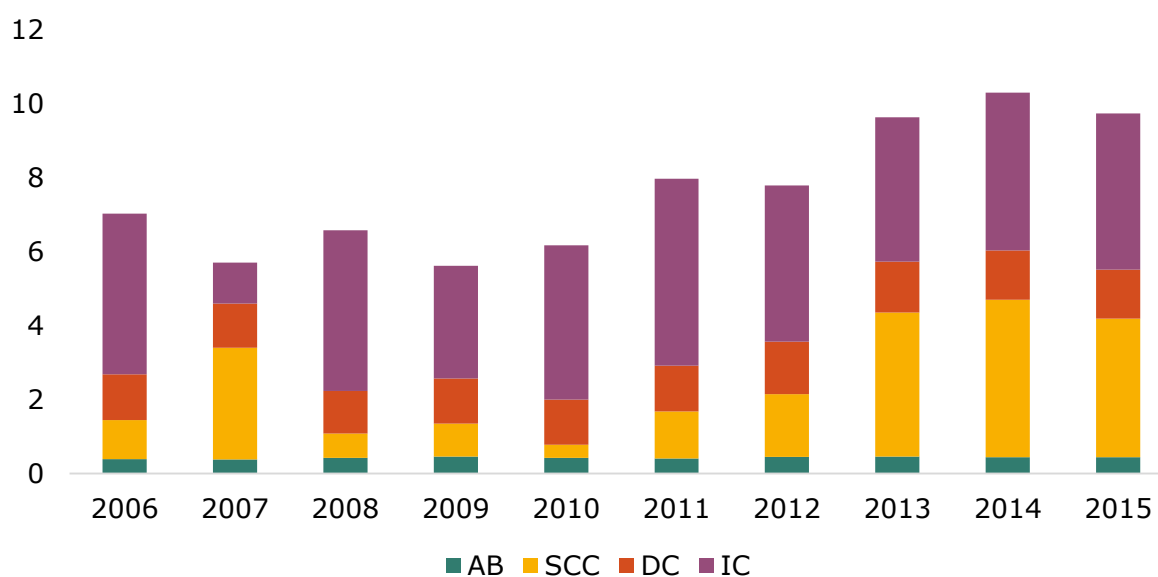
13.3 Flat glass

13.3.1 EU

The EU rules covered by this Study generated regulatory costs on EU flat glass manufacturers of between **€5.60 and €10.30 per tonne of output** (Figure 102). While in later years substantive compliance costs and indirect costs represented the bulk of regulatory costs, between 2006 and 2012 sampled producers had the opportunity to generate revenues by selling EUAs on the carbon market, with the sole exception of 2007 when low prices for EUAs influenced both substantive compliance costs and indirect costs linked to climate legislation.¹⁹² On average, **legislation affecting the price of electricity generated the highest regulatory costs (€1.95/tonne)**, followed by environmental legislation (€1.90/tonne) and legislation in the field of gas (€1.53/tonne; Figure 103).

In 2015, the cumulative regulatory costs were equal to €9.74/tonne, comprising €0.44/tonne of administrative burdens, €3.75/tonne of substantive compliance costs, €1.32/tonne of direct charges and €4.22/tonne of indirect costs (mainly generated by energy and climate legislation). Rules affecting the electricity prices generated the 28% of total regulatory costs, followed by environmental legislation (20%), rules affecting the gas price (17%) and climate legislation (15%).

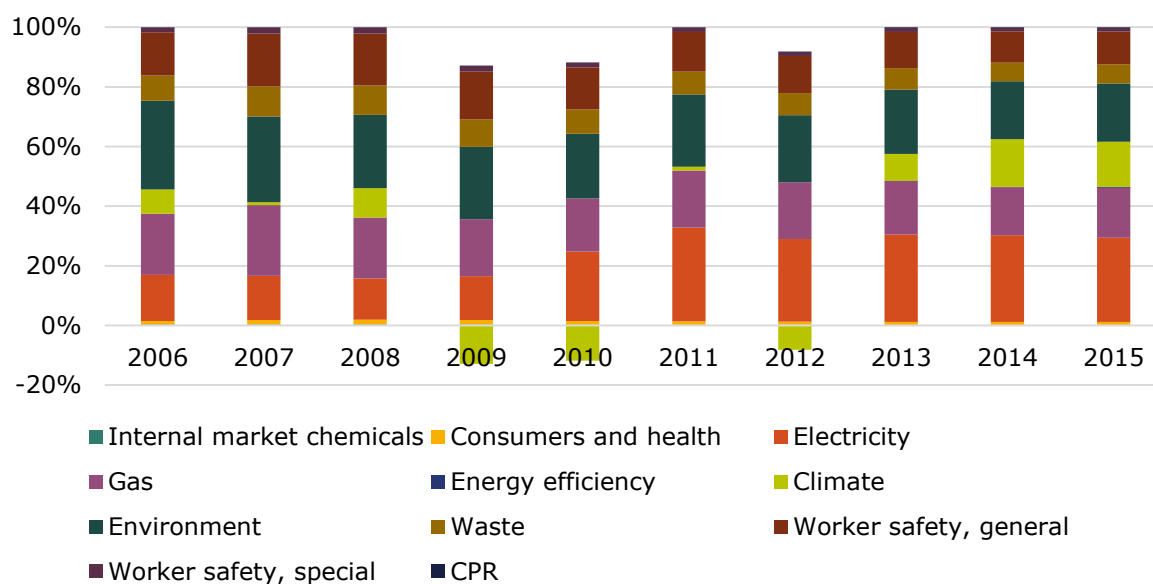
Figure 102. Flat glass: Cumulative cost per category of regulatory costs (€/tonne, EU)



Source: Authors' own elaboration.

¹⁹² Note that both revenues and costs generated by either selling or purchasing EUAs are based on a model presented in the Chapter detailing costs generated by climate legislation in Chapter 7 of this Study.

Figure 103. Flat glass: Cumulative cost per area of legislation (% , EU)

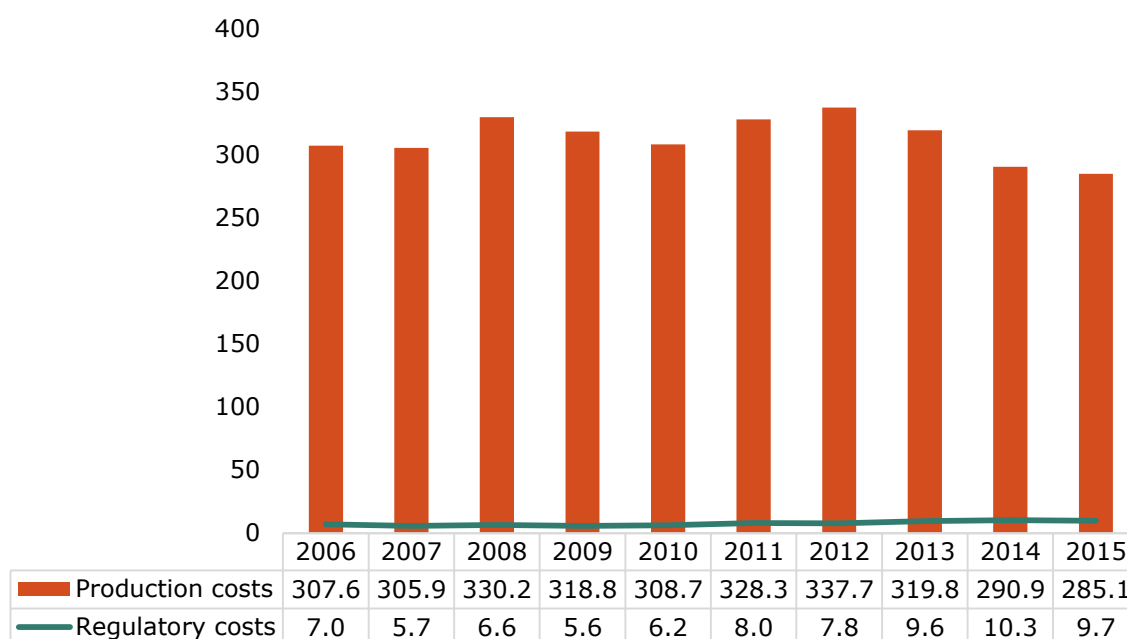


*Note: In 2009, 2010 and 2012 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market.
Source: Authors' own elaboration.*

Cumulative regulatory costs represented between **1.9% and 3.5% of production costs** incurred by producers of flat glass in the time span covered by this CCA (Figure 104). Interestingly, the share of regulatory costs over production was higher in most recent years (3% in 2013, 3.5% in 2014 and 3.4% in 2015). This was mainly due to the combined effect of: i) a reduction in production costs per tonne of output; ii) an increase in regulatory costs generated by climate legislation as well as rules affecting the electricity price.¹⁹³ EBITDA in the flat glass sector were rather volatile (Figure 105); accordingly, whereas regulatory costs represented only **4.9% of this key performance indicator in 2007**, they were **above 50% of EBITDA in 2014** and higher than EBITDA in 2013, when the indicator was negative. In 2015, regulatory costs represented 31.3% of EBITDA, due to a growing trend in the last two years. EBIT of the flat glass sector followed the same volatile trend of EBITDA and registered negative values in 2009, 2012 and 2013. With regard to 2015, **regulatory costs were equal to 78.2% of the EBIT** (Figure 106).

¹⁹³ The EU sectoral turnover per tonne of output ranged between €339 (in 2014) and €473 (in 2007). Cumulative regulatory costs represented between 1.2% and 3.0% of the turnover per tonne of flat glass.

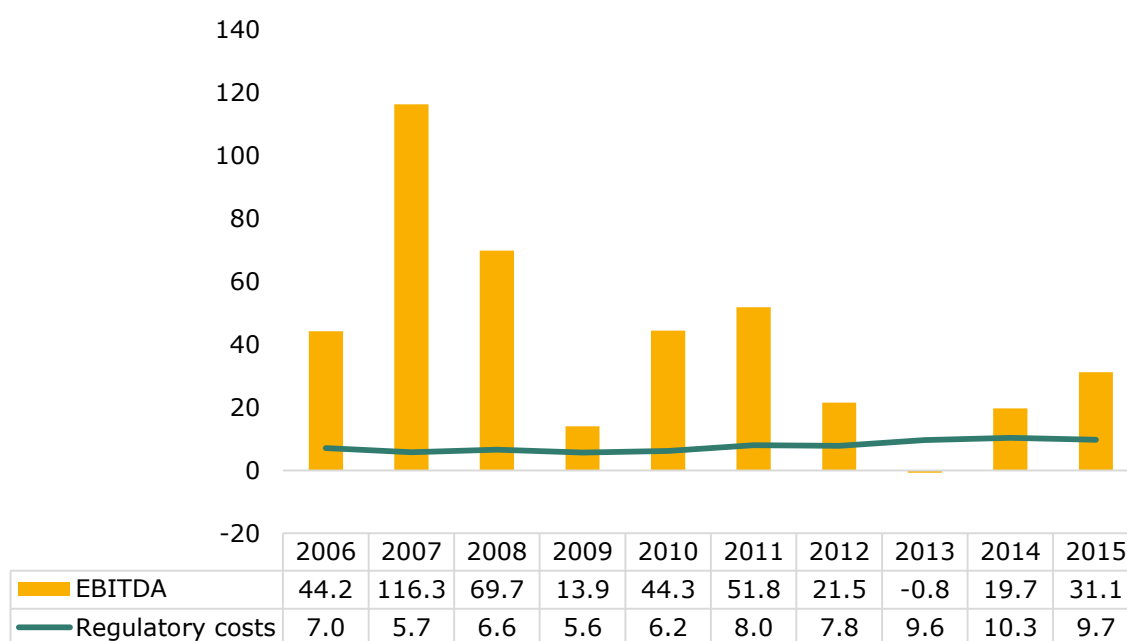
Figure 104. Flat glass: Cumulative cost versus production costs (€/tonne, EU)



Note: Production costs are estimated on a sample of nine plants in 2006, 12 plants between 2007 and 2008, and 13 plants between 2009 and 2015.

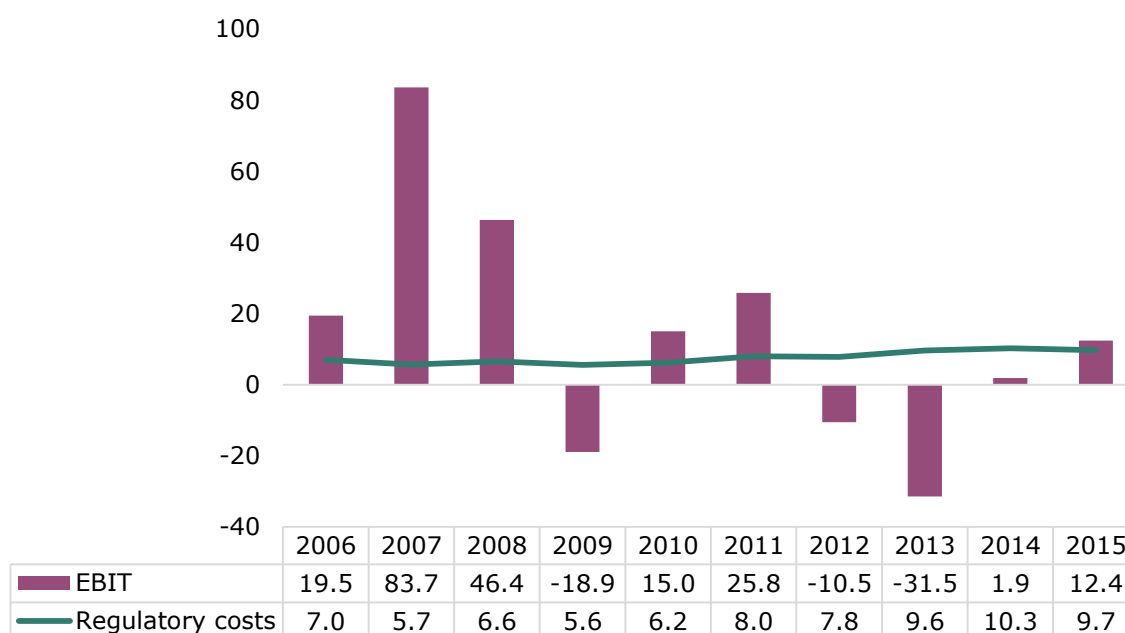
Source: Authors' own elaboration.

Figure 105. Flat glass: Cumulative cost versus EBITDA (€/tonne, EU)



Note: EBITDA are estimated on a sample of nine plants in 2006, 12 plants between 2007 and 2008, and 13 plants between 2009 and 2015.

Source: Authors' own elaboration.

Figure 106. Flat glass: Cumulative cost vs. EBIT (€/tonne, EU)


Note: EBIT are estimated on a sample of nine plants in 2006, 12 plants between 2007 and 2008, and 12 plants between 2009 and 2015.

Source: Authors' own elaboration.

13.3.2 Central-Eastern Europe

Regulatory costs borne by flat glass producers based in CEE were dominated by indirect costs. Also, the role played by overallocation of EUA (and ensuing potential revenues) was prominent; therefore, substantial compliance costs appeared to be limited in 2006, 2009, 2010 and 2011 and even negative in 2008. Total regulatory costs for CEE producers of flat glass **are estimated to have ranged between €8.60 and €13.30/tonne. Environmental rules (39% on average) and rules affecting the price of electricity (32% on average) were the most burdensome areas of legislation**, followed by rules affecting the price of gas, which accounted for 18% of total regulatory costs over the period under observation (Figure 108).

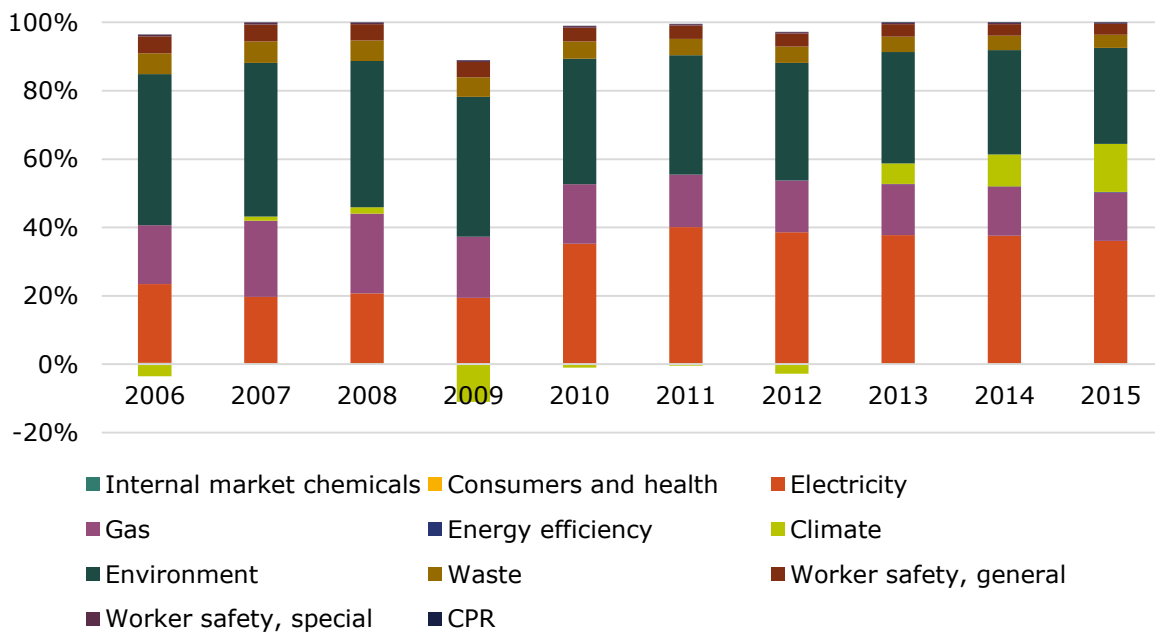
In 2015, total regulatory costs were €12.91/tonne, comprising €0.18/tonne of administrative burdens, €4.30/tonne of substantial compliance costs, €1.39/tonne of direct charges and €7.04/tonne of indirect costs (Figure 107). **Rules affecting the price of electricity generated €4.64/tonne of regulatory cost in 2015**, followed by environmental legislation (€3.62/tonne) and climate legislation and rules affecting gas price (€1.82/tonne each).

Figure 107. Flat glass: Cumulative cost per category of regulatory costs (€/tonne, Central-Eastern Europe)



Note: In 2008, substantive compliance costs are negative due to potential revenues generated by the opportunity to sell EUAs on the carbon market.
Source: Authors' own elaboration.

Figure 108. Flat glass: Cumulative cost per area of legislation (% , Central-Eastern Europe)



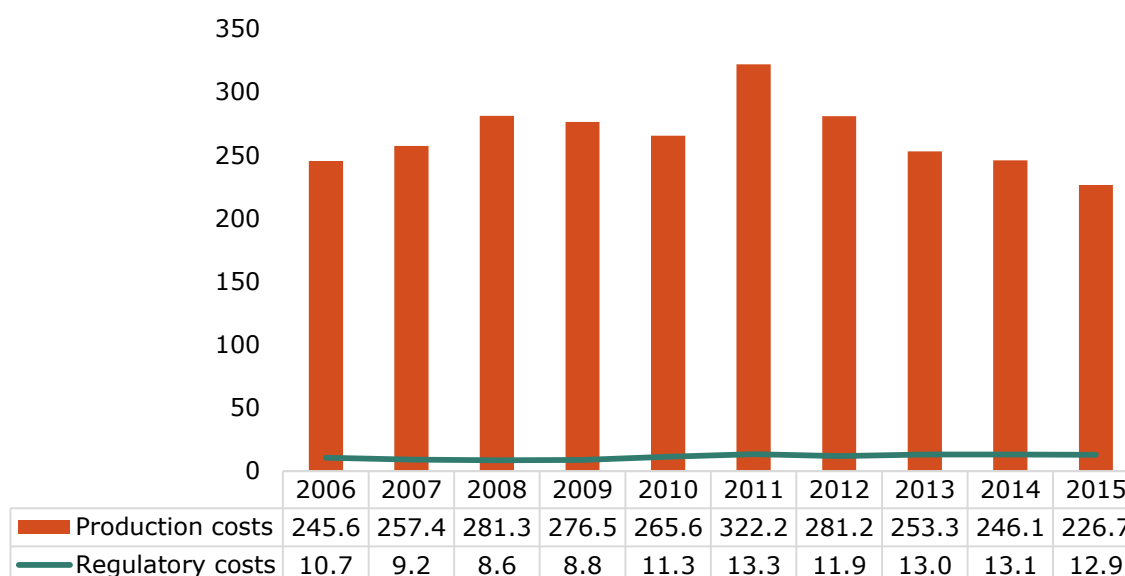
Note: In 2006, 2009 and 2012 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market.
Source: Authors' own elaboration.

Production costs for flat glass producers in CEE were on average €45/tonne lower than EU values, while total regulatory costs were on average €4/tonne higher than EU values.

Accordingly, regulatory costs represented a larger share of production costs (**between 3.1% and 5.7%**; Figure 109).

With regard to margins, EBITDA and EBIT followed the European trend even though the EBITDA never registered negative values in the region. After peaking in 2013 when regulatory costs represented 71.9% of the EBITDA, **in 2015 the share dropped to 37.5%**, i.e. slightly above the EU average (Figure 110). **In 2015 regulatory costs appeared to be still higher than EBIT**, which is not the case for the EU average (Figure 111).

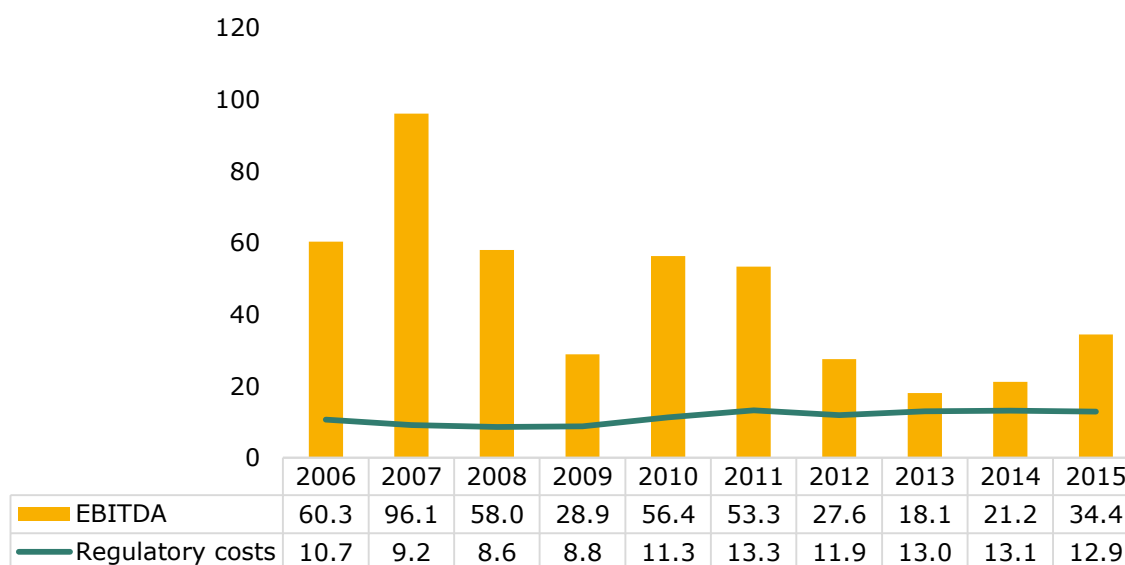
Figure 109. Flat glass: Cumulative cost versus production costs (€/tonne, Central-Eastern Europe)



Note: Production costs are estimated on a sample of three plants in 2006 and four plants between 2007 and 2015.

Source: Authors' own elaboration.

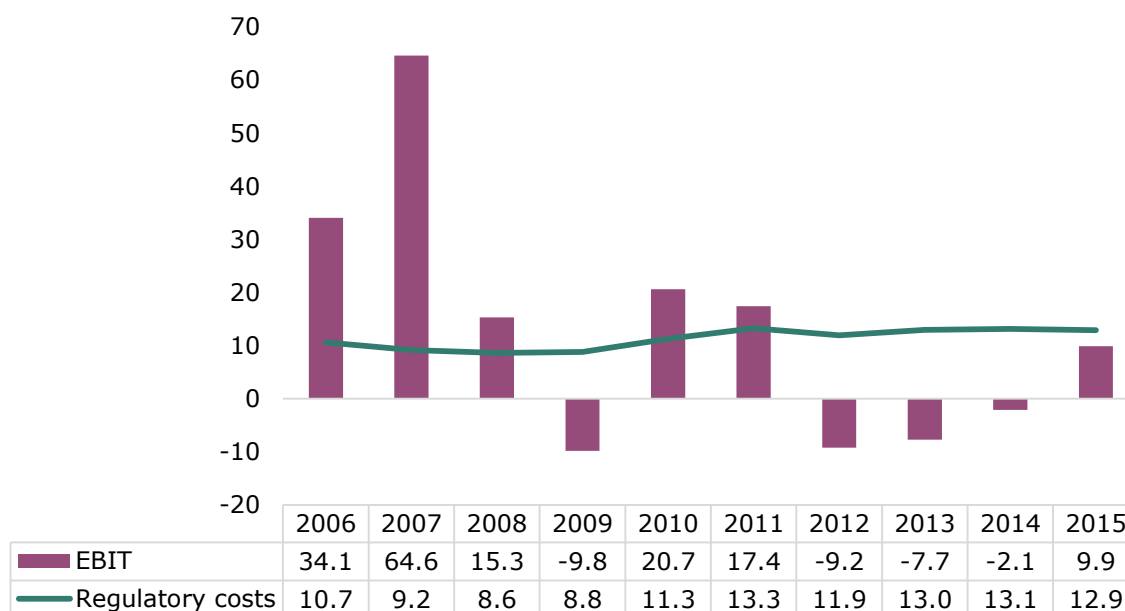
Figure 110. Flat glass: Cumulative cost versus EBITDA (€/tonne, Central-Eastern Europe)



Note: EBITDA are estimated on a sample of three plants in 2006 and four plants between 2007 and 2015.

Source: Authors' own elaboration.

Figure 111. Flat glass: Cumulative cost versus EBIT (€/tonne, Central-Eastern Europe)



Note: EBIT are estimated on a sample of three plants in 2006 and four plants between 2007 and 2015.

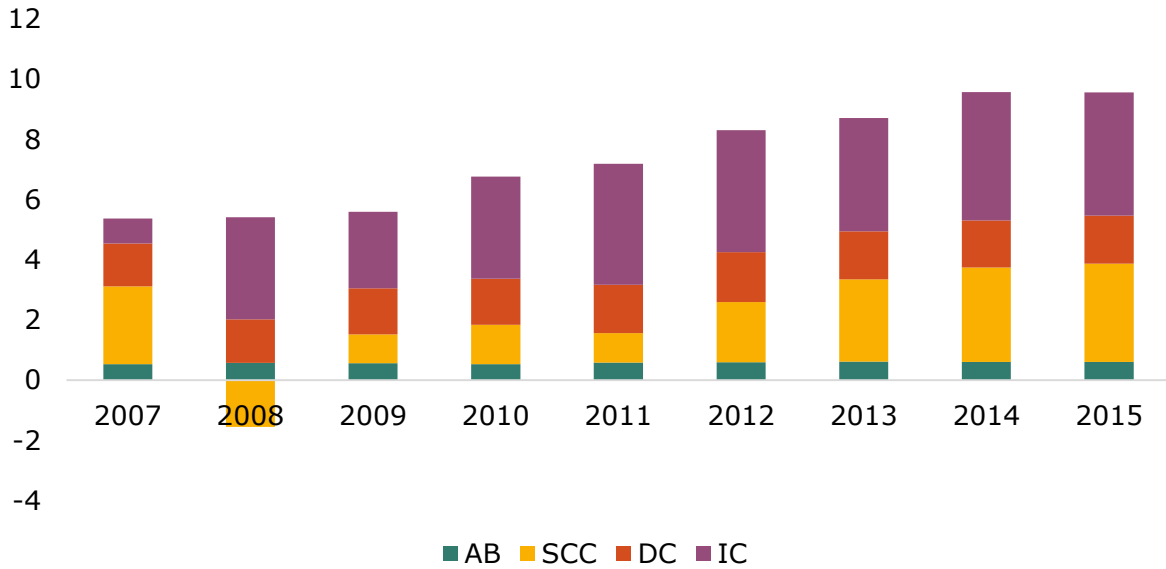
Source: Authors' own elaboration.

13.3.3 Southern Europe

In the same way as in CEE, in SE indirect costs were the main component of total regulatory costs. On average, **total regulatory costs for flat glass manufacturers based in SE were equal to €7.24/tonne**, ranging between €3.85 in 2008 and €9.57/tonne in 2014. In 2015, regulatory costs were equal to €9.55/tonne and comprised €0.60/tonne of administrative burden, €3.27/tonne of substantive compliance costs, €1.59/tonne of direct charges and €4.10/tonne of indirect costs (Figure 112).

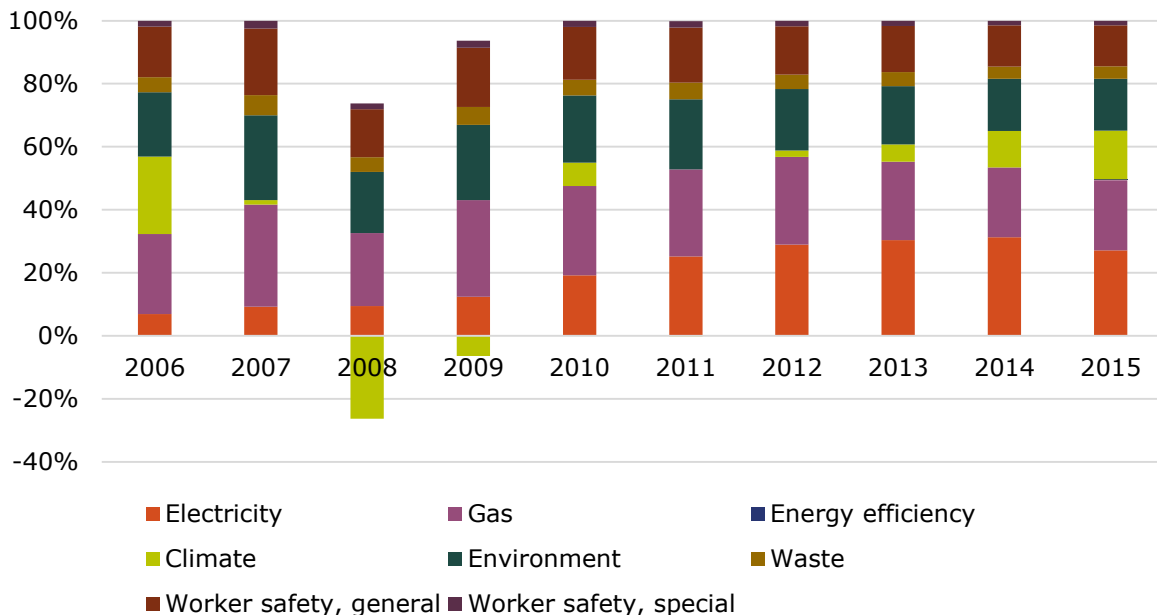
In the same year, the most burdensome areas of legislation for the region were **rules affecting prices of both electricity and gas, which generated costs equal to €2.55/tonne (27% of total costs) and €2.10/tonne (22%), respectively (Figure 113)**. Environmental legislation was the third most burdensome area, generating 16% of total regulatory costs, i.e. €1.55/tonne.

Figure 112. Flat glass: Cumulative cost per category of regulatory costs (€/tonne, Southern Europe)



Note: In 2008, substantive compliance costs were negative due to potential revenues generated by the opportunity to sell EUAs on the carbon market. Data for 2006 cannot be shown for this region due to confidentiality reasons.
Source: Authors' own elaboration.

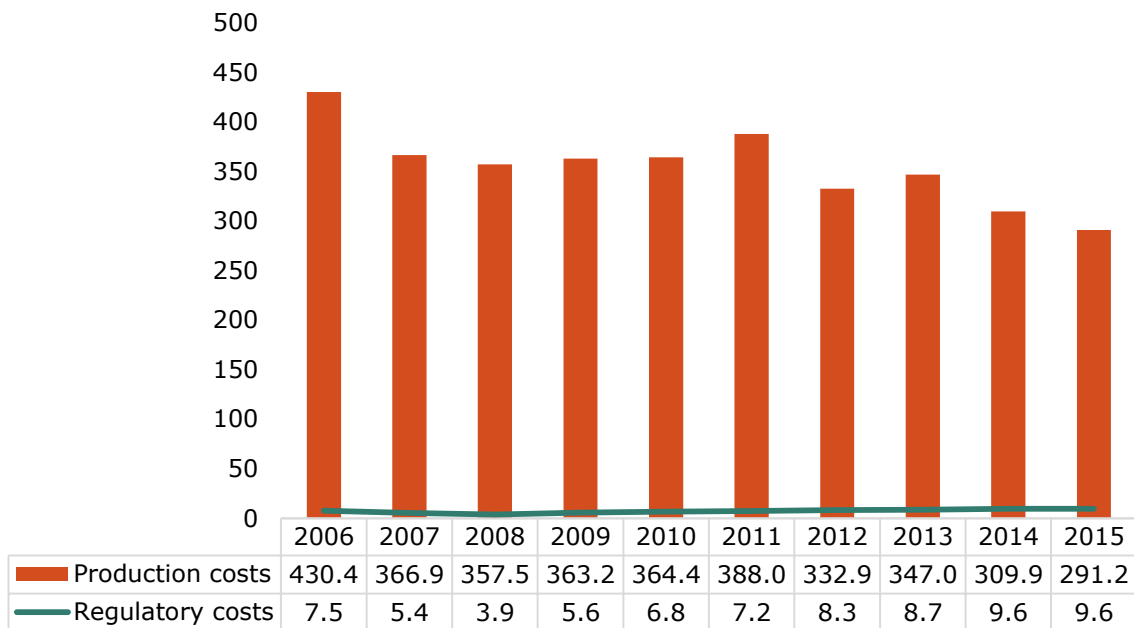
Figure 113. Flat glass: Cumulative cost per area of legislation (% , Southern Europe)



Note: In 2008 and 2009, climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market. Data for 2006 cannot be shown for this region due to confidentiality reasons; costs for "Internal Market for chemicals" and "consumers and health" cannot be shown for this region due to confidentiality reasons.
Source: Authors' own elaboration.

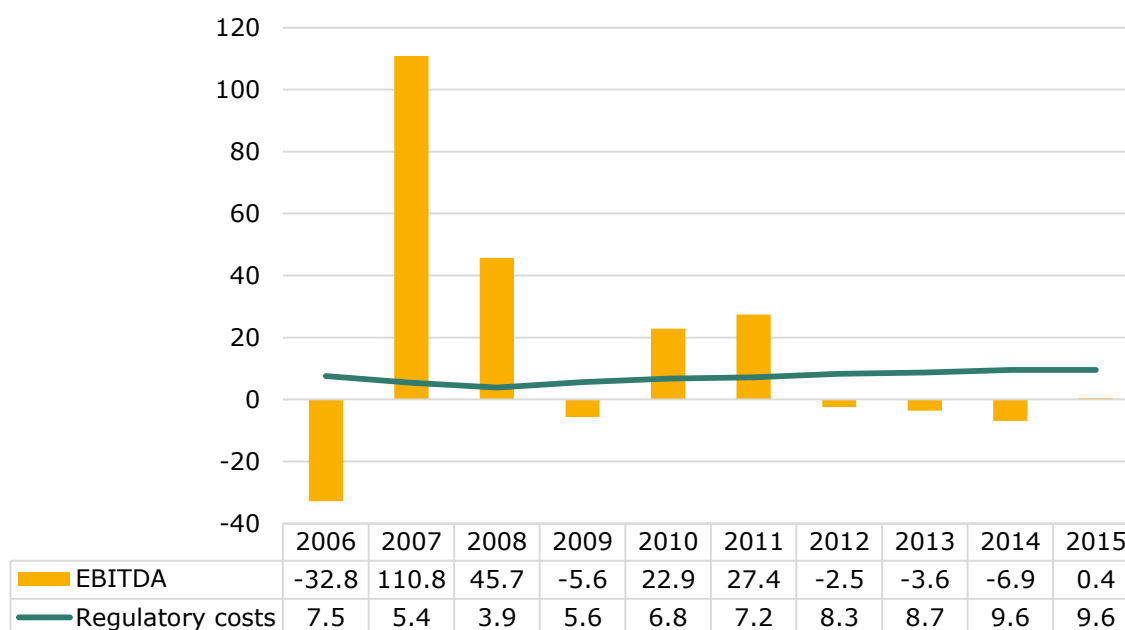
SE producers of flat glass reported **higher production costs than their competitors in other European regions**; hence, regulatory costs represented a more limited share of total production costs (between 1.1% and 3.3%; Figure 114). Nonetheless, **higher production costs were also reflected by lower profitability in the region**; in fact, both EBITDA and EBIT of SE producers were below the European average. Interestingly, this region was the only one in which the EBITDA were negative (or close to zero) between 2012 and 2015. In this respect, 2011 was the last year when positive values were registered and regulatory costs represented 26% of the EBITDA (Figure 115) and 57% of the EBIT (Figure 116).

Figure 114. Flat glass: Cumulative cost versus production costs (€/tonne, Southern Europe)



Note: Data for 2006 cannot be shown for this region due to confidentiality reasons. Production costs are estimated on a sample of three plants between 2007 and 2008, and of four plants between 2009 and 2015.
Source: Authors' own elaboration.

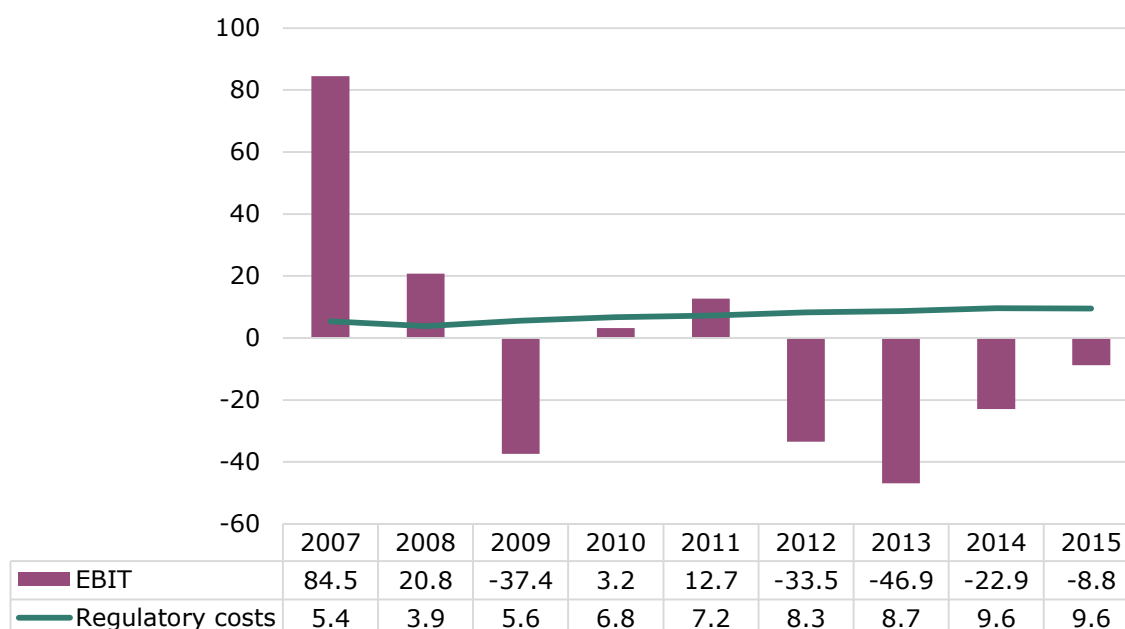
Figure 115. Flat glass: Cumulative cost versus EBITDA (€/tonne, Southern Europe)



Note: Data for 2006 cannot be shown for this region due to confidentiality reasons; EBITDA are estimated on a sample of three plants between 2007 and 2008, and of four plants between 2009 and 2015.

Source: Authors' own elaboration.

Figure 116. Flat glass: Cumulative cost versus EBIT (€/tonne, Southern Europe)



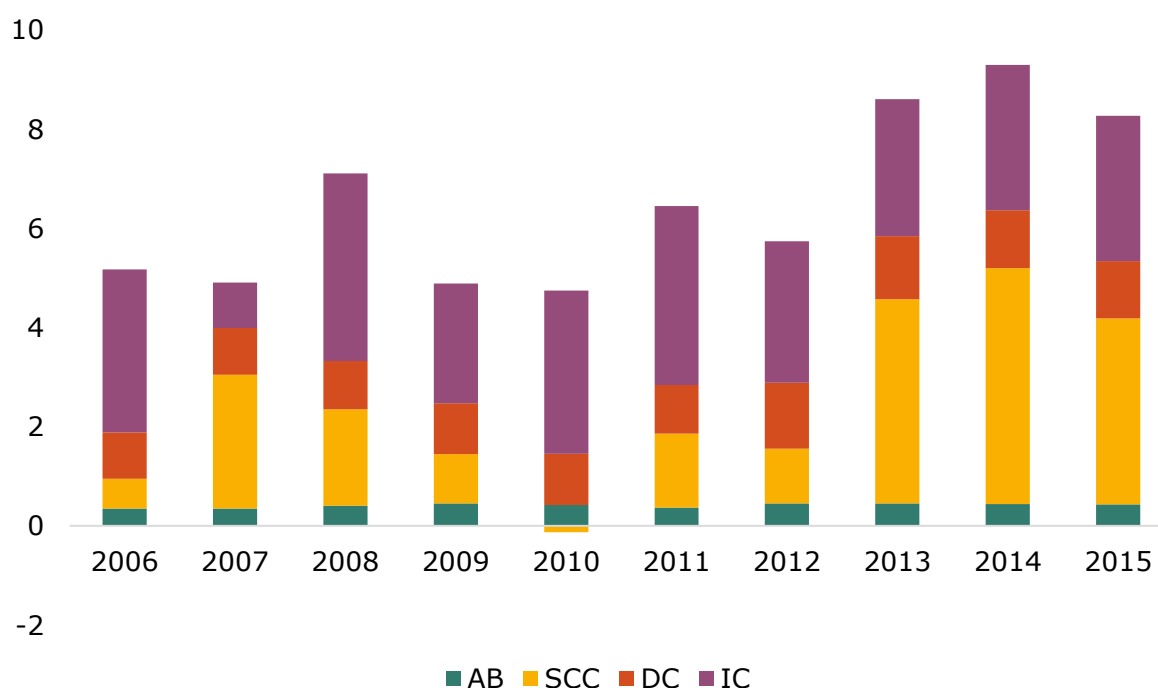
Note: Data for 2006 cannot be shown for this region due to confidentiality reasons; EBIT are estimated on a sample of three plants between 2007 and 2015.

Source: Authors' own elaboration.

13.3.4 Northern-Western Europe

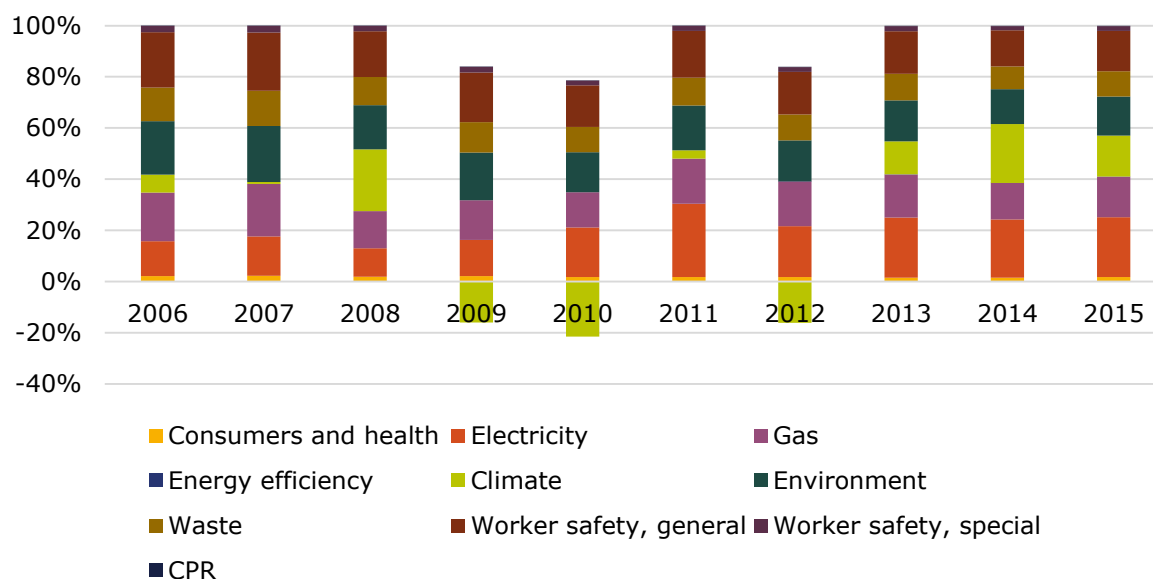
Overall allocation of EUAs played a minor role in NWE; hence, while indirect costs greatly contributed to total regulatory costs, substantive compliance costs overtook indirect costs in the period 2013-15. Overall, **regulatory costs in NEW lay between €4.62 in 2010 and €9.33/tonne in 2014** (Figure 117). In 2015, administrative burdens were equal to €0.44/tonne, substantive compliance costs equal to €3.75/tonne, direct charges equal to €1.15/tonne and indirect costs equal to €2.93/tonne, thus leading to overall regulatory costs in the region of €8.27/tonne. In the same year, the most burdensome areas of legislation in descending orders were: i) **rules affecting the price of electricity** (23% of total regulatory costs, i.e. €1.94/tonne); ii) **climate legislation** (16%, i.e. €1.32/tonne); iii) **legislation in the field of general workers' health and safety and workplace safety** (16%, i.e. €1.31/tonne); iv) rules affecting the price of gas and climate legislation (16%, €1.30/tonne); and v) environmental legislation (15%, i.e. €1.26/tonne; Figure 118).

Figure 117. Flat glass: Cumulative cost per category of regulatory costs (€/tonne, Northern-Western Europe)



Source: Authors' own elaboration.

Figure 118. Flat glass: Cumulative cost per area of legislation (% , Northern-Western Europe)

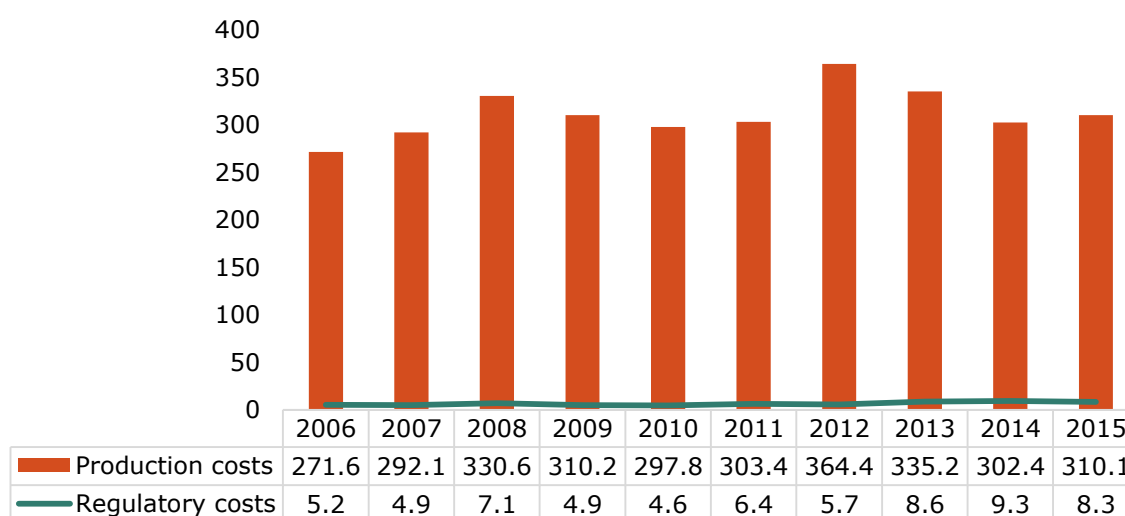


Note: In 2009, 2010 and 2012, climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market; costs for "Internal Market chemicals" cannot be shown for this region due to confidentiality reasons.

Source: Authors' own elaboration.

Production costs registered in NEW were close to the EU average. In this region, **total regulatory costs represented between 1.6% and 3.1% of total production costs, including 2.7% in 2015** (Figure 119). Interestingly, the region was the best performing when it came to EBITDA and EBIT. Accordingly, **in 2015 regulatory costs amounted to 18.1% of EBITDA** (Figure 120) **and 33.2% of EBIT** (Figure 121).

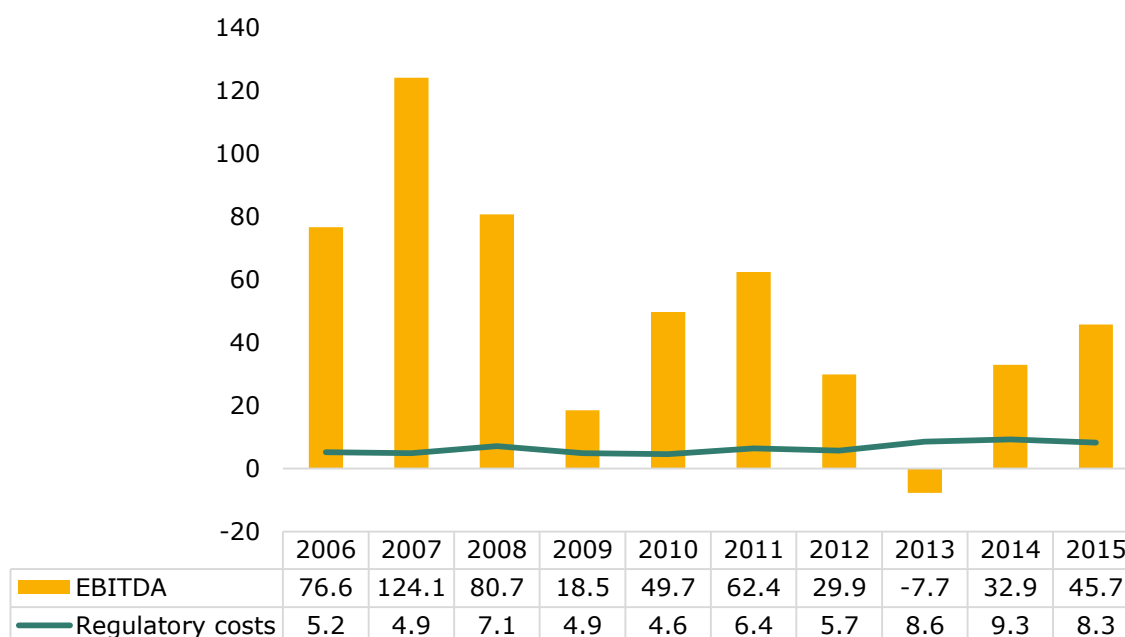
Figure 119. Flat glass: Cumulative cost versus production costs (€/tonne, Northern-Western Europe)



Note: Production costs are estimated on a sample of four plants in 2006, and of five plants between 2007 and 2015.

Source: Authors' own elaboration.

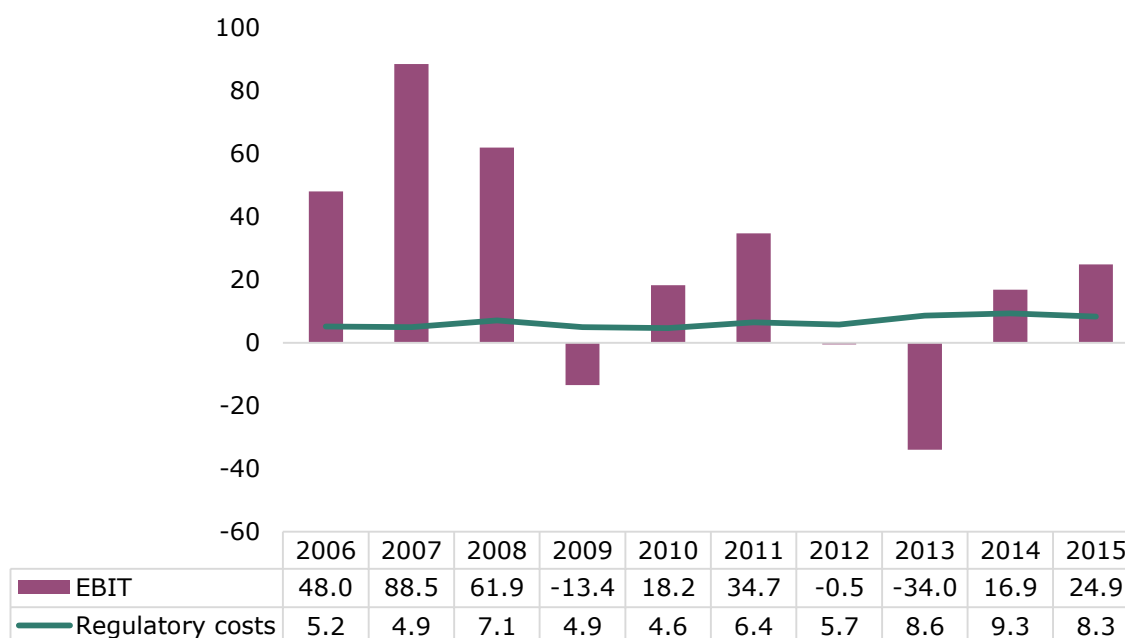
Figure 120. Flat glass: Cumulative cost versus EBITDA (€/tonne, Northern-Western Europe)



Note: EBITDA are estimated on a sample of four plants in 2006, and of five plants between 2007 and 2015.

Source: Authors' own elaboration.

Figure 121. Flat glass: Cumulative cost versus EBIT (€/tonne, Northern-Western Europe)



Note: EBITDA are estimated on a sample of four plants in 2006, and of five plants between 2007 and 2015.

Source: Authors' own elaboration.

14 Relevance 'heat maps'

Table 82 provides a **relevance 'heat map' of EU legislation** discussed in Part B of this Study. More specifically, **areas of legislation generating more than 20% of the overall regulatory costs are marked as highly relevant**; medium relevance is attributed to areas generating between 5% and 20% of regulatory costs borne by glass manufacturers; other areas are classified as either slightly relevant (below 5%) or not relevant (no regulatory costs were detected).

Table 82. Relevance heat map of the EU legislation affecting the EU glass industry: regulatory costs generated by specific areas of legislation as a share of total regulatory costs (2015)

Legislation		Flat glass	Packaging glass	Glass tableware
Internal Market	<i>Internal Market for construction products</i>	0.2%		
	<i>Internal Market chemicals</i>	0.2%	0.1%	*
	<i>Measuring Instrument Directive</i>			6.9%
Energy	<i>Electricity</i>	28.2%	27.9%	16.9%
	<i>Gas</i>	16.8%	9.3%	12.1%
	<i>Energy Efficiency</i>	0.3%	0.3%	*
Climate		15.1%	18.2%	21.6%
Environmental	<i>Industrial emissions</i>	19.5%	19%	20.3%
	<i>Waste</i>	6.4%	10.1%	6.4%
	<i>Packaging & packaging waste</i>		2%	1.1%
Consumers & health		1%	2.6%	0.7%
Worker safety	<i>Worker safety, general</i>	11%	9%	12.1%
	<i>Worker safety, special</i>	1.3%	1.4%	2%

Note: Red for high relevance, orange for medium relevance, light blue for low relevance, white for no relevance; the relevance assessment is based on regulatory costs measured in this CCA; *shares for "Internal Market for chemicals" and "energy efficiency" cannot be shown due to confidentiality reasons.

Source: Authors' own elaboration.

Table 83 provides another **relevance 'heat map' of EU legislation** in the scope of the CCA. More specifically, **areas of legislation generating more than 1% of the overall production costs are marked as highly relevant**; medium relevance is attributed to areas generating between 0.5% and 1% of regulatory costs borne by glass manufacturers; other areas are classified as either slightly relevant (below 0.5%) or not relevant (no regulatory costs were detected).

Table 83. Relevance heat map of the EU legislation affecting the EU glass industry: regulatory costs generated by specific areas of legislation as a share of total production costs (2015)

Legislation		Flat glass	Packaging glass	Glass tableware
Internal Market	<i>Internal Market for construction products</i>	0.01%		
	<i>Internal Market chemicals</i>	0.01%	0%	*
	<i>Measuring Instrument Directive</i>			0.16%
Energy	<i>Electricity</i>	0.96%	1.08%	0.39%
	<i>Gas</i>	0.57%	0.36%	0.28%
	<i>Energy efficiency</i>	0.01%	0.01%	*
Climate		0.52%	0.52%	0.70%
Environmental	<i>Industrial emissions</i>	0.67%	0.73%	0.47%
	<i>Waste</i>	0.22%	0.39%	0.15%
	<i>Packaging & Packaging Waste</i>		0.08%	0.03%
Consumers & health		0.03%	0.03%	0.10%
Worker safety	<i>Worker safety, general</i>	0.37%	0.35%	0.28%
	<i>Worker safety, special</i>	0.04%	0.05%	0.05%

Note: Red for high relevance, orange for medium relevance, light blue for low relevance, white for no relevance; the relevance assessment is based on regulatory costs and production costs measured in this CCA; *shares for "Internal Market for chemicals" and "energy efficiency" cannot be shown due to confidentiality reasons.

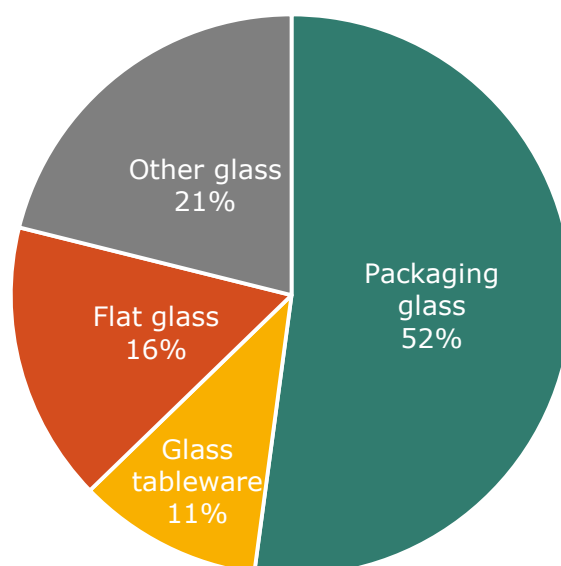
Source: Authors' own elaboration.

Annex I – Sectoral analysis of glass sectors not covered by the CCA

Introduction

This Annex provides sectoral statistics for the “manufacture and processing of other glass, including technical glassware” sector, which corresponds to the NACE rev.2 class 23.19. As mentioned in Box 5 in Chapter 3.2 above, while this sector was listed in the Technical Specifications for this Study, in agreement with the Commission it was not covered by the CCA for two main reasons: i) difficulties of collecting plant level data, which have been envisaged upfront by the relevant EU sectoral associations; and ii) difficulties of identifying representative plants and aggregating data, due to the high level of heterogeneity in terms of products, production processes and technologies. Against this background, it is worth remarking that in 2015 the three sectors covered by the CCA (flat glass, packaging glass and glass tableware) accounted for some 80% of the total value of production sold by the EU glass sectors listed in the Technical Specifications for this Study (Figure 122).

Figure 122. Share of the value of production sold by the EU glass sectors listed in the Technical Specifications (2015)



Source: Authors' own elaboration on PRODCOM.

Other glass, including technical glassware

The long list of specific products encompassed by the NACE rev.2 class 23.19 illustrates the **broad spectrum of companies and products falling under this sector**.¹⁹⁴ This diversity is also reflected in the **variety of production processes**, required raw materials (and their shares) and company sizes. Generally speaking, the same raw materials are used as for flat and hollow glass, but their composition might differ for each product. Furthermore, processes are often **less automated and more specialised** (which

¹⁹⁴ This class includes manufacture of: laboratory, hygienic or pharmaceutical glassware; clock or watch glasses, optical glass and optical elements not optically worked; glassware used in imitation jewellery; glass insulators and glass insulating fittings; glass envelopes for lamps; glass figurines; glass paving blocks; glass in rods or tubes.

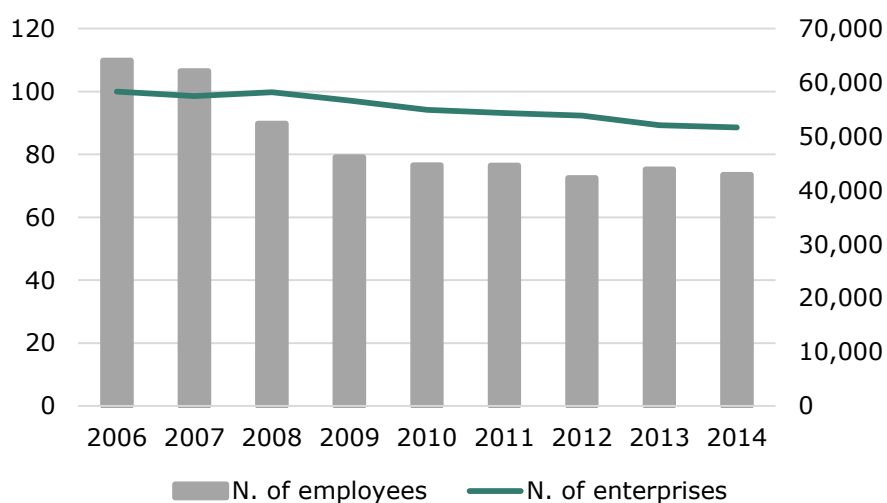
requires more manpower).¹⁹⁵ Many manufacturers are SMEs. Nevertheless, large companies, e.g. Schott, Swarovski, tend to have large market shares, e.g. Swarovski in the jewellery segment.¹⁹⁶

The value of the product usually comes from its **individualised and customised design**. Therefore, price competition is of less importance to the sector (this does not mean, of course, that companies do not aim to reduce their costs). Hence, companies have more possibilities of **passing on the costs to downstream clients** as long as the interaction between the marketing/sales activities and the design activities function well. Given the heterogeneity of the products, the sector also demands high-skilled labour forces in its design and manufacturing processes. Typical clients of this sector are **B2B** such as construction companies, laboratories or hospitals, but also shops or, to a minor extent, end-consumers (**B2C**), especially in those segments such as jewellery where some large companies have their own distribution network.¹⁹⁷

Sectoral statistics

As Figure 123 shows, the sector “other glass (including technical glassware)” contracted significantly beginning in 2008, as the numbers of enterprises and employees constantly decreased. The value of production sold remained relatively constant, in the range of €3.5-€4 billion, registering an upward trend between 2012 and 2015 (Figure 124); nonetheless, 2015 values were still below pre-crisis levels.

Figure 123. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture and processing of other glass including technical glassware



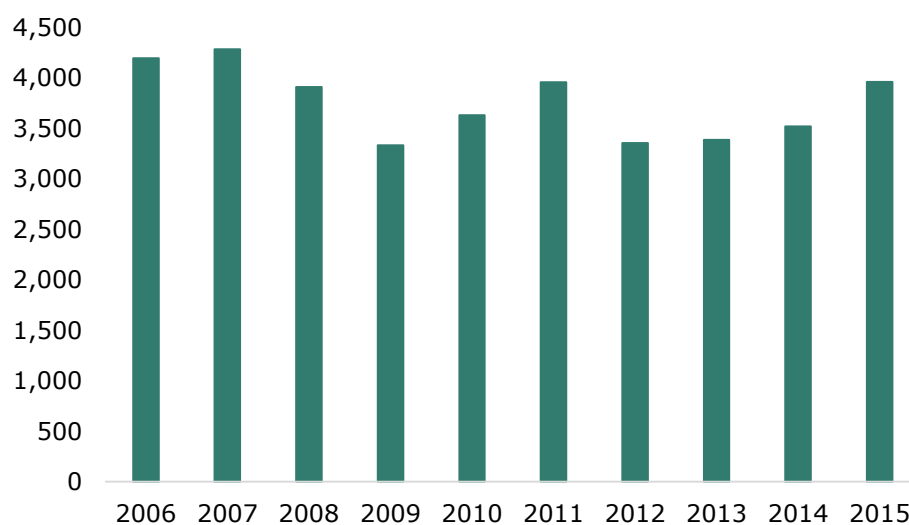
Source: Authors' own elaboration on Eurostat Structural Business Statistics.

¹⁹⁵ Ecorys (2008), “Competitiveness of the Glass Sector”.

¹⁹⁶ For further details see: www.luxurydaily.com/swarovski-benchmarks-2020-strategy-with-247-global-accessibility/.

¹⁹⁷ Ecorys (2008), “Competitiveness of the Glass Sector”.

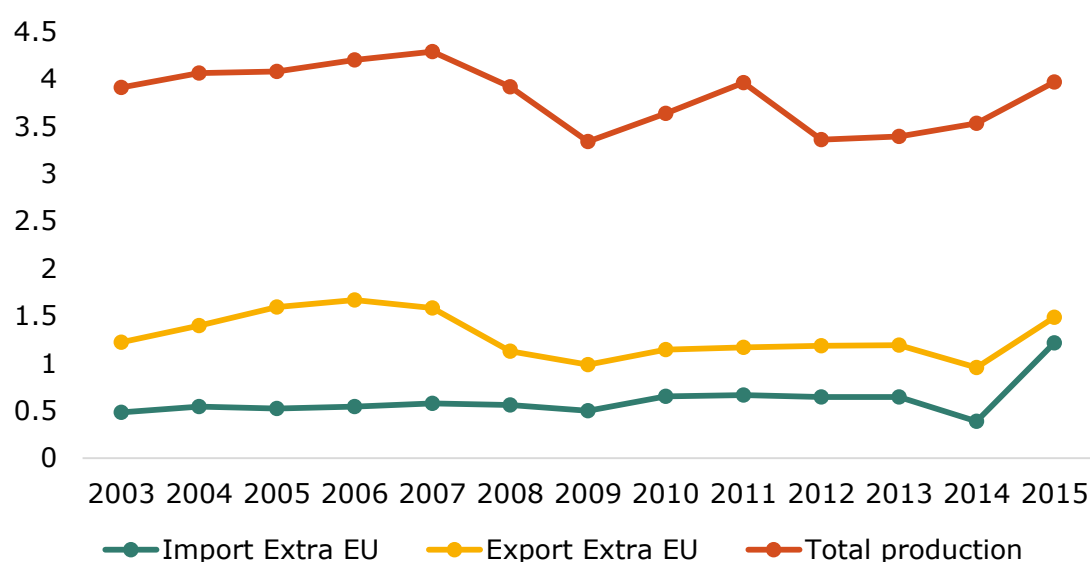
Figure 124. Value of production sold by EU producers of other glass including technical glassware (€ millions)



Source: Authors' own elaboration on PRODCOM.

As regards extra-EU trade in other glass (including technical glassware), **the EU was a net exporter**, as shown in Figure 125. However, in 2015, the positive trade balance narrowed to €270 million from €566 million registered in 2014. The first two international trade partners for the EU in this sector are the US and China, which rank first and second as both destination markets and exporters to the EU (Table 84). Together, these two countries make up to 42% and 68.2% of total extra-EU exports and imports, respectively.

Figure 125. Extra-EU-28 trade and total production in manufacture and processing of other glass including technical glassware (€ billions)



Note: The NACE category "Manufacture of other glass including technical glassware" (C2319 NACE Rev.2) corresponds to HS 7001, 7002, 7011, 7014, 7015, 7017, 7018, and 7020.

Source: Authors' own elaboration on COMEXT (2016).

Table 84. Top 10 trading partners for manufacture and processing of other glass including technical glassware in 2015 (% of overall export/import values)

Top 10 Destination Markets		Top 10 Exporters to the EU	
United States	24.4%	China	47.4%
China	18.1%	United States	21.2%
Switzerland	6.2%	Japan	8.1%
Japan	4.3%	Liechtenstein	5.1%
Norway	4.1%	Switzerland	4.3%
Russia	3.7%	India	3.7%
United Arab Emirates	3.7%	Malaysia	1.7%
Hong Kong	3.4%	Turkey	1.3%
South Korea	3.3%	Serbia	1.2%
India	3.0%	Hong Kong	0.7%

Note: The NACE category "Manufacture of other glass including technical glassware" (C2319 NACE Rev.2) corresponds to HS 7001, 7002, 7011, 7014, 7015, 7017, 7018, and 7020.

Source: Authors' own elaboration on COMEXT (2016).

Annex II – International Comparison

Introduction

This Annex compares production costs, energy costs and margins registered by European glass manufacturers in 2015 *vis-à-vis* those registered in the same year by manufacturers based in neighbouring countries. More specifically, the international comparison was performed for both producers of packaging glass and producers of flat glass. While the methodology applied to collect data and estimate all the indicators is detailed in Box 3, Table 85 and Table 86 report the number of plant-level observations on which each estimate relies.

Table 85. Packaging Glass: number of observations used to estimate key performance indicators and energy costs in 2015

	PRODUCTION COSTS	EBITDA	EBIT	ELECTRICITY COSTS	GAS COSTS
EU	21	21	21	21	21
CEE	6	6	6	6	6
SE	8	8	8	8	8
NWE	7	7	7	7	7
NEIGHBOURING COUNTRIES	5	6	6	6	6

Source: Authors' own elaboration.

Table 86. Flat Glass: number of observations used to estimate key performance indicators and energy costs in 2015

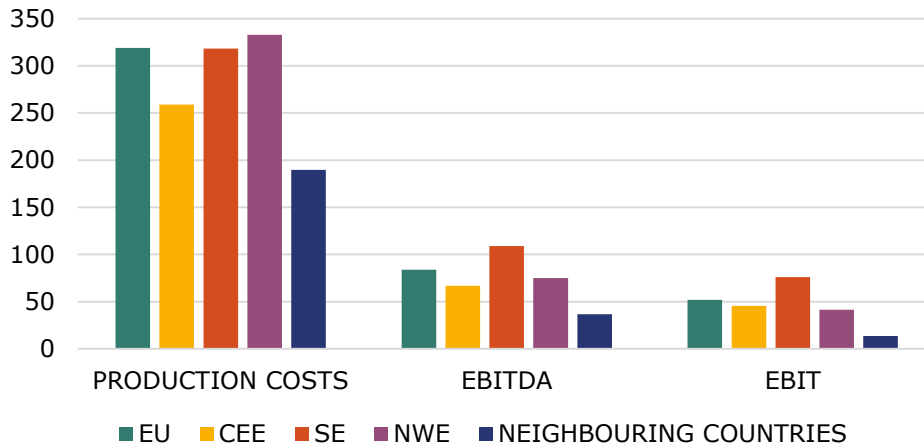
	PRODUCTION COSTS	EBITDA	EBIT	ELECTRICITY COSTS	GAS COSTS
EU	13	13	12	15	15
CEE	4	4	4	5	5
SE	4	4	3	5	5
NWE	5	5	5	5	5
RUSSIA	3	3	3	3	3

Source: Authors' own elaboration.

Packaging Glass

Figure 126 compares per-tonne production costs and margins registered in 2015 by EU packaging glass manufacturers *vis-à-vis* those registered in the same year by manufacturers based in a mix of neighbouring countries including Algeria, Ukraine, Russia, Switzerland and Turkey. Production costs as well as EBITDA and EBIT experienced by plants based in neighbouring countries were considerably lower than those borne by EU producers (190€/tonne versus 319€/tonne for production costs, 37€/tonne versus 84€/tonne for EBITDA and 14€/tonne versus 52€/tonne for EBIT). In fact, also the 2015 per-tonne turnover registered by neighbouring plants was much lower than the average EU turnover (€246 vs €438).

Figure 126. Packaging Glass: International Comparison – Key performance indicators (€/tonne, 2015)

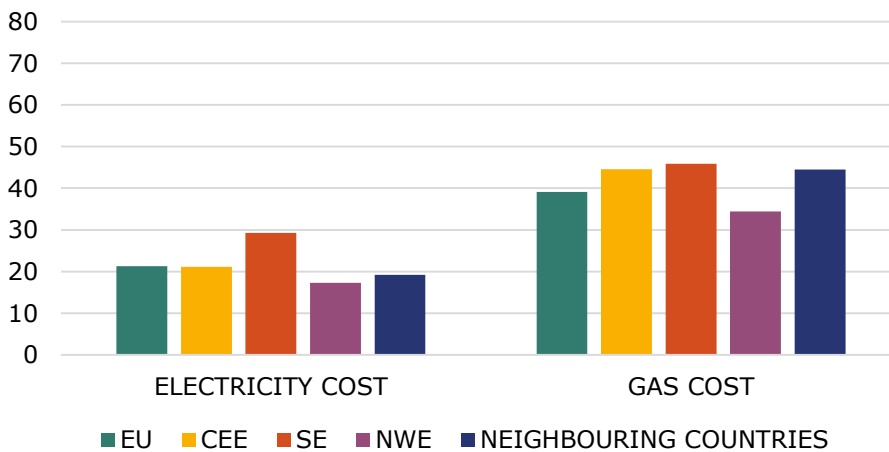


Note: Production costs for the neighbour region are estimated on a sample of five plants, while both EBITDA and EBIT rely on the entire sample of six plants.

Source: Authors' own elaboration.

As regards energy costs (Figure 127), per-tonne gas and electricity costs in neighbouring countries were on average comparable to those incurred by EU plants in 2015. Nonetheless, it is worth stressing that the variance for energy costs borne by the six plants producing packaging glass in the neighbouring region is quite high as they are located in countries characterised by important differences in the local energy market.

Figure 127. Packaging Glass: International Comparison – Energy costs (€/tonne, 2015)

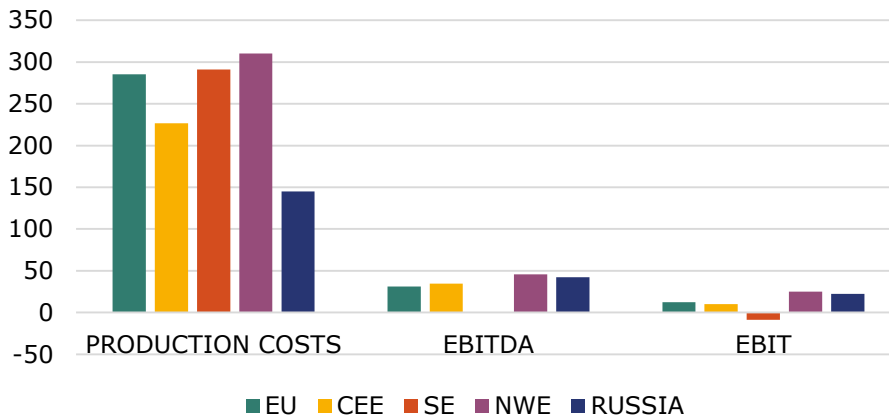


Source: Authors' own elaboration.

Flat Glass

Per-tonne production costs registered in 2015 by flat glass producers located in Russia were considerably lower than EU average values (145€/tonne versus 285€/tonne). By contrast, the average EBITDA and EBIT for Russia were higher than EU average values (42€/tonne versus 31€/tonne for EBITDA and 22€/tonne versus 12€/tonne for EBIT; Figure 128). This is consistent with the evidence that flat glass travels long distances (as shown in Chapter 12.3, Figure 77) and location based cost advantages play a prominent role in this sector.

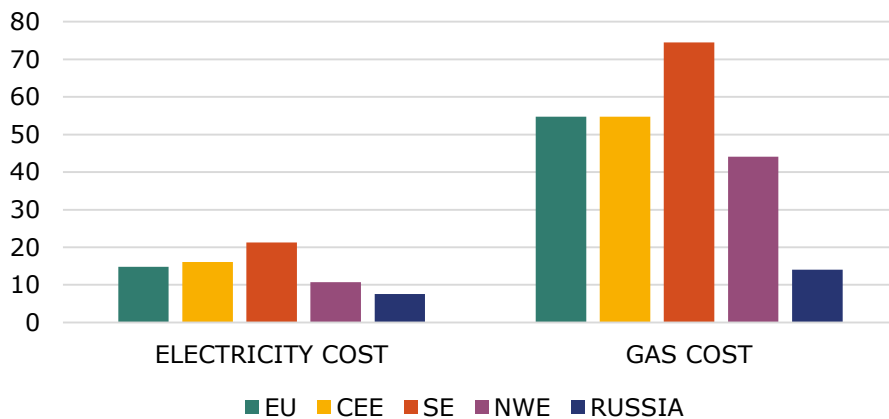
Figure 128. Flat Glass: International Comparison – Key performance indicators (€/tonne, 2015)



Source: Authors' own elaboration.

As flat glass plants covered by the international comparison are all based in Russia, differences in energy costs when compared with costs borne by EU plants were rather pronounced (Figure 129). Whereas average electricity costs in Russia were approximately half of the European ones in 2015 (7.6€/tonne versus 14.8€/tonne), the average gas costs were even lower, approximately one-fourth of those incurred by EU plants (14.0€/tonne versus 54.7€/tonne).

Figure 129. Flat Glass: International Comparison – Energy costs (€/tonne, 2015)



Source: Authors' own elaboration.

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