



# Cumulative Cost Assessment (CCA) of the EU Ceramics Industry

Final Report

Written by:  
CEPS, Economisti Associati and Ecorys  
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Final Report

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***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

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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 <sub>x</sub>	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.<sup>1</sup> 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.<sup>2</sup> 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.<sup>3</sup> Recently, the European Commission announced its intention to also use REFIT to stimulate innovation-driven investment.<sup>4</sup> 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.<sup>5</sup> For the first time, **cumulative cost studies** were listed among those measures that can more effectively contribute to growth and economic recovery. A subsequent Communication in October

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

<sup>2</sup> "REFIT – making EU law lighter, simpler and less costly", available at: [http://ec.europa.eu/smart-regulation/docs/refit\\_update.pdf](http://ec.europa.eu/smart-regulation/docs/refit_update.pdf).

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

<sup>4</sup> 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](http://ec.europa.eu/research/innovation-union/pdf/innovrefit_staff_working_document.pdf).

<sup>5</sup> 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.<sup>6</sup> 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,<sup>7</sup> 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,<sup>8</sup> 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.<sup>9</sup>

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.<sup>10</sup> 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

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

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

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

<sup>9</sup> 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. Note that the present CCA does not include any finding on international competitiveness as cost data for ceramics producers based in third countries are not available.

<sup>10</sup> 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 industries<sup>11</sup> to devise a coherent methodology.

**The CCA, *nomen omen*, is all about costs.** Hence, it does not include the benefit side of rules,<sup>12</sup> 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**.<sup>13</sup> 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**:<sup>14</sup> 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.<sup>15</sup> **Industry competitiveness is affected by several forces** such as industry rivalry, threat of new entrants, bargaining power, etc.<sup>16</sup> It depends, in part, on the business environment that is also influenced by the quality of regulation.<sup>17</sup> 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.<sup>18</sup> 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 complement the Impact Assessment Guidelines.<sup>19</sup> The toolkit reflects the need that "all

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

<sup>12</sup> 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.

<sup>13</sup> 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.

<sup>14</sup> 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.

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

<sup>16</sup> 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.

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

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

<sup>19</sup> European Commission, Impact Assessment Guidelines, SEC(2009)92.

proposals with a significant effect on industry undergo a thorough analysis for their impacts on competitiveness".<sup>20</sup> The CCA provides useful data to assess two out of the three dimensions of enterprise competitiveness as defined by the European Commission:<sup>21</sup> 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.<sup>22</sup>

### 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) general worker's health and safety and workplace safety, x) special worker's health and safety and xi) consumers and health; in addition, it discusses the role played by trade, competition and transport legislation as well as the Eco-Label Regulation and Natura 2000 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.

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<sup>20</sup> 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.

<sup>21</sup> Commission, Competitiveness Proofing Toolkit, *supra* note 20, at p. 7.

<sup>22</sup> 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. Note that the present CCA does not include any finding on international competitiveness, as cost data for ceramics producers based in third countries are not available.

## 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**.<sup>23</sup> 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).<sup>24</sup>

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

- As discussed in the 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.<sup>25</sup> 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.<sup>26</sup> Therefore, **cost savings are in principle out of the scope of the CCA**. Yet, as the CCA of the EU ceramics 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. recurrent costs), degree of certainty (cost vs. risk), target/addressee of the cost, e.g.

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

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

<sup>25</sup> Ibid., pp. 338, 341.

<sup>26</sup> Ibid., p. 147.

business, consumers, public authorities, etc. Nonetheless, the most comprehensive classification, which was adopted by the new better regulation guidelines,<sup>27</sup> 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:<sup>28</sup>

- 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.<sup>29</sup> At the EU level, administrative burdens are normally assessed through the International Standard Cost Model (SCM),<sup>30</sup> whose main principles are then integrated in the EU's SCM.<sup>31</sup> 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),<sup>32</sup> 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 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.

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<sup>27</sup> European Commission website on the guidelines for Better Regulation, at: [http://ec.europa.eu/smart-regulation/guidelines/tool\\_51\\_en.htm](http://ec.europa.eu/smart-regulation/guidelines/tool_51_en.htm).

<sup>28</sup> 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.

<sup>29</sup> 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).

<sup>30</sup> 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](http://www.administrative-burdens.com/filesystem/2005/11/international_scm_manual_final_178.doc).

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

<sup>32</sup> 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](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).

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

<b>Action 1.</b>	<b>Identifying the SOs or IOs</b> generated by each legal provision under analysis.
<b>Action 2.</b>	<b>Identifying the target group of addresses</b> that have to comply with each SO and IO.
<b>Action 3.</b>	<b>Segmenting</b> , if appropriate, <b>the target group by creating 'case groups'</b> based on, e.g. size, e.g. SMEs vs. large enterprises, or other dimensions, e.g. subsectors, products, regions. <sup>33</sup>
<b>Action 4.</b>	<b>Estimating the mode of compliance</b> with each SO or IO by a "normally efficient business". <sup>34</sup>
<b>Action 5.</b>	<b>Selecting those SOs and IOs that are expected to generate major regulatory costs</b> ; this allows for determining which legal obligations need to be quantified.
<b>Action 6.</b>	<b>Estimating the relevant cost parameters associated with each SO or IO</b> , by accounting for: <ul style="list-style-type: none"> <li>▪ <b>Personnel costs (PC)</b>, i.e. expenditures on salaries and wages for employees performing the activities requested by the legal obligation;<sup>35</sup></li> <li>▪ Other <b>operating expenditures (OPEX)</b>, including annual expenditures on energy inputs, materials and supplies, purchased services, maintenance of equipment and <b>out-of-pocket expenses</b>, i.e. any external cost required for experts' services or counselling;</li> <li>▪ <b>Investment costs</b> which includes: <ul style="list-style-type: none"> <li>• <b>Capital expenditures (CAPEX)</b>, "annualised" over the period of the useful life of the equipment purchased;</li> <li>• <b>Financial costs (FC)</b>, i.e. costs related to the financing of investment (normally considered in relation to CAPEX).</li> </ul> </li> </ul>
<b>Action 7.</b>	<b>Estimating the business as usual (BAU) factor for each SO or IO</b> , based on direct assessment or empirical data.
<b>Action 8.</b>	<b>Estimating the yearly frequency of occurrence</b> , i.e. by distinguishing between one-off obligations/costs and recurrent obligations/costs and measuring the yearly frequency of recurrent obligations/costs.
<b>Action 9.</b>	<b>Multiplying the costs per single SO or IO</b> (Action #6), <b>net of the BAU factor</b> (Action #7), <b>by the yearly number of occurrence</b> (Action #8).

<sup>33</sup> 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.

<sup>34</sup> 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.

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

**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** based on data collected at the plant level.

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

- |                  |  |
|------------------|--|
| <b>Action 1.</b> | <b>Identify the MOs</b> generated by each legal provision under analysis.  |
| <b>Action 2.</b> | <b>Identify the target group of addresses</b> that have to comply with each MO.  |
| <b>Action 3.</b> | <b>Segment</b> , if appropriate, <b>the target group by creating 'case groups'</b> based on e.g. size, e.g. SMEs vs. large enterprises, or other dimensions, e.g. subsectors, products, regions.           |
| <b>Action 4.</b> | <b>Estimate the unit cost of the charge</b> , e.g. cost of the fee, tax, license, and permit.  |
| <b>Action 5.</b> | <b>Estimate the frequency of the payment</b> , i.e. by distinguishing between one-off obligations/costs and recurrent obligations/costs and measuring the yearly frequency of recurrent obligations/costs. |
| <b>Action 6.</b> | <b>Multiply the unit cost of the charge (Action #4) by the yearly number of occurrence (Action #5).</b>  |
| <b>Action 7.</b> | <b>Dividing the yearly cost (Action #6) by the total output</b> 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 Specifications<sup>36</sup> for this Study, which require focusing on those pieces of legislation that generate the most significant costs for the ceramics industry.

Our assessment, based on CEPS<sup>37</sup> previous studies, other relevant literature as well as interviews with stakeholders,<sup>38</sup> indicates that the following indirect costs are proximate and significant for the EU ceramics 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 did not have data on relevant regulatory costs; in fact, transport activities were mostly outsourced and regulatory costs were not visible in bills paid by ceramics producers.

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<sup>36</sup> See Technical Specifications, pp. 23 and 24.

<sup>37</sup> 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".

<sup>38</sup> 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.

### **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 ceramics 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.<sup>39</sup> 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 started to **collect 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 were collected by requesting the full set of information from the relevant company. Nonetheless, **only a very limited number of ceramic companies provided such information and compliance with confidentiality rules does not allow for presenting any international comparison**. 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.*

### **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.

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

### **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 which 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.<sup>40</sup> 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 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

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<sup>40</sup> 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.

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**.<sup>41</sup>
  - A **person-month** is assumed to correspond to **142 hours**.<sup>42</sup>
  - A **working year (or FTE)** is assumed to correspond to **1,700 hours**.<sup>43</sup>
- **Multiplying the time by the hourly fee of the staff fulfilling the obligation.** Relevant categories of workers carrying out activities related to each legal obligation in a 'normally efficient business' were identified via follow-up interviews with company experts.<sup>44</sup> The monetisation of personnel costs relies on average

<sup>41</sup> Eurofound (2016), "Working time developments in the 21st century: Work duration and its regulation in the EU".

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> 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.

hourly earnings per category of workers at the Member State level based on Eurostat data.<sup>45</sup> 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 University<sup>46</sup> **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,<sup>47</sup> 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.

Finally, 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

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<sup>45</sup> 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>.

<sup>46</sup> The entire dataset is available at: [http://people.stern.nyu.edu/adamodar/New\\_Home\\_Page/datacurrent.html](http://people.stern.nyu.edu/adamodar/New_Home_Page/datacurrent.html).

<sup>47</sup> 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.

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.<sup>48</sup> 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, SME participation in the data collection phase was very limited and regional or EU average for SMEs cannot be presented due to confidentiality reasons.

### **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 collected in previous interviews. Additional details on data validation are provided in the Chapters assessing costs generated by specific areas of legislation (see Part B). 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

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<sup>48</sup> As mentioned at the beginning of this Chapter, it is worth remarking that one of the main benefits 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.

the EU production of ceramics. 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,<sup>49</sup> the CCA of the EU ceramics 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 ceramics 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** was selected. Against this background, this Chapter aims to:

1. discuss sampling criteria used to partition the EU population of ceramics producers into more homogenous groups;
2. describe the required composition of samples of ceramics 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 actual 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.<sup>50</sup> 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.**"<sup>51</sup>

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.<sup>52</sup> 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**

<sup>49</sup> 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.

<sup>50</sup> European Commission, Better Regulation "Toolbox" attached to the Better Regulation Guidelines, p. 345.

<sup>51</sup> OECD (2014), OECD Regulatory Compliance Cost Assessment Guidance, OECD Publishing, p. 35.

<sup>52</sup> 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 showed 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 was crucial to **partition the population of EU companies into homogenous groups**, based on selected sampling criteria, and then to **collect at least five observations for each of these groups**.

Against this background, for the purposes of the CCA, the **sampling strategy** for the ceramics 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,<sup>53</sup> 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 9), to ensure the broadest geographical coverage, data have been 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:

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<sup>53</sup> 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**.<sup>54</sup>

**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 *ex 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 linked to 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.<sup>55</sup> 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.

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<sup>54</sup> 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 2003/361/EC 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)).

<sup>55</sup> 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 ceramics 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. refractories, differences in products and production technologies should be considered 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 ceramics industry is discussed. More specifically, this section focuses on the three 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 **refractory products** (NACE rev.2 23.20);
- Manufacture of **ceramic tiles and flags** (NACE rev. 2 23.31; hereinafter 'ceramic tiles');
- Manufacture of **bricks, tiles and construction products in baked clay** (NACE rev. 2 23.32; hereinafter 'bricks and tiles').

#### Box 5. Reasons to refrain from launching a CCA of other sectors of the EU ceramics industry

The **Technical Specifications for this CCA required covering nine sectors of the EU ceramics industry**:

- 23.20 Manufacture of refractory products;
- 23.31 Manufacture of ceramic tiles and flags;
- 23.32 Manufacture of bricks, tiles and construction products, in baked clay;
- *23.41 Manufacture of ceramic household and ornamental articles;*
- *23.42 Manufacture of ceramic sanitary fixtures;*
- *23.43 Manufacture of ceramic insulators and insulating fittings;*
- *23.44 Manufacture of other technical ceramic products;*
- *23.49 Manufacture of other ceramic products;*
- *23.91 Production of abrasive products.*

The EU associations representing ceramics sectors highlighted in italics 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 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 sectors. 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 these ceramics sectors 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 these sectors 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:

- heterogeneity within product categories, and consequently of production technology, is a major feature of **manufacture of ceramic household and ornamental articles**;
- a large variety of products, very different when it comes to features and production processes, are also comprised in the **manufacture of other technical ceramic products** and the **manufacture of other ceramic products** that are by their very nature residual categories comprising ceramics goods (technical and non-technical) not covered by other NACE 4-digit codes;
- even greater heterogeneity is found in the **manufacturing of ceramic insulators and insulating fittings**, a sector that represents a relatively minor share of the EU ceramics industry turnover (some 1.6% in 2015);
- for what concerns the production of abrasive products, it is worth recalling that **only a minor share of abrasive products are actually made of ceramics** (according to PRODCOM data, about 14% of the sectoral turnover in 2015) and several companies have multi-product facilities; hence, the relevance of the sector for the EU ceramics industry is limited;
- **ceramic sanitary-ware** (some 5.5% of total turnover in 2015) are characterised by "homogeneity within heterogeneity": while production processes are rather homogeneous for similar products, substantial elements of heterogeneity emerge between different products comprised in the sector.

See Annex I for further details on the ceramics sector highlighted in italics.

Finally, it is worth remarking that sectors covered by the CCA represent the lion's share of the EU ceramics industry. In fact, in 2015 manufacturers of refractories, ceramic tiles and bricks and tiles were responsible for some **67% of the overall turnover in the EU ceramics sectors** listed in the Technical Specifications. Hence, a CCA confined to the three sectors covered by this Study still covers a **substantial share of the EU ceramics industry turnover**. At any rate, no conclusion for missing sectors can be drawn by relying on data collected in the sectors under observation.

*Source: Authors' own elaboration.*

Dividing the EU population of manufactures of refractories, ceramic tiles and flags, and bricks and tiles into homogenous groups requires considering the following sampling criteria:

- **sectors**;
- **geographical distribution**;
- **company size/ownership**;
- **plant features** (limited to the refractories sector).

In 2014, **large companies** were responsible for some 45% of the turnover in the refractory sectors, where a less prominent role was played by **medium-sized enterprises**, which account for 38% of total turnover. The role of small companies was rather marginal. Comparable considerations apply to the manufacturing of clay building materials (NACE rev.2 23.3), where the turnover was mainly generated by large (53%)

and medium-sized (34%) companies. Interestingly, according to industry associations, **SMEs** have a more central role in the ceramic tile sector, while manufacturing of bricks and tiles is relatively more concentrated. At any rate, it is worth stressing that medium-sized companies are more important in the ceramics industry than in the manufacturing of flat glass and hollow glass. This is the main reason why, in principle, **company size is considered a relevant sampling variable** in the ceramics industry.

**Plant features** are not a relevant variable for the **ceramic tiles** and **bricks and tiles** sectors (see Box 6 and Box 7 for a description of the production process in the two sectors). Although both sectors comprise very heterogeneous products (in terms of physical composition, dimension, weight, shape, surface and colour), they are rather **homogenous when it comes to the production process**. Relevant stakeholders have confirmed that this applies also to the clay pipes segment within the bricks and tiles sector. In the same vein, the configuration of the **value chain** in the two sectors is quite straightforward and do not entail downstream processing activities performed by different companies. In principle, there is room for **different levels of vertical integration**, especially when it comes to access to raw materials and logistics, which should be considered while assessing the nature of costs (either direct or indirect) triggered by EU rules.

#### **Box 6. Bricks and tiles: overview of the production process**

The bricks and tiles sector (NACE Rev.2 23.32) includes manufacturers of products with diverse shapes and properties, divided on the basis of their intended usage. More specifically, bricks and tiles manufacturing includes **four different kind of goods**, namely: (i) building bricks, including both clay blocks and facing bricks; (ii) roof tiles; (iii) paving bricks; and (iv) chimney bricks and other clay building products.<sup>56</sup>

In spite of those differences, **the production process remains largely the same** for all the previous goods. In a nutshell, bricks and tiles are products made from inorganic non-metallic minerals (such as clay) manufactured through a permanent firing process that changes their chemical properties.<sup>57</sup>

The production process includes **five main stages**: i) preparation of the raw materials; ii) shaping; iii) drying; iv) firing; and v) finishing.<sup>58</sup>

**Preparation of raw materials.** Clay constitutes the main raw material employed by the industry, together with a few other argilliferous materials (bentonite, fire clay, etc.) and minerals. Sawdust or residue from the paper industry can be added to increase the porosity of the final product. Due to the low value-to-weight ratio of raw materials, manufacturing plants of bricks and tiles are usually located near extraction sites.<sup>59</sup> In many cases brick and tile producers are vertically integrated with quarrying operations, namely clay extraction. After extraction, raw materials are transported and stored at the production site, where they are prepared, usually through dry or semi-wet processes. During the preparation step, the particle size of raw materials is reduced

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<sup>56</sup> CEPS (2014), "Composition and Drivers of Energy Prices and Costs in Energy-Intensive Industries: The Case of the Ceramics Industry—Bricks and Roof Tiles", p. 1.

<sup>57</sup> Ecofys and Fraunhofer-ISI (2009), "Developing benchmarking criteria for CO2 emissions", Study ordered by European Commission (Service contract ENV.C.4/SER/2007/0059), Ecofys and Fraunhofer ISI, Utrecht and Karlsruhe, February.

<sup>58</sup> Tiles and Bricks Europe, TBE (2015), "Production Process" ([www.tiles-bricks.eu/industry](http://www.tiles-bricks.eu/industry)).

<sup>59</sup> Ecorys (2008), "Competitiveness of the Ceramics Sector". Within the Framework Contract of Sectoral Competitiveness Studies, ENTR, Competitiveness, p. 22.

through pan-mills<sup>60</sup> and double roller crushers, water content is adjusted to the appropriate moisture level, and additives and other raw materials are added.

**Shaping.** Raw materials are then shaped, through pressing, extrusion or moulding. Extrusion, the most widespread technique, consists of making the raw material sufficiently 'plastic', so that it can be forced through the die of the extruder, to acquire the desired form, and then be cut into units of the required size. Pressing, which is still used for the manufacture of bricks, consists in loading boxes of the desired shape with a certain volume of clay, and then applying pressure from above and below. Moulding, most often a residual technique, demands less power and energy than pressing or extrusion, but requires a wetter mix of raw materials, thus increasing the energy consumption and time required for drying.

**Drying.** Drying and firing are the most energy-intensive steps of the production process of bricks and tiles. Drying is used to reduce the water content of materials at relatively low temperature (45°-90°C) and mainly takes place in chamber (intermittent) or tunnel (continuous) dryers. The drying equipment is usually heated through either hot air recovered from the kiln or gas burners. With new and more efficient drying technology, the duration of the process has been significantly reduced and depending on the type of product, drying can last from as few as four hours to over 40 hours.

**Firing.** Once dried, brick and tiles are fired in kilns. This is the key step to determining the properties of the finished products. Kilns may be either intermittent or continuous, the latter being more suitable for larger plants and more energy-efficient. Most bricks and roof tiles are nowadays fired in continuous tunnel kilns, whose temperature ranges between 800° and 1,300°, depending on the mineralogical properties of the clay mix, the type of products and the characteristics to be obtained. The firing process lasts from around six hours to over 40 hours, depending on the product. Kilns are usually gas-fired (over 80%), though oil, coal, or biomass can also be used (Figure 2). Intermittent kilns can be used to produce smaller batches of specialised roof tiles or bricks.

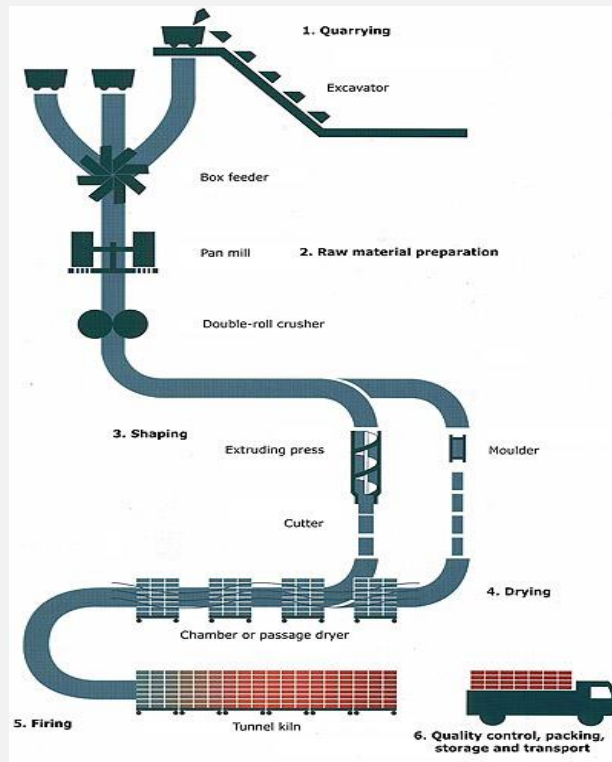
**Finishing.** Once fired, products may require subsequent treatments, such as calibration, cutting or surfacing or either be ready for shipping and distribution.<sup>61</sup>

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<sup>60</sup> This may include sieving in the case of dry crushing.

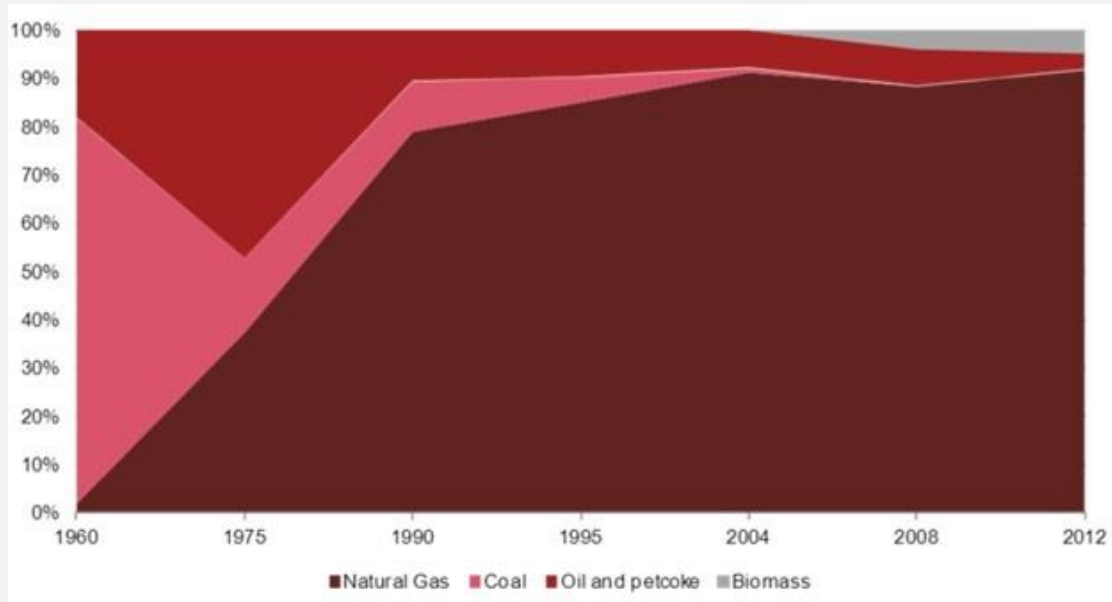
<sup>61</sup> European Commission (2007), Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, August.

**Figure 1. Production process for the bricks and tiles sector**



Source: Tiles and Bricks Europe.

**Figure 2. Energy carrier consumption in the bricks and tiles sector**



Source: Tiles & Bricks Europe.

Source: Authors' own elaboration.

**Box 7. Ceramic tiles: overview of the production process**

Ceramic tiles (NACE rev. 2 23.31) are thin slabs made of clay and other inorganic materials (which give them their main physical characteristics), which are usually employed in the construction industry as a finishing material and/or to fulfil an aesthetic function.<sup>62</sup> Ceramics tiles are heterogeneous products in terms of physical composition, dimension, weight, shape, surface and colour as well as use. Covering and/or decorating both internal, e.g. kitchen and bathrooms, and external surfaces, swimming pools and public areas are among the most traditional uses for tiles. Moreover, unlike many other ceramic products (such as bricks and roof tiles), ceramic tiles are high value added and highly tradable goods; hence, they are more subject to international competition.

The production process includes **five main stages**: i) preparation of the raw materials; ii) shaping; iii) drying; iv) glazing; and v) firing.<sup>63</sup>

**Preparation of raw materials.**<sup>64</sup> Raw materials preparation consists of selecting, grinding and mixing the necessary inputs. The body composition of the tile is determined by the amount and type of raw materials employed which ultimately influence factors such as colour, resistance and water absorption. As a consequence, batching, i.e. the selection of the raw material to be employed, has to take into account both physical properties and chemical composition of the inputs.

Once the right combination of materials is determined, they are grinded and mixed: inputs are transferred to primary crushers, i.e. jaw or gyratory crushers, which reduce them into large lumps, and to hammer mills for secondary crushing to obtain smaller particles. Sometimes water has to be added (the so-called 'wet milling' process) and, at a later stage, removed through filtering and spray drying<sup>65</sup> in order to improve the mixing of a multi-component batch.

It is worth noting that, even though 'dry milling' is more energy efficient,<sup>66</sup> wet milling is the most commonly used process in Europe as it allows for finer grinding and, thus, a better-quality product.

**Shaping.** Shaping is needed to give the desired form to the input mix. This step can take place through two processes, namely dry pressing and extrusion. The former constitutes the most commonly used method and despite the name the materials still contain 3-10% water. Two types of presses could be employed, i.e. the hydraulic press and friction press. The first is more commonly used in this sector as it offers the advantage of easier controllability thanks to consistently higher pressure. Unlike dry pressing, extrusion is used when the inputs are still in a wetter and more mouldable form.

<sup>62</sup> European Commission (2007), Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, 2007 (<http://tinyurl.com/njerd3h>).

<sup>63</sup> Gabaldón-Estevan, D. et al. (2014), "Is European Union Environmental Policy Efficient at Promoting a Post-carbon Industry? The Case of Energy in the European Ceramic Tile Sector", in Proceedings of the 11th ICIM 2014, Vaasa (Finland) 104-113 (<http://icim.vamk.fi/2014/uploads/UploadPaperDir/11thICIM2014.pdf>).

<sup>64</sup> The raw material employed by the industry is clay, together with a few other argilliferous materials (bentonite, fire clay, etc.); minerals such as manganese dioxide, titanium dioxide and calcium carbonate could be added to obtain different colours or porosity. Finally, chemical additives might be necessary for the shaping process.

<sup>65</sup> Spray drying involves pumping the slurry into an atomizer which is composed of a rapidly rotating disk. Inside the atomizer droplets evaporate in a hot air column, leaving granulate powder which is suitable for shaping.

<sup>66</sup> The wet process entails a greater consumption of energy resources which are necessary to evaporate excess water and obtain granules of atomized powder suitable for being shaped by pressing.

**Drying.** Drying consists of the gentle expulsion of residual water through heat. Once shaped, tiles are heated in order to remove the water slowly enough to prevent shrinkage and cracks; this stage might take several days and employ continuous or tunnel driers heated using gas or oil or infrared lamps.

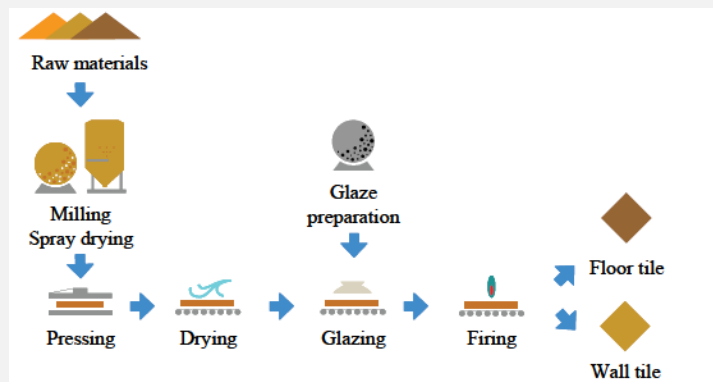
**Glazing.** Just before firing, tiles are glazed. The glaze is made using methods that are similar to those adopted for the preparation of the body: after a batch formulation is calculated, the raw materials are weighed, mixed and dry- or wet-milled.

**Firing.** Firing is the core of the production process and allows tiles to acquire their main characteristics, i.e. water-resistance, fire-resistance and hardness. More specifically, ceramic tiles are thermally consolidated into a dense and cohesive body through the use of kilns or ovens. This step can be performed via two different processes depending on whether wet milling or dry milling is used to prepare the raw materials.

Wet-milled tiles require a single firing process through roller kilns, usually taking about 60 minutes at a temperature of at least 1,150°C. For other tiles, a two-step process is employed. First, they go through a preliminary firing before glazing in order to remove the volatiles; subsequently, the body and glaze are fired together in a tunnel or batch kiln. In this case firing can take from two to three days with a temperature of about 1,300 °C.

Kilns for firing represent a major capital investment for ceramic tile producers and are characterised by an investment life cycle of more than 40 years. Finally, tiles are ready to be tested before being packed and shipped.<sup>67</sup> Figure 3 provides a schematic illustration of the manufacturing process for a single-fired ceramic tile.

**Figure 3. Schematic illustration of a single-fired ceramic tile manufacturing process**



Source: Mezquita et al. (2014).<sup>68</sup>

Source: Authors' own elaboration.

Conversely, **plant features** do matter in the **refractories sector** (see Box 8 for a description of the production process). In this respect, **heterogeneity in the production process** to obtain different refractories products needs to be reflected in the sample. More specifically, regulatory costs generated by EU rules are expected to have **different impacts on manufacturing of fired products vis-à-vis unfired products**. On the one

<sup>67</sup> Quality control procedures on finished product regarding size, shape and any cracks present in the text are key in this sector.

<sup>68</sup> Mezquita, A. et al. (2014), "Energy saving in ceramic tile kilns: Cooling gas heat recovery", *Applied Thermal Engineering*, 65(1), 102-110 (<http://doi.org/10.1016/j.applthermaleng.2014.01.002>).



hand, the firing stage<sup>69</sup> appears to be pivotal in determining the energy intensity of the entire production process and, in turn, the magnitude of some regulatory costs. More specifically, costs generated by the energy and climate legislation as well as by the environmental legislation (in particular by the Industrial Emission Directive) are expected to be significantly higher for plants involved in the production of fired refractories. On the other hand, **production of shaped unfired shaped refractories relies on chemical additives** to skip the firing stage and this is likely to be reflected in higher regulatory costs descending from some pieces of legislation including in the Internal Market area, e.g. REACH and CLP.

Also the **value chain configuration** has an important role in building the sample for the refractories sector. In particular, when it comes to **unshaped products, their production involves only the upper part of the refractories value chain**, as part of the production process is performed at the site of use. In this respect, unshaped refractories are intermediate products<sup>70</sup> and it is common that manufacturers of fired or unfired products sell part of their mixed raw materials as unshaped products.

### Box 8. Refractories: classification and overview of the production process

Refractory products (also known as 'refractories') are a class of **ceramics that retain their strength at high temperatures**. Due to their properties, refractories are used in many industrial applications of the steel, iron, cement, lime, glass, ceramic, aluminium, copper and petrochemicals industries, in incinerators, power plants, and house heating systems including night storage heater blocks.<sup>71</sup> Refractories can be classified, according to their physical form, in shaped and unshaped products;<sup>72</sup> more specifically, different products serve different uses.

**Shaped refractories** are products which have a fixed shape when delivered to the user; these are manufactured by either fired or chemically bonded (unfired) methods. **Fired refractories** are formed by heating the refractory material to high temperatures in a kiln to form a ceramic bond; this process gives the raw materials their refractory properties. As opposed to fired refractories, **unfired shaped refractories** are formed with the aid of selected additives (usually a carbonaceous binder and possible addition of antioxidants and steel fibres) that, set up at lower temperatures, provide structural integrity, eliminating the need for a proper firing stage (only drying applies).<sup>73</sup>

Finally, **unshaped (unfired) refractories**, also called monolithic, are without definite form and are only given shape upon application. Common unformed refractories include monolithic-plastic, ramming and gunning mass, castables, mortars and dry vibrating cements. Unshaped refractories typically do not go through a firing or drying process until they reach the customer.<sup>74</sup>

<sup>69</sup> Firing is the core of the production process for fired refractory products and consists of a thermal treatment that may take up to 40 hours at a temperature ranging between 700°C and 2,500°C. See Surendranathan, A.O. (2014), "An Introduction to Ceramics and Refractories", Boca Raton, FL: CRC Press, Taylor and Francis Editions, p. 255.

<sup>70</sup> Saxena, J.P. (2003), *Refractory Engineering and Kiln Maintenance in Cement Plants*, New Delhi, India: Tech Books International, p. 117.

<sup>71</sup> Ecorys (2008), "Competitiveness of the Ceramics Sector", p. 23.

<sup>72</sup> Garbers-Craig, A.M. (2008), "Presidential address: How cool are refractory materials?", *The Journal of the Southern African Institute of Mining and Metallurgy*, 108, p. 1.

<sup>73</sup> Dreser, M.L. and W.H. Boyer (1963), "High-Temperature Firing of Basic Refractories", *Journal of the American Ceramic Society*, 46(6), 257-264.

<sup>74</sup> Environmental Protection Agency (2001), "Refractories Manufacturing NESHAP: Industry Profile, Methodology, and Economic Impact Analysis", p. 10.

Class 23.20 of the **NACE (Rev.2) statistical classification** of economic activities in the European Community encompasses the manufacture of refractory products. More specifically, the following NACE 8-digit codes are covered by the present CCA:

- **Fired Refractories:**

- 23.20.11.00: Ceramic goods of siliceous fossil meals or earths including bricks, blocks, slabs, panels, tiles, hollow bricks, cylinder shells and pipes excluding filter plates containing kieselguhr and quartz;
- 23.20.12.10: Refractory ceramic constructional goods containing >50% of MgO, CaO or Cr<sub>2</sub>O<sub>3</sub> including bricks, blocks and tiles excluding goods of siliceous fossil meals or earths, tubing and piping;
- 23.20.12.33: Refractory bricks, blocks..., weight >50% Al<sub>2</sub>O<sub>3</sub> and/or SiO<sub>2</sub>: ≥93% silica (SiO<sub>2</sub>);
- 23.20.12.35: Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods containing, by weight, >7% but <45% alumina, but >50% by weight combined with silica;
- 23.20.12.37: Refractory bricks, blocks..., weight >50% Al<sub>2</sub>O<sub>3</sub> and/or SiO<sub>2</sub>: others;
- 23.20.12.90: Refractory bricks, blocks, tiles, etc., n.e.c.

- **Unfired shaped refractories:**

- 23.20.14.10: Articles containing magnesite, dolomite or chromite (including bricks and other shapes, touchstones for testing precious metal, paving blocks and slabs) (excluding refractory goods);
- 23.20.14.30: Refractory ceramic goods, n.e.c., by weight >25% graphite or other forms of carbon;
- 23.20.14.55: Refractory ceramic goods, n.e.c., alumina or silica or mixture > 50%: alumina <45%;
- 23.20.14.59: Refractory ceramic goods, n.e.c., alumina or silica or mixture > 50%: alumina ≥45%;
- 23.20.14.90: Refractory ceramic goods, n.e.c.

As further discussed below, the CCA does not cover the EU production of unfired unshaped refractories.

The refractories' production process entails **different stages**, depending on the kind of product:<sup>75</sup> i) preparation of the raw materials, i.e. crushing, batching and mixing, which applies to all products; ii) moulding, which applies only to fired and unfired shaped refractories; iii) drying, which applies only to fired and unfired shaped refractories; and iv) firing, which applies only to fired shaped refractories.

**Preparation of raw materials.** Raw materials preparation consists of selecting, grinding and mixing the necessary inputs. Indeed, the body composition of the refractory product is determined by the amount and type of raw materials employed which ultimately influence factors such as density, porosity, permeability, crushing strength, modulus of rupture and elasticity as well as thermal shock resistance. The raw materials used for the manufacture of refractories include different types of clays, chamotte (i.e. a ceramic raw material with high percentages of alumina and silica), processed raw materials (magnesia either sintered or fused), and, depending on the kind of product, chemical bonding materials and other additives, e.g. for unfired shaped

<sup>75</sup> Surendranathan, A.O. (2014), "An Introduction to Ceramics and Refractories", Boca Raton, FL: CRC Press, Taylor and Francis editions, p. 385.

refractories. These refractory materials, which are usually found as mineral deposits, are then crushed through jaw or gyratory crushers for primary crushing and roller crushers, disk crushers or various types of hammer mills for secondary crushing. Eventually, crushed raw materials are then subjected to mineral dressing, i.e. a purification processes by which impurities are segregated. Along with raw materials, some water or organic binders (e.g. lingo-sulfonate or citric acid) is also added, varying from less than 5% to 20% of the batch. Once raw materials have been properly treated they are batched and mixed. Batch weighing cars are normally used to draw accurate proportions of required materials from the storage bins. Finally, mixing is carried out by employing one of the available kind of mixers, e.g. pan mixer, trough mixer, drum mixer, pug mill and counter current mixer etc. The mixing process should ascertain a homogenization and wetting of the individual components, thus achieving a plasticity of the mix, which eases compaction during subsequent pressing. Additionally – as a side effect – the shearing forces appearing in the mixing process allow a temperature adjustment of the final mix. Batch sizes (and thus the size of the mixers) vary between 100 kg up to 5000 kg. Mixing times vary between a few minutes and -in extreme cases - several hours.

**Moulding/Pressing.** Moulding is needed to give the desired form to the input mix. This step can take place through two processes, namely hand moulding and machine moulding. The former method entails the hand-filling of a wooden box mould with a plastic mix containing about 14%-20% of water. Unlike hand moulding, machine moulding entails the extrusion and pressing by machines of a 10%-12% water-mixed semi-plastic compound. Finally, non-plastic mixtures as well as clays containing not more than 5% of water are moulded by dry pressing, thus applying pressure in the range of 35-140 MPa. Shaped refractory products undergo a compaction process by an external force, which is in contrast to e.g. casting a refractory concrete in a mould. There are several ways of applying this external force (e.g. hydraulic press, friction press, rarely isostatic pressing or even manual compaction with a pneumatic hammer in a mould). Depending on target values maximum specific press forces range between 50 N/mm<sup>2</sup> and 400 N/mm<sup>2</sup>. Usually, the pressing process is split into individual strokes, whereby the first stroke aims at deairing, subsequent ones at compacting and the final one at achieving proper dimensions of the shaped product. It is common practice that more than one brick is pressed within a single cycle by relying on multi-hole moulds and a corresponding number of plungers. The maximum force of a press is usually described by its "press tonnage" (e.g. 2000 to press). Standard cycling times range between 20 seconds and a few minutes (including filling and release of the shaped product). Individual shapes vary between below one kg and up to more than 100 kg.

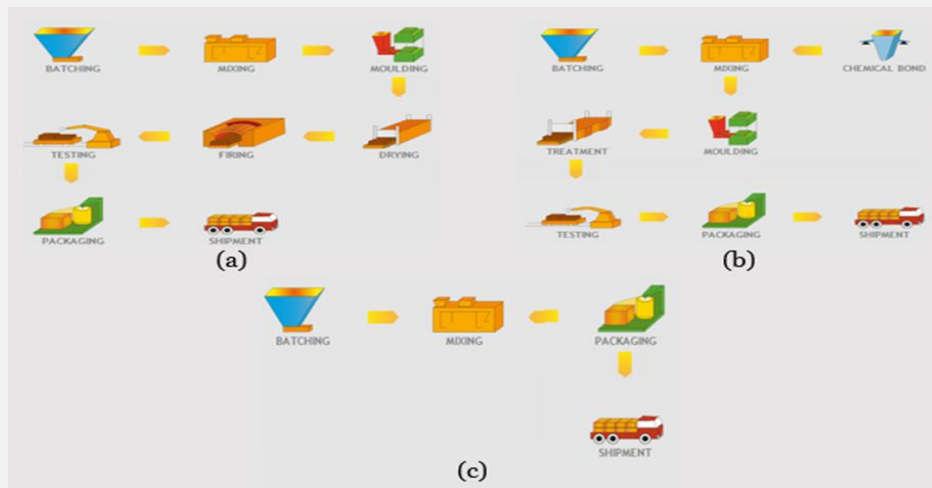
**Drying.** Drying consists of the gentle expulsion of residual water through heat. Two alternative methods of drying are commonly used: drying floors and tunnel kilns. In the first case, shaped refractory products are laid down on open trays and dried through the waste heat coming from kilns. Conversely, tunnel kiln drying entails the stacking of refractory parts on bogies which are then admitted at one end of the tunnel kiln; as the bogeys come down the kiln, the drying takes place.

**Firing.** Firing is the core of the production process of fired refractory products, consisting in a thermal treatment enabling the ceramic sintering of the moulded bricks. More specifically, fired refractory products are thermally consolidated into a dense and cohesive body through the use of kilns or ovens. This step can be performed via several types of kilns (intermittent, semi-continuous and tunnel kilns) and employing mainly natural gas, or in some cases oil or coal. Through intermittent kilns, stacks of refractories are loaded, fired, allowed to cool and unloaded, after which the same steps are repeated. These kilns are normally used only in the small manufacturing units or those making specialised products (e.g. products requiring special temperature curves which cannot provided by continuous kilns); they are characterised by a low heat

efficiency because of their intermittent nature.<sup>76</sup> Shuttle kilns represent examples of semi-continuous kilns. Continuous or tunnel kilns, which constitute the most common category of kilns employed, allow the movement of bricks on rail cars along the length of a fixed temperature profile (depending on the product and properties required) tunnel. The firing of the bricks typically takes between 10 and 40 hours, depending upon kiln type and other variables, and it could be ideally divided into five stages:<sup>77</sup> i) final drying (evaporating free water); ii) dehydration; (iii) oxidation; (iv) vitrification; and (v) flashing or reduction firing. After the previous stages, the cooling process takes place, rarely exceeding 10 hours for tunnel kilns and from 5 to 24 hours for intermittent kilns.

Finally, refractory products are ready to be tested before being packed and shipped. Figure 4 provides a schematic illustration of the manufacturing process for each of the refractory product categories presented above.

**Figure 4. Fired shaped (a), unfired shaped (b) and unshaped (c) refractories production flow**



Source: [http://www.sanac.com/en/production\\_process.aspx](http://www.sanac.com/en/production_process.aspx).

Source: Authors' own elaboration.

In this context and after conducting interviews with industry experts, the Research Team divided **the refractories sector into two subsectors**: i) plants manufacturing **fired refractories**; and ii) plants manufacturing **unfired shaped refractories**. Some caveats apply:

- Some plants (between 30% and 50% of EU facilities) are involved in the production of both fired and unfired shaped refractories in two or more product lines. Ideally, the sample should have focused only on **plants producing either fired or unfired products** to avoid problems generated by the attribution of common costs. Mixed plants were sampled only if able to attribute regulatory costs to specific product lines.
- Few plants based in Europe (in a limited number of Member States) produce refractories for special applications, e.g. gas furnaces, through **electric arc or**

<sup>76</sup> Intermittent kilns may also be used at other manufacturing units, where small batch sizes of highly specialised, high-value products are required and a high-volume tunnel kiln firing may not be appropriate.

<sup>77</sup> "Production Process for Shaped Refractories" (<http://ispatguru.com/production-process-for-shaped-refractories/>).

**induction furnaces** at very high temperatures (1,900-2,500°C). This production process is not representative for the EU refractories industry and collecting data from the small number of existing facilities would generate problems of confidentiality.

- Finally, relevant EU and national associations have pointed out difficulties in involving more than 30 plants across the EU in the CCA. In this respect, to comply with the principle of proportionate analysis, the Research Team **dropped the company size/ownership** criterion for the refractories sector.

In addition, to allow a sound comparison of results within the different segments of the refractories sector and across sectors, **plants producing only unshaped products should not be included in the sample**, as part of the costs (and related regulatory costs) to finish these products are born by players outside the scope of this CCA and cannot be quantified.

Against this background and keeping in mind international best practices to collect data on regulatory costs, a minimum of 30 interviews for each sector of the ceramic industry are necessary (Table 2), which translates into a total of 90 interviews.<sup>78</sup>

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

Geographical regions	Refractories	Refractories	Ceramic tiles	Ceramic tiles	Bricks and tiles	Bricks and tiles
	Fired	Unfired	Large	SME	Large	SME
Southern Europe	5	5	5	5	5	5
Central-Eastern Europe	5	5	5	5	5	5
Northern-Western Europe	5	5	5	5	5	5
<b>Total</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>

*Source: Authors' own elaboration.*

Notwithstanding the same minimum number of interviews per geographical region, 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 in the refractories and bricks and tiles sectors to reflect the uneven distribution of production across the EU; conversely, in the ceramic tiles sector, responses from plants based in Southern Europe were weighted more than those from the two other geographical regions.

<sup>78</sup> As previously mentioned, segmenting the population in 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.

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

Geographical regions	Refractories	Ceramic tiles	Bricks and tiles
Southern Europe	21.3%	78.8%	24.8%
Central-Eastern Europe	13.7%	8.3%	16.7%
Northern-Western Europe	65%	12.9%	58.5%

Note: Missing data on turnover for refractories, for ceramic tiles and for bricks and tiles were estimated via Amadeus.

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

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.

The 'main list' and 'mirror list' for the three ceramics sectors were compiled by relying upon the **Amadeus database and lists of members of the main national associations** of manufacturers. As regards the Amadeus database, the Research Team adopted the following selection criteria: i) primary NACE code: 23.20/23.31/23.32; ii) primary line of business: manufacturing. It is worth remarking that the **'reserve list'** provided by Cerame-Unie for the three sectors included a limited number of plants, namely **below the required targets for the samples** (see Table 2). In addition, information on company size are not accurate nor always available, hence selected plants were further categorised on the grounds of a preliminary question aiming at identifying the number of employees at the company level during the scoping phase of the data collection exercise (see below). In the same vein, with regard to the refractories sector, available information does not allow for identifying *ex ante* plants manufacturing fired refractories and plants manufacturing unfired shaped refractories. Compliance with this sampling criterion was ascertained via an *ad hoc* preliminary question included in the scoping questionnaire (see below).

In fact, as some information relevant to the sampling strategy were not publicly 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 clarifications 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.<sup>79</sup> 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 subsector 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 above. 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 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 **375 EU ceramics manufacturers were involved in Step 1** (see above) of the Data Collection strategy. More specifically, 157 plants producing bricks and tiles, 153 plants producing ceramic tiles and 65 plants producing refractories were requested to fill in the 'scoping questionnaire'. In spite of numerous reminders, both via email and telephone, and the support of national sectoral associations, the average response rate was lower than 20% and this had a negative impact on the size of the samples (Table 4).<sup>80</sup>

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<sup>79</sup> 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 case and exploring differences between interviewees' experiences.

<sup>80</sup> It is worth stressing that the scoping questionnaire is a very concise (two-page) document which requires limited effort to be filled in.

**Table 4. Scoping questionnaires**

	Bricks and tiles		Ceramic tiles		Refractories	
	Requested	Collected	Requested	Collected	Requested	Collected
SE	101	10	120	12	28	7
CEE	9	5	13	5	14	3
NWE	47	17	20	6	23	8
<b>Total</b>	<b>157</b>	<b>32</b>	<b>153</b>	<b>23</b>	<b>65</b>	<b>17</b>

*Source: Authors' own elaboration.*

All respondents to Step 1 were requested to complete the 'full questionnaire'. Notwithstanding several reminders, both via email and telephone, and constant guidance by the Research Team, the response rate was below expectations, especially for bricks and tiles and ceramic tiles.<sup>81</sup> The current samples are composed as follows (Table 5; see Box 9 for key statistics on ceramics sectors covered by the CCA):

- Bricks and tiles.** The sample comprises 23 plants, as two plants decided to withdraw from the Study and the remainder did not fully complete the questionnaire. Responding plants represent more than 5% of the total value of production sold by EU producers of bricks and tiles (Table 6). Ten plants belong to the SME category if one considers only the number of employees of the business entity managing the plant (see note 54); nonetheless, only two plants are SMEs according to the definition spelled out by the Commission Recommendation 2003/361/EC<sup>82</sup> as the business entities managing the remaining eight plants are part of larger groups. Plants belonging to large groups tend to deal with regulatory obligations in a more efficient way as they may benefit from cost efficiencies stemming from centralising some activities and related costs at the group level. More specifically, compliance with CPR/CPD, legislation on the Internal Market for chemicals and consumer and health legislation is frequently held by company headquarters in all sectors covered by the CCA. In this context, the number of SMEs participating to the data collection phase is too limited to draw any conclusions concerning regulatory costs borne by small players. Therefore, the sample does not fully reflect the structure of the EU bricks and tiles sector, which is dominated by SMEs.
- Ceramic tiles.** The sample includes 16 plants, as three plants decided to withdraw from the CCA and the others did not fully complete the questionnaire. The sample covers more than 10% of the total value of production sold by EU producers of ceramic tiles (Table 6). Whereas four plants are managed by business entities with fewer than 250 employees, none of them belong to the SME category, as they are part of larger groups. Also in this sector, no conclusion can be drawn for SMEs; hence, the sample does not fully reflect the structure of the EU ceramic tiles sector, which is dominated by SMEs.
- Refractories.** The sample is composed of 11 plants producing fired refractories and four producing shaped unfired shaped refractories; in fact, two plants decided to withdraw from the CCA. Sampled plants cover more than 25% of the total value of production sold by EU producers of **fired refractories** and more than 15% of

<sup>81</sup> Note that the Research Team has also translated the full questionnaire into Spanish in order to foster participation from ceramics plants based in the SE region.

<sup>82</sup> Commission Recommendation 2003/81/EC 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).



the total value of production sold by EU manufacturers of **unfired shaped refractories**.

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 5. Full questionnaires**

	Bricks and Roof Tiles		Ceramic Tiles		Refractories	
	Requested	Collected	Requested	Collected	Requested	Collected
SE	10	6	12	7	6	6*
CEE	5	5	5	5	3	2
NWE	17	12	6	4	8	7*
<b>Total</b>	<b>32</b>	<b>23</b>	<b>23</b>	<b>16</b>	<b>17</b>	<b>15**</b>

*Note: \*This figure includes two producers of shaped unfired shaped refractories; \*\*this figure includes four producers of shaped unfired shaped refractories.*

*Source: Authors' own elaboration.*

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

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bricks and Roof Tiles	2.8**	2.9**	4.0**	3.8**	4.5**	4.9**	4.8**	5.0**	5.0**	5.1**
Ceramic Tiles	3.9*	4.0*	6.0*	6.9*	7.1*	10.1*	10.3*	10.2*	10.7*	11.2*
Fired Refractories	21.8	21.4	23.9	27.7	25.5	25.5	26.2	27.2	27.9	25.7
Unfired Shaped Refractories	11.1	12.6	14.1	10.5	19.3	18.2	17.2	17.1	18.7	15.4

*Note: \*Missing data for one plant over the period 2006-14; for a second plant over the period 2006-10, for a third plant over the period 2006-08, for a fourth plant over the period 2006-07.*

*\*\*Missing data for three plants over the entire period, and for another two plants over the period 2006-07; fired refractories includes the NACE Rev. 2 categories 23.20.11 and 23.20.12; unfired shaped refractories includes the NACE Rev. 2 category 23.20.14.*

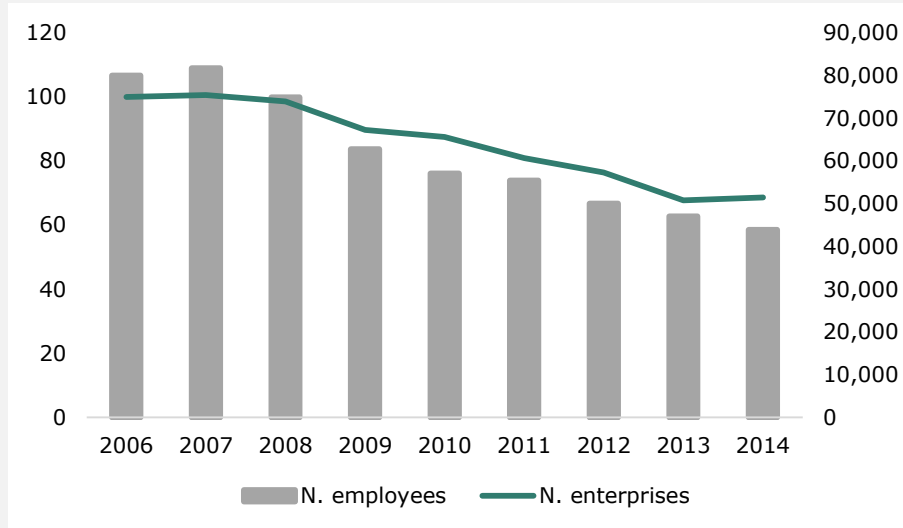
*Source: Authors' own elaboration on PRODCOM.*

**Box 9. Bricks and tiles, ceramic tiles and refractories: sectoral statistics**

**Bricks and tiles**

Over the 10-year study period, the bricks and tiles sector experienced a strong contraction. Since 2006, the number of persons employed was cut in half, from 81,000 to just over 43,000. During the same period the number of enterprises decreased by more than 30% (Figure 5).

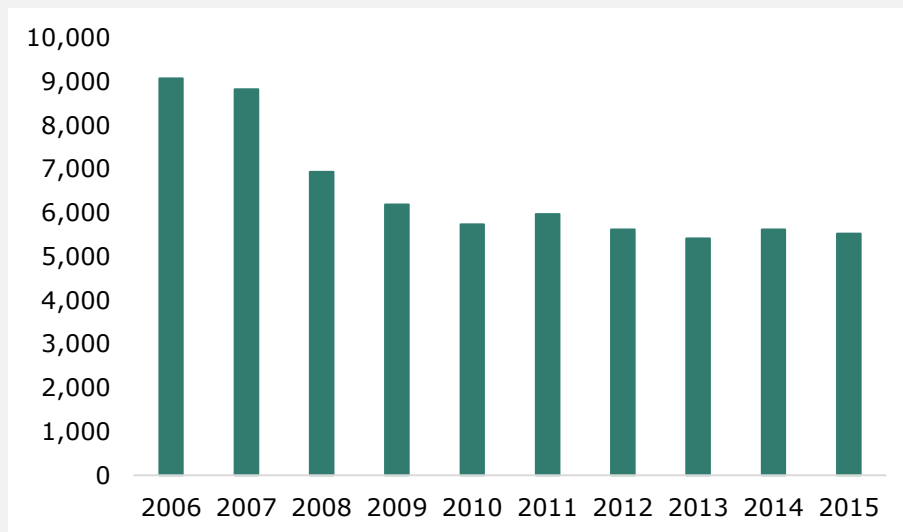
**Figure 5. Number of employees (right axis, absolute value) and enterprises (left axis side, index number 2006=100) in the EU bricks and tiles sector**



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

In addition, the trend registered by the value of production sold by EU producers during 2006-15 (Figure 6) confirms the substantial contraction the sector experienced since the beginning of the economic crisis. However, after 2010, the value of production remained fairly constant at around €5.5 billion.

**Figure 6. Value of production sold by EU bricks and tiles producers (€ millions)**



Source: Authors' own elaboration based on PRODCOM.

As regards the distribution of production across Member States, half of the EU sectoral turnover was generated by three Member States, with Germany being responsible on average for the 21.6% of the turnover over the period 2006-14 (Table 7).

**Table 7. Share of turnover per major Member States for bricks and tiles (average 2006-14)**

Member State	% of total turnover
Germany	21.6%
France	14.7%
Italy	14.0%
United Kingdom	9.3%
Spain	8.7%
Belgium	4.8%
Poland	4.7%
Czech Republic	4.6%
Netherlands	2.9%
Croatia	2.5%
Austria	2.3%
<b>Total</b>	<b>90%</b>

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

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

### Ceramic tiles

The ceramic tiles sector registered a sharp decline in both the number of enterprises (30% reduction) as well as employment (-33,000 employees) (Figure 7).<sup>83</sup>

**Figure 7. Number of employees (right axis, absolute value) and enterprises (left axis side, index number 2006=100) in the EU ceramic tiles sector**

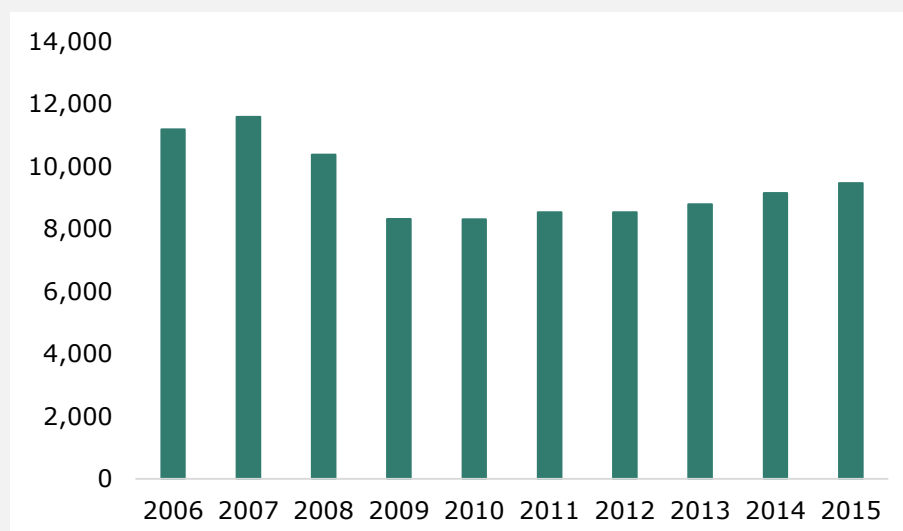


Source: Authors' own elaboration based on Eurostat Structural Business Statistics.

<sup>83</sup> According to CET (European Ceramic Tile Manufacturer's Federation) EU ceramic tiles producers employed 59,856 workers in 2012, 59,349 in 2013, 59,010 in 2014 and 59,352 in 2015. Such figures are in line with data reported by Eurostat. Interestingly, between 2014 and 2015 employment in the EU ceramic tiles sector grew.

The significant contraction experienced by the ceramic tiles sector is also apparent if one considers the drop registered by the value of production (Figure 8). In fact, between 2007 and 2009, the value of production sold by EU ceramic tiles producers shrank by 28.4%, from €11.6 billion in 2007 to €8.3 billion in 2009. Despite a growing trend which started in 2011, the value of production is still below pre-crisis levels.

**Figure 8. Value of production sold by EU ceramic tiles producers (€ millions)**



Source: Authors' own elaboration based on PRODCOM.

Although the turnover of the Italian ceramic tiles sector significantly decreased after the beginning of the economic crisis, between 2006 and 2014 on average Italy accounted for almost half of the entire European market (Table 8). Spain was the other main European producer covering, on average, 28.4% of the EU turnover over the period 2006-14.

**Table 8. Share of turnover per major Member States for ceramic tiles (average 2006-14)**

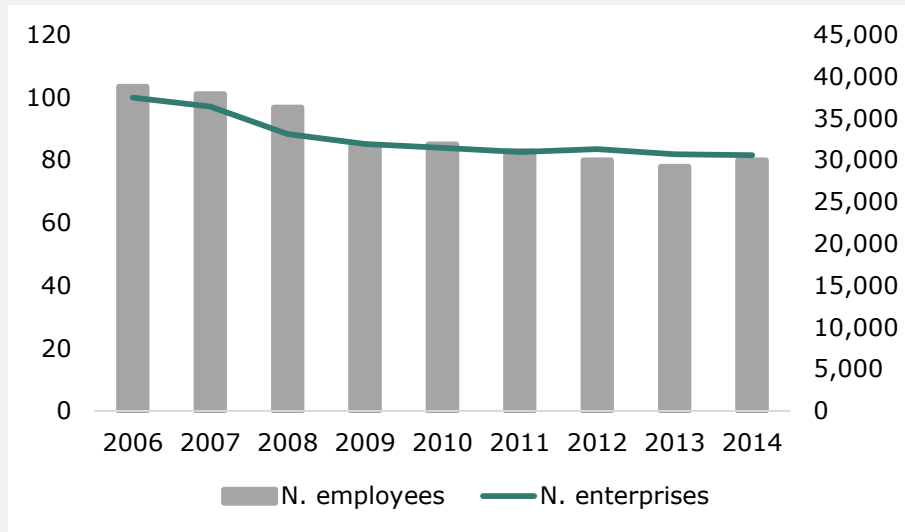
Member State	% of total turnover
Italy	47.1%
Spain	28.4%
Germany	6.5%
Poland	5.5%
Portugal	3.3%
<b>Total</b>	<b>90.8%</b>

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

### **Refractories**

The refractories sector has experienced a **gradual decline over the period under observation** in both the number of enterprises and number of employees (Figure 9).

**Figure 9. Number of employees (right axis, absolute value) and enterprises (left axis side, index number 2006=100) in the EU refractories sector**



*Note: Figures include all products covered by NACE Rev.2 23.20.*

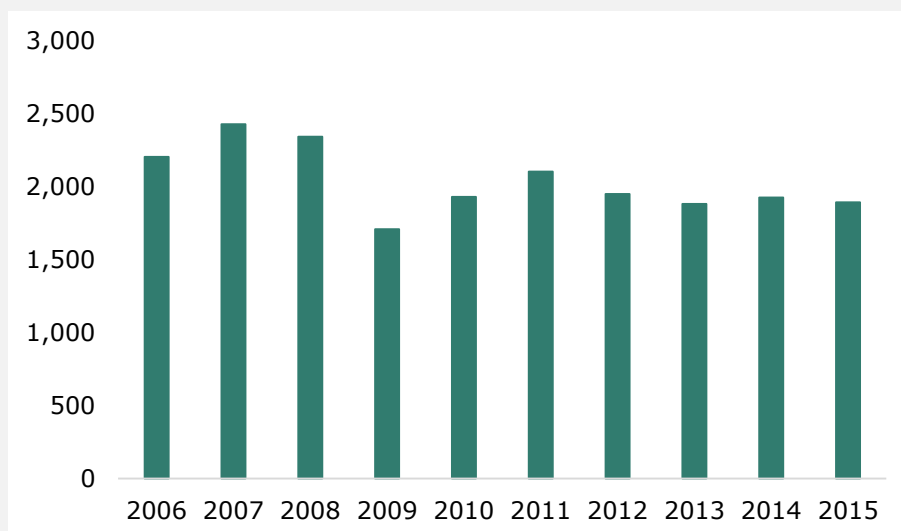
*Source: Authors' own elaboration based on Eurostat Structural Business Statistics.*

Interestingly, as

Figure 10 and Figure 11 show, the decline in number of enterprises and employees is reflected by the value of production sold by both EU fired and unfired shaped refractories producers, which is still below pre-crisis level.<sup>84</sup>

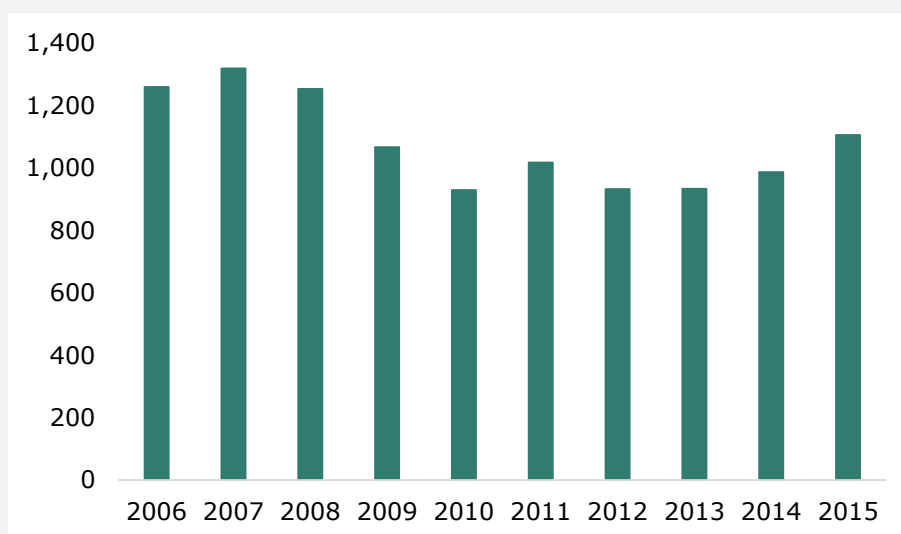
<sup>84</sup> The figures below do not include the value of production sold by EU producers of unfired unshaped refractories, otherwise called mixes (NACE code 23 20 13 00). The weight of this subsector in total value of production sold by EU refractories producers in the period 2006-15 ranged between 21.1% (registered in 2007) and 31.5% (registered in 2014). In 2015, the value of production sold by EU manufacturers of unfired unshaped refractories was equal to €1,365 million, i.e. 31.3% of overall production sold in the EU refractories sector.

**Figure 10. Value of production sold by EU fired refractories producers (€ millions)**



Source: Authors' own elaboration based on PRODCOM.

**Figure 11. Value of production sold by EU unfired shaped refractories producers (€ millions)**



Source: Authors' own elaboration based on PRODCOM.

Germany alone covered almost one-third of the total sectoral turnover. In fact, on average, Germany produced 30.6% of the EU turnover of the refractory sector over the period 2006-14 (Table 9). France, Italy and United Kingdom together had a turnover comparable to Germany's. More than 90% of the production was concentrated in nine Member States.

**Table 9. Share of turnover per major Member States for refractories (average 2006-14)**

<b>Member State</b>	<b>% of total turnover</b>
Germany	30.6%
France	12.2%
Italy	11.0%
United Kingdom	9.3%
Spain	9.1%
Austria	6.8%
Poland	4.5%
Czech Republic	4.3%
Slovakia	2.5%
<b>Total</b>	<b>90.4%</b>

*Note: Missing values for specific countries in Eurostat were estimated via Amadeus. Figures include all products covered by NACE Rev.2 23.20.*

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

## **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 ceramics 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 some Chapters providing a more qualitative discussion of the role played by **EU trade, competition and transport legislation** as well as by the **Eco-Label Regulation** and **Natura 2000** in the EU ceramics industry.

As discussed in Chapters 1 and 2, **the CCA focuses on the most burdensome legislation for the EU ceramics 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 was extended** to cover all the pieces of legislation that potentially affected the ceramics 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.<sup>85</sup> 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 (bricks and tiles, ceramic tiles, fired refractories and unfired shaped refractories).
- 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 ceramics. 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 10. Importantly, the Research Team also assessed impacts of prior legislation that

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<sup>85</sup> 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](http://ec.europa.eu/environment/nature/natura2000/management/docs/nee_i_n2000_guidance.pdf)).

was still in force in some of the years covered by this Study and was then repealed by the acts listed below.

**Table 10. List of EU legislation covered by the CCA**

<b>1. Internal Market legislation</b>
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)
<b>2. Energy legislation</b>
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
<b>3. Climate legislation</b>
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)
<b>4. Competition legislation</b>
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

#### **11. Other legislation**

Regulation (EC) No 66/2010 of the European Parliament and of the Council on the EU Ecolabel

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds

*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)<sup>86</sup> 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);<sup>87</sup> and (ii) prohibiting Member States from impeding the making available on the market or the use of construction products compliant with the CPR framework.<sup>88</sup>

The CPR came fully into force in July 2013, replacing the Construction Product Directive (CPD).<sup>89</sup> 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.<sup>90</sup>

The CPR and CPD are relevant for ceramics sectors producing construction products, which are bricks and tiles and ceramic tiles. However, these acts are not relevant for the refractory subsector, as refractoriness is not among the Basic Requirements listed in Annex I to the CPR, and its testing and declaration of performance is not covered by CPR-related standards.<sup>91</sup>

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<sup>86</sup> 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).

<sup>87</sup> See Art. 4-6 CPR.

<sup>88</sup> See Art. 8.4 CPR.

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

<sup>90</sup> 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.

<sup>91</sup> The applicable family of standards is EN 1402.

### **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 **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,<sup>92</sup> 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);<sup>93</sup> and
- **substantive compliance costs**, namely the costs for the testing of products and production control.<sup>94</sup>

**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

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<sup>92</sup> With regard to indirect compliance costs, in principle CPR costs may be passed on to the ceramics 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 ceramics sector is estimated to be limited. Finally, there is no evidence of significant litigation costs.

<sup>93</sup> 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 considered an out-of-pocket expenditure linked to an information obligation. This change has no impact on the quantification provided below.

<sup>94</sup> According to Tool #54, "testing costs are not considered as administrative burdens". See European Commission (2015), Better Regulation Toolbox.

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 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 the 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, i.e. a form of fixed costs.
- 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, 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 sector. Obviously, for plants which 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'*.<sup>95</sup> In line with this early result, all plants in the ceramic tiles sector, and all plants except for two in the bricks and tiles sector concurred that these activities are part of their normal business practice. This assessment was further confirmed by the sectoral experts. 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 10 below.

**Box 10. 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.*

<sup>95</sup> 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 – Bricks and Tiles**

##### *Sample*

**A total of 23 bricks and tiles plants responded to the questionnaire and the data of all questionnaires could be used.** Nonetheless, results for the CEE region cannot be shown due to confidentiality issues; in fact, the minimum requirement of having three independent companies is not satisfied.

##### *Administrative Costs*

The estimated parameters for administrative costs generated by DoP and CE marking are presented below. Comparisons to the data for the ceramic tiles sector and the estimates from the Cumulated Costs and Benefits Assessment of the Construction Sector (in short, the 'Construction report') are provided when possible.

- **Amount of personnel:** the average value for FTE is 0.26, while the median value is of 0.07 FTE. The range of FTEs goes from 0.01 to 1.4. The estimates are largely in line with the expectation of sectoral experts, and similar to those of ceramic tiles producers, with the average being higher and the median slightly lower. However, the 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 €71 and the average value is €212. These estimates are considerably lower than those for ceramic tiles, and those included in the Construction report.
- **IT investments and operational costs:** annualised median value is €433, average value is €377, lower than for the ceramic tiles sector. Limited costs can be explained by the fact that the IT required for this administrative tasks is mostly shared with other company functions.
- **Printing investment and operational costs:** annualised median value is €4,244, while average value is €9,845. These estimates are slightly higher than for ceramic tiles producers. Printing and IT costs (median values) combined (€4,677) are in line both with the data from ceramic tiles and from the Construction report (€6,000).
- **Annual other costs:** Only four plants reported any other costs, the median value is €0, while the average value is €47.

The total administrative costs due to DoP and CE marking have a median value of about €7,800 and a sample average value of €14,100. The sample weighted average is higher with about €19,400, meaning that larger plants face higher costs. As pointed out by sectoral experts, this is consistent with a larger product range and maintenance of larger company profile. The BAU factor analysis shows a modal and median assessment corresponding to a BAU factor of 60%, which is higher than the estimation of the Construction report (36%) and of the ceramic tiles sector. This implies that the median and sample average typical administrative burdens are around €3,200 and €6,800, with a sample weighted average of about €8,900.

*Cumulative regulatory costs*

The regulatory costs per tonne of bricks and tiles generated by the CPR and CPD can be seen in Table 11 and Table 12 below. The costs are measured respectively in the typical years 2015 and 2012, and presented for the EU and the three sub-regions. **The regulatory costs are in the area of a few euro cents per tonne of product.** The costs for NWE manufacturers are lower than the EU average, while SE producers face higher costs. Regulatory costs generated by CPR are in line with those estimated for ceramic tiles tile producers.

In Figure 12 to Figure 13, costs per tonne are presented over the 10-year period, again for the EU and NWE and SE sub-regions. CPR and CPD costs show a slight, but marginal, increase for the 2006-15 period, moving from €0.02 towards €0.07 per tonne. In NWE the increase in regulatory costs was comparable, as costs increased from €0.02 to €0.06 per tonne. The most significant increase was in SE, where it rose from €0.02 to almost €0.12. This depends not only on the evolution of regulatory costs, but also on the contraction of output that followed the 2009 crisis. In both the EU and the sub-regions, costs remained relatively constant from 2006 to 2012 and then again from 2013 to 2015, with an increase in costs from 2012 to 2013, that is, following the introduction of the new CPR obligations.

**Table 11. Regulatory costs generated by the CPR on the bricks and tiles sector (€/tonne – Typical year: 2015 – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.06	<i>Confidential</i>	0.11	0.07
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
Total regulatory costs		<b>0.06</b>	<b><i>Confidential</i></b>	<b>0.11</b>	<b>0.07</b>

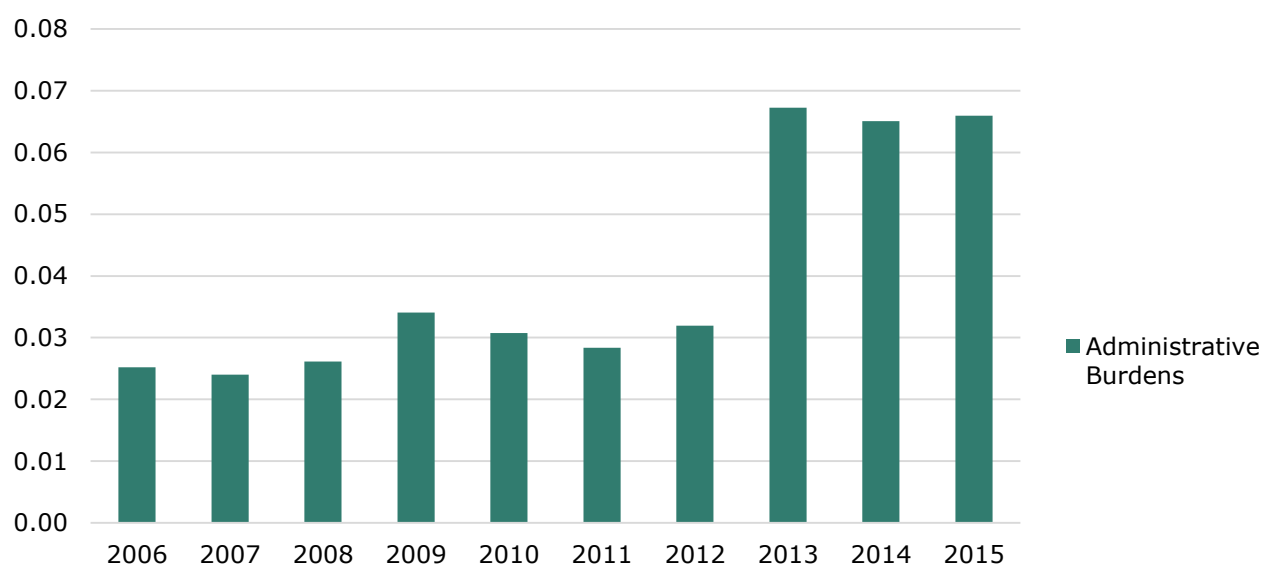
*Source: Authors' own elaboration.*

**Table 12. Regulatory costs generated by the CPD on the bricks and tiles sector (€/tonne – Typical year: 2012 – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.03	<i>Confidential</i>	0.04	0.03
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
Total regulatory costs		<b>0.02</b>	<b><i>Confidential</i></b>	<b>0.04</b>	<b>0.03</b>

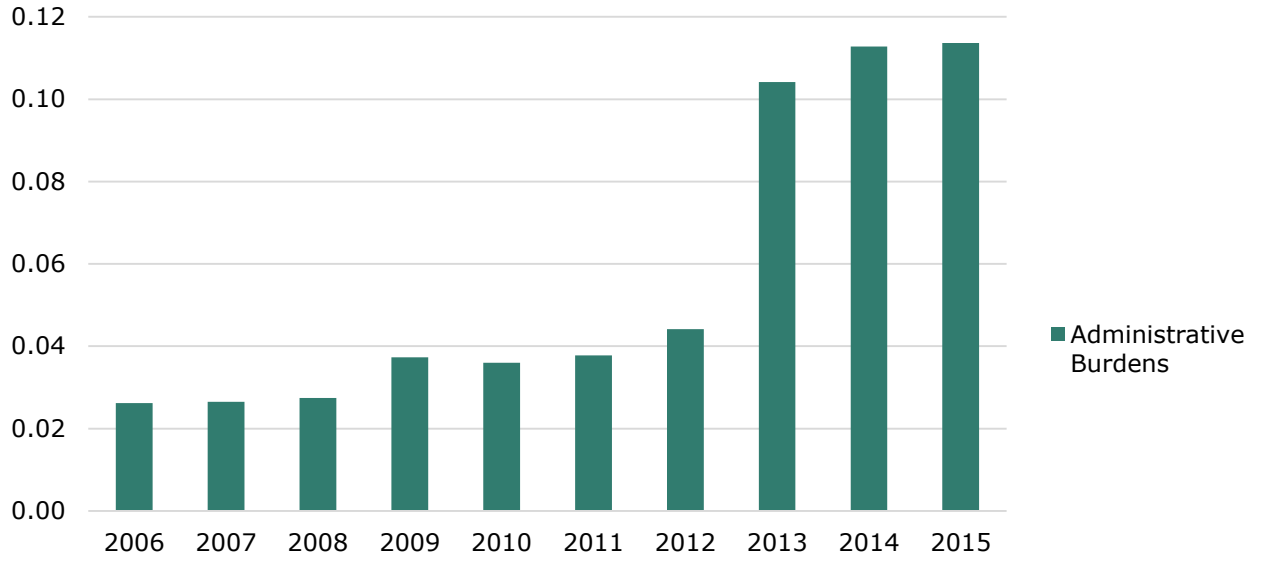
Source: Authors' own elaboration.

**Figure 12. Regulatory costs generated by the CPD/CPR on the bricks and tiles sector at the EU level (€/tonne - average costs)**



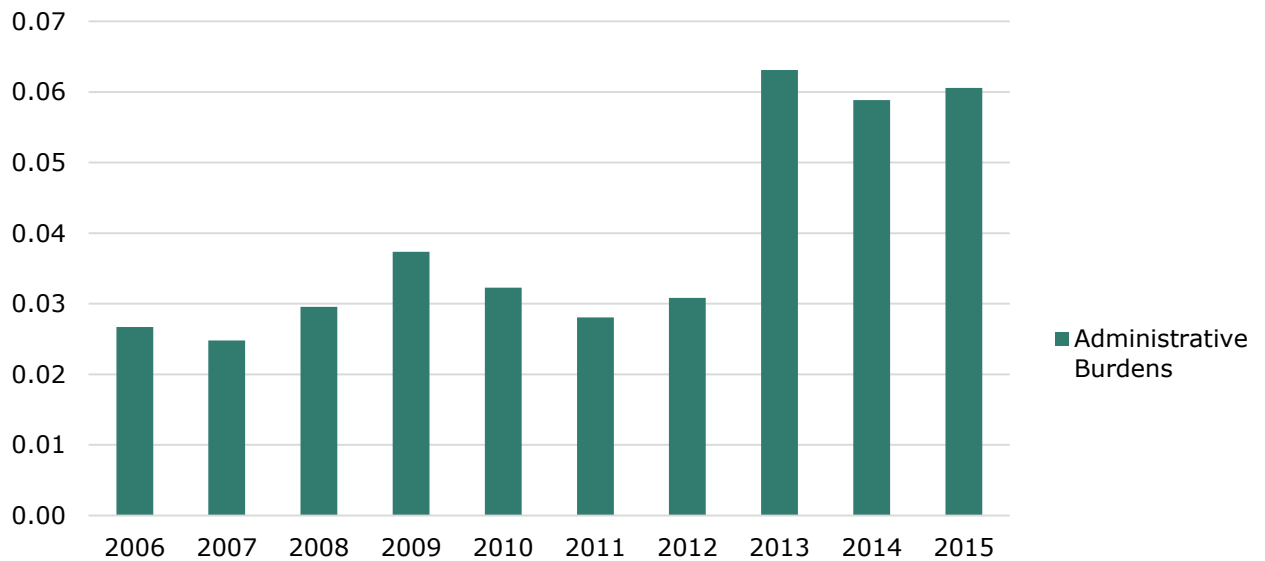
Source: Authors' own elaboration.

**Figure 13. Regulatory costs generated by the CPD/CPR on the bricks and tiles sector in the Southern European Region (€/tonne – average costs)**



Source: Authors' own elaboration.

**Figure 14. Regulatory costs generated by the CPD/CPR on the bricks and tiles sector in the Northern-Western European Region (€/tonne – average costs)**



Source: Authors' own elaboration.

### **5.1.5 Cost assessment – Ceramic Tiles**

#### *Sample*

**No questionnaire needed to be discarded, and data from all the 16 ceramic tile plants which responded to the questionnaire could be used.** Nonetheless, results for the CEE region cannot be shown due to confidentiality issues; in fact, the minimum requirement of having three independent companies is not satisfied.

#### *Administrative burdens*

For administrative costs due to the DoP and CE marking, estimated cost parameters are described here below. When possible, a comparison with the data for the bricks and tiles sector and the estimates provided in the Cumulated Costs and Benefits Assessment of the Construction Sector (in short, the 'Construction report'), is provided.

- **Amount of personnel:** median value is of 0.09 FTE, while average value is of 0.17 FTE. The range goes from marginal (0.01 FTE) to 1.0. These estimates are largely in line with the expectation of sectoral experts, and similar to those provided by bricks companies, while significantly lower than the estimate included in the Construction report, where small companies were estimated to spend one FTE, and medium and large companies two FTE.
- **Annual costs of access to hEN** (including subscription to standardised bodies): median value is €379, while average value is €2,035; this is significantly higher than the bricks and tiles sector, but broadly in line with the Construction report, where costs were estimated at €1,000 per year.
- **IT investments and operational costs:** annualised median value is €661 and average value is €1,013.
- **Printing investment and operational costs:** annualised median value is €4,831 and average value is €6,531. The sum of median values for IT and printing costs (€5,492) is in line with both the data for the bricks and tiles sector, and the estimation of the construction report (€6,000).
- **Annual other costs:** only one plant reported other costs; median value is thus €0, while average value is €31.

Median and simple average administrative costs due to DoP and CE marking provisions amount to about €7,000 and €9,000 per plant. EU weighted average is significantly higher, at about €12,100, signalling that larger plants have higher costs. As for the BAU factor, the modal and median assessment corresponds to a BAU factor of 60%. This is in line with the bricks and tiles sector (60%), but higher than the value estimated in the Construction report (36%). This results in median and average administrative burdens in the area of €2,800 and €4,300 respectively. As for costs, EU weighted average is slightly higher, at about €5,600.

#### *Cumulative regulatory costs*

Table 13 and Table 14 below show the regulatory costs per tonne of ceramic tiles generated by the CPR and CPD, measured respectively in the typical years 2015 and 2012, for the EU and the NWE and SE sub-regions. Clearly, **costs are in the area of few euro cents per tonne of product.** CPR costs per tonne of products are in line with those estimated for the bricks and floor tiles sector. Costs for NWE manufacturers are slightly lower than the EU average, while they are slightly higher for SE producers.

Figure 15 to Figure 16 show the costs per tonne over the 10-year period of the analysis, again for the EU and the NWE and SE sub-regions. Over the 2006-15 period, CPR and CPD costs remained fairly constant, between €0.04 and €0.07 per tonne. Interestingly, EU costs per tonne were higher in 2012 than in 2015, even though CPD obligations were smaller in scope and did not include provision of DoP to customers. This was due to the variation in output: estimated costs in absolute values were higher in 2015 than in 2012; however, since output was significantly lower in 2012 than in 2015 – especially in SE which was the region that had by far the highest weight in the EU average – costs per tonne decreased.

**Table 13. Regulatory costs generated by the CPR on the ceramic tiles sector (€/tonne – Typical year: 2015 – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.03	<i>Confidential</i>	0.05	0.04
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
Total regulatory costs		<b>0.03</b>	<b><i>Confidential</i></b>	<b>0.05</b>	<b>0.04</b>

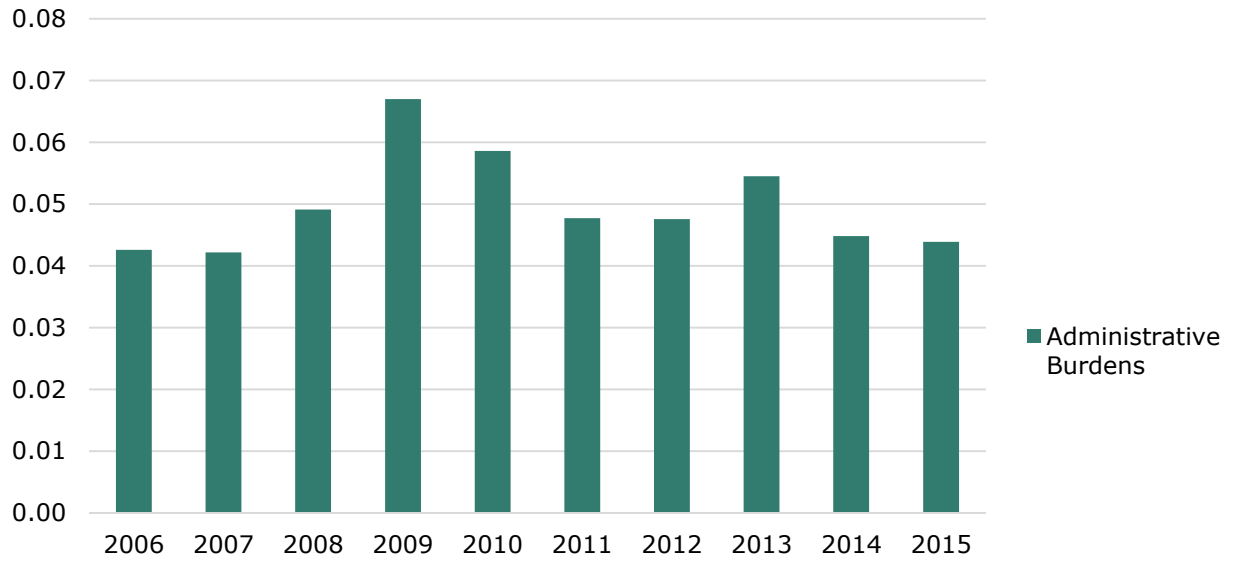
Source: Authors' own elaboration.

**Table 14. Regulatory costs generated by the CPD on the ceramic tiles sector (€/tonne – Typical year: 2012 – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.02	<i>Confidential</i>	0.06	0.05
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
Total regulatory costs		<b>0.02</b>	<b><i>Confidential</i></b>	<b>0.06</b>	<b>0.05</b>

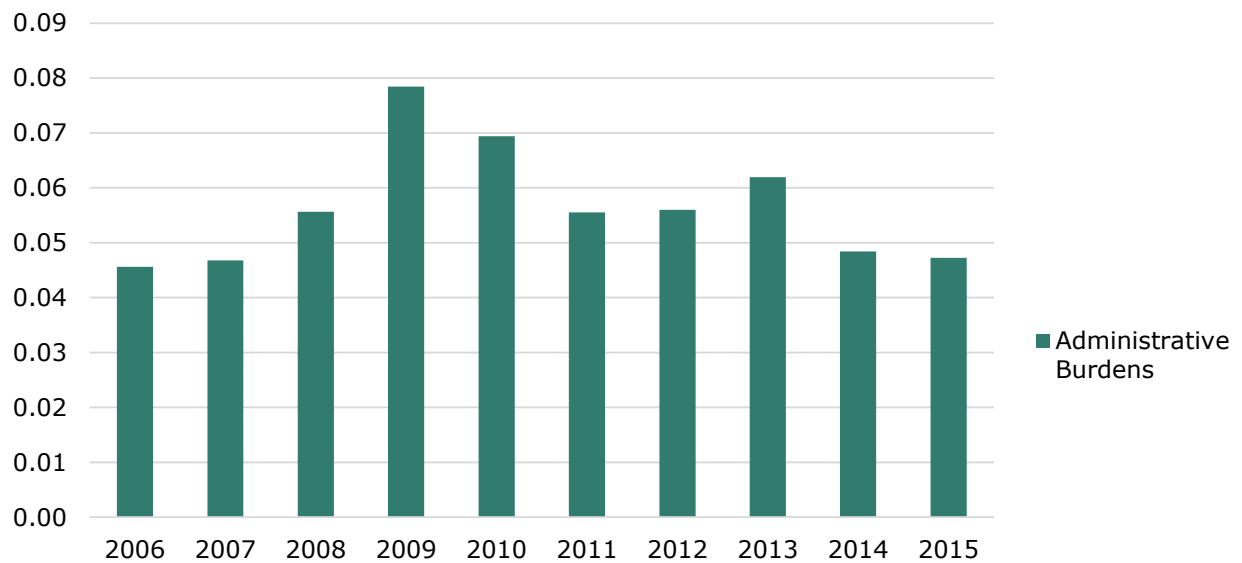
Source: Authors' own elaboration.

**Figure 15. Regulatory costs generated by the CPD/CPR on the ceramic tiles sector at the EU level (€/tonne – average costs)**



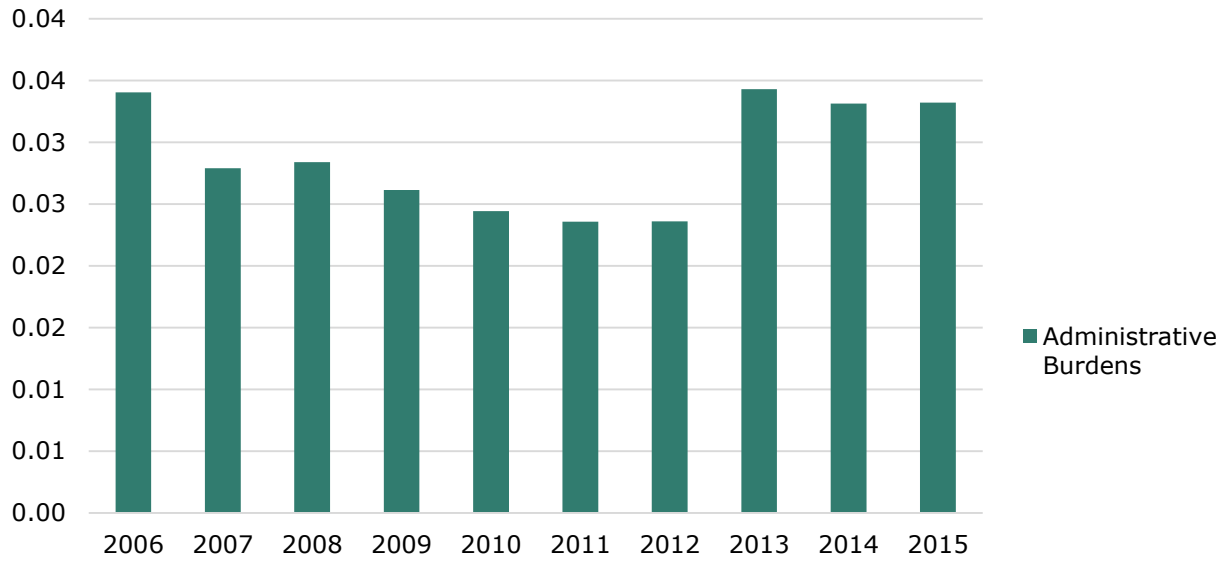
Source: Authors' own elaboration.

**Figure 16. Regulatory costs generated by the CPD/CPR on the ceramic tiles sector in the Southern European Region (€/tonne – average costs)**



Source: Authors' own elaboration.

**Figure 17. Regulatory costs generated by the CPD/CPR on the ceramic tiles sector in the North 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)

**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.

**Regulation No 1272/2008** (CLP Regulation) lays down EU-wide criteria that must be applied to determine **whether a substance or mixture** which is manufactured or imported into the European market **has properties which could damage human health or the environment**.<sup>96</sup>

According to the **REACH Regulation**, it is the producer's responsibility to demonstrate with conclusive scientific data that substances used in its production process fulfil the criteria specified in the Regulation. The REACH Regulation also includes several obligations for downstream users, who have to prepare chemical safety reports and 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; and in some cases they have to notify ECHA.<sup>97</sup>

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(7)(c) REACH, to classify, label and package substances and mixtures in accordance with the CLP Regulation.<sup>98</sup> The most common tool for hazardous communication is the labelling on the packaged substance or mixture, but also the Safety Data Sheet which is provided to other companies in the supply chain. Manufacturers and importers who place a hazardous substance on the market also have to notify certain information, in particular the substance identity and the classification and labelling of that substance to ECHA, unless this information has already been submitted as part of a registration under REACH.<sup>99</sup>

Our survey indicates that both Regulations generate **small administrative burdens** for the ceramic sector, e.g. preparation of Safety Data Sheets, exchange of data/information, communicating information to downstream users and workers, implementation of the use conditions as defined in the registration dossier, etc., and **limited direct charges** – such as payments of fees to the European Chemicals Agency (ECHA).<sup>100</sup> We originally envisaged a third component – **substantive compliance costs** – to include costs associated with laboratory and industrial testing. Nonetheless, this area of cost proved to be negligible in the sample of plants surveyed.

The ceramics industry is often only a downstream user of substances falling under the scope of the REACH Regulation or does not use them at all. To some extent, however, the

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<sup>96</sup> 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](https://echa.europa.eu/documents/10162/13643/questions_and_answers_clp_20090526_en.pdf))

<sup>97</sup> 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.

<sup>98</sup> 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](https://echa.europa.eu/documents/10162/13643/questions_and_answers_clp_20090526_en.pdf))

<sup>99</sup> Ibid.

<sup>100</sup> Note: Direct fees to ECHA are usually not paid by downstream users such as the ceramics or glass industry.

REACH Regulation raises the cost base of the producers and therefore **indirectly affects upstream markets**, as in some cases the producers might be obliged to substitute the chemical substances they commonly use in their production process as a result of REACH provisions. According to the REACH Extended Impact Assessment,<sup>101</sup> costs falling on downstream users result either from increases in prices of chemical substances or substitution costs. Thus substitution costs arise when substances need to be substituted as a result of some suppliers of chemical substances withdrawing substances because testing and registration costs make their production unprofitable. In some cases, downstream users find available substitutes relatively easily or are able to reformulate the required preparations themselves.<sup>102</sup> In other cases, there might arise a need to modify the production techniques, resulting in additional investment or longer production times.<sup>103</sup> Finally, the non-availability of chemical preparations may also lead to a deterioration in product quality and some loss of product competitiveness.<sup>104</sup>

According to the interviewed companies, if a substance needs to be substituted, it is usually the supplier that provides replacement products. As an example, the replacement of solvent-based inks used in ink-injection printing systems on bulk packaging with water-based inks was mentioned, which proved to be less reliable and long lasting. Still, this substitution was made in the vast majority of cases. These new substances need to be tested in the plant before they are introduced in the production process and required documentation needs to be prepared.

**Box 11. Example of steps required to substitute a substance in a ceramics plant<sup>105</sup>**

When substitution of substances is necessary, the plant contacts its suppliers for a solution. First tests are conducted by the supplier. Afterwards the plant will test the alternative substance on a small sample of their products (10 pieces) in their laboratory. After the laboratory test, the plant tests the new substance on a bigger sample with handmade products (100 to 200 pieces). After approval, the plant proceeds with industrial testing. These tests follow up on the order of one hour of production; eight hours of production; and a full production day. Every test needs to be put aside till approval of the raw material manager and/or development manager and/or plant manager and/or central laboratory.

Thus, the total costs for substance substitution include:

- material and substances costs;
- visits of the supplier and exchange of data and/or information;
- small laboratory testing (application, composition of mixtures, visual control, exchange with supplier and if required in house chemical analysis);
- industrial testing, which includes loss of production.

*Source: Interview with a ceramics plant.*

According to a study done by DG GROW,<sup>106</sup> 50.4% of the downstream users that had experienced a substance withdrawal reported that they carried out research to identify an alternative substance (these were mainly the suppliers of articles and formulators). Moreover, 24% indicated that they changed their manufacturing processes so that they no longer needed the substance. In general, manufacturers and formulators tend to

<sup>101</sup> European Commission (2003), "Extended Impact Assessment" (COM(2003)644 final).

<sup>102</sup> Ibid.

<sup>103</sup> Ibid.

<sup>104</sup> Ibid.

<sup>105</sup> Not all of these steps are required in every instance, e.g. ink replacement.

<sup>106</sup> European Commission DG GROW (2015), "Monitoring the Impacts of REACH on Innovation, Competitiveness and SMEs".

allocate more resources than downstream users, even though there are also some article suppliers and end users which also allocate significant resources.<sup>107</sup>

### **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. The limited number of replies calls for an additional level of care at the moment of computing EU averages. Minor uncertainties in the estimations may result in negligible fluctuations in overall figures.

We 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. We similarly inquired, referring to Art. 7(2) of REACH legislation regarding costs, about the notification of substances of very high concern (SVHC)<sup>108</sup> or substances used in process-oriented research and development (PPORD). If the notifications for SVHC and PPORD were differed greatly, we asked about separate information for the two cases. Feedback on these two areas was limited to isolated responses. We also analysed the cost associated with providing sufficient information to allow for safe use of products (refer to Art. 33).

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. training and warning signs at work. In our questionnaire, we have collected data on substitution costs related to REACH and they appear to be very limited across the period 2006-15.

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. As result, the CLP Regulation does not generate significant regulatory costs for most ceramics producers. It is only relevant for fired and unfired shaped refractories.

We investigated the extent of costs as compared to a BAU scenario, by asking plants how much of the costs would have been paid in the absence of the REACH and CLP prescriptions. This approach is meant to isolate the share of costs which can be reasonably associated with the two items of legislation. It is not an attempt to build a counterfactual, to the extent that is difficult to foresee how national legislation would have changed if no EU legislation would have been in place.

### **5.2.3 Cost assessment REACH – Bricks and tiles**

#### *Sample*

The quantification of costs for this segment is challenging due to its low relevance for individual plants and the diverse relevance across subsectors (causing costs of different magnitude depending on the plant). Many plants either do not report costs or provide highly diverging answers. In this context, the sample used for cost estimates for this area of legislation consists of the following number of plants, split across the three defined regions.

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<sup>107</sup> Ibid.

<sup>108</sup> Only a very few SVHC substances were identified and many were replaced very quickly. The major area of concern was the long-term leaching of substances into ground water.

**Table 15. Bricks and tiles: Sample size by geographic region**

Bricks and tiles /REACH	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	3	4	10

Source: Authors' own elaboration.

Due to confidentiality issues, only EU averages can be presented.

#### *Direct regulatory costs*

Direct regulatory costs of the REACH Regulation for bricks and tiles are estimated to be **€0.01/tonne of production output in a typical year at the EU level**. Such costs include only administrative burdens, associated with the duty to communicate information to downstream users and workers, for example on safe use and disposal placed on packaging. No direct charges or substantive compliance costs were detected, as companies did not report having submitted or updated applications to ECHA and a very limited number of companies reported to have changed their production process as a result of the use conditions in the registration dossiers.

The variance between company responses across regions is very low. The BAU factor, however, differs, though is within a similar range, from 40% to 50%. EU estimates are therefore not biased by regional outliers. The fact that the BAU is assessed to be at almost half the costs shows that some of the activities classified as being due to applications for REACH might also be necessary for a different purpose, e.g. demanded by downstream clients or necessary to ensure workers' safety. Establishing and assessing a business-as-usual scenario requires the assumption of no legislation. The answer, however, might be biased in the way that if legislation already existed in a country, before REACH, it would have been seen as a normal or usual activity.

#### *Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs generated by REACH on bricks and tiles producers.

**Table 16. Bricks and tiles: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)**

		EU
Direct regulatory costs	Administrative burdens	0.01
	Substantive compliance costs	0
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		<b>0.01</b>

Source: Authors' own elaboration.

#### 5.2.4 Cost assessment REACH – Ceramic tiles

##### Sample

With regards to the ceramic tiles sector, costs generated by REACH are estimated by relying on the following sample.

**Table 17. Ceramic tile: Sample size by geographic region**

Ceramic tiles /REACH	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	2	3	2	7

Source: Authors' own elaboration.

Only EU figures can be provided owing to the confidentiality requirement and the target sample number.

##### Direct regulatory costs

In a typical year, direct regulatory costs of the REACH Regulation for ceramic tiles producers are estimated at **€0.06/tonne at the EU level**. These costs are exclusively defined as administrative burdens. There is a low variance of company responses across the EU. The BAU is in a similar range, between 47% and 57%. As for bricks and tiles, the fact that the BAU is assessed to be around half the costs shows that some of the activities classified as being administrative burdens due to applications for REACH might also be necessary for a different purpose, e.g. demanded by downstream clients or necessary to ensure workers' safety.

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs generated by REACH on the ceramic tiles sector.

**Table 18. Ceramic tiles: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)**

		EU
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.06
	<b>Substantive compliance costs</b>	0
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>		NA
<b>Total regulatory costs</b>		<b>0.06</b>

*Source: Authors' own elaboration.*

**5.2.5 Cost assessment REACH – Fired refractories**

*Sample*

The sample used for cost estimates in this area of legislation consists of the following plants, split across the three geographic regions.

**Table 19. Fired refractories: Sample size by geographic region**

Fired refractories /REACH	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	2	3	8

*Source: Authors' own elaboration.*

Due to confidentiality reasons, only EU averages and SE data can be shown.

*Direct regulatory costs*

Direct regulatory costs generated by the REACH Regulation on EU producers of fired refractories are estimated at **€1.77/tonne of production in a typical year**. Differences in terms of costs occur between geographic areas: in SE, for example, costs are below the EU average, at €0.18/tonne. This cannot be explained by differences in the BAU factor which is in the same range, between about 50% and 60%. The spread in costs between

plants operating in Southern Europe and their Northern and Central-Eastern European counterparts is likely due to differences in registration of new substances with ECHA. Only plants in Northern Europe and, to a lesser extent, in Central-Eastern Europe, have undertaken the registration procedures. As mentioned above, preparation of a registration dossier for ECHA comes with costs, in terms of personnel involved as well as out of pocket expenses and direct fees.<sup>109</sup> According to the ECHA report,<sup>110</sup> many SMEs have the impression that registration is costly for their business. To a large extent, this is due to the evolution of the surrounding economic environment: investment decisions are made in a shorter cycle. As a consequence, the costs will need to be borne over a shorter period of time, which can be a challenge for companies, especially those with a broad portfolio of low tonnage substances.<sup>111</sup> The direct regulatory costs mainly consist of:

- administrative burdens; and
- a very small share of direct charges.

These sub-categories of direct regulatory costs are further elaborated in the paragraphs below.

### *Administrative burdens*

Administrative burdens represent the vast majority of costs in this subsector, about 93%, i.e. €1.6/tonne at the EU level. SE reports lower costs (€0.18/tonne), a gap which is primarily due to the additional burdens generated by ECHA registration procedures, which were experienced only by NWE and CEE plants. Costs to this extent are due to the resources used to submit a registration dossier to ECHA, e.g. primarily expressed by plants in terms of man-days.<sup>112</sup>

The plants for SE that provided information on REACH indicated that they did not submit a registration dossier in the years considered. To this account, costs of providing information to workers were reported to be higher in NWE than in SE. Administrative burdens for plants in SE are exclusively generated by operations necessary to convey information to downstream users and to workers, e.g. replies referred to Safety Data Sheets under REACH to be sent to costumers, supply of information regarding REACH registration numbers to customer. They indicated costs related to REACH in the form of the duty to communicate information, e.g. Safety Data Sheets according to REACH to be sent to costumers, supply of information to customers relative to REACH registration numbers. It is possible that the three plants are downstream users.

According to ECHA's report,<sup>113</sup> meeting the obligation of communicating information through the supply chain poses considerable challenges, in particular where supply chains are long and transcend the external borders of the EU market or where suppliers are ill-informed of their substances.

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<sup>109</sup> According to the amended Fee Regulation (EC) No 254/2013, the standard fees for registrations (individual submission) submitted under Articles 6, 7 or 11 of Regulation (EC) No 1907/2006 range between €1,714 and €33,201, depending on the tonnage range. For joint submission the fees for registration range between €1,285 and €24,901, depending on the tonnage range. Fees for the update of registrations under Article 22 of Regulation (EC) No 1907/2006 (individual submission) range between €2,892 and €20,885, depending on the tonnage range. For joint submission the fees for the update of registration range between €2,169 and €15,663, depending on the tonnage range. The base fee for applications for an authorisation under Article 62 of Regulation (EC) No 1907/2006 is €53,300. The same fee (base charge) applies for the review of an authorisation under Article 61 of Regulation (EC) No 1907/2006. There are reduced fees for SMEs. More fees are provided in the Annexes of the amended Fee Regulation (EC) No 254/2013.

<sup>110</sup> European Chemicals Agency (2016), "ECHA report on the operation of REACH and CLP 2016".

<sup>111</sup> Ibid.

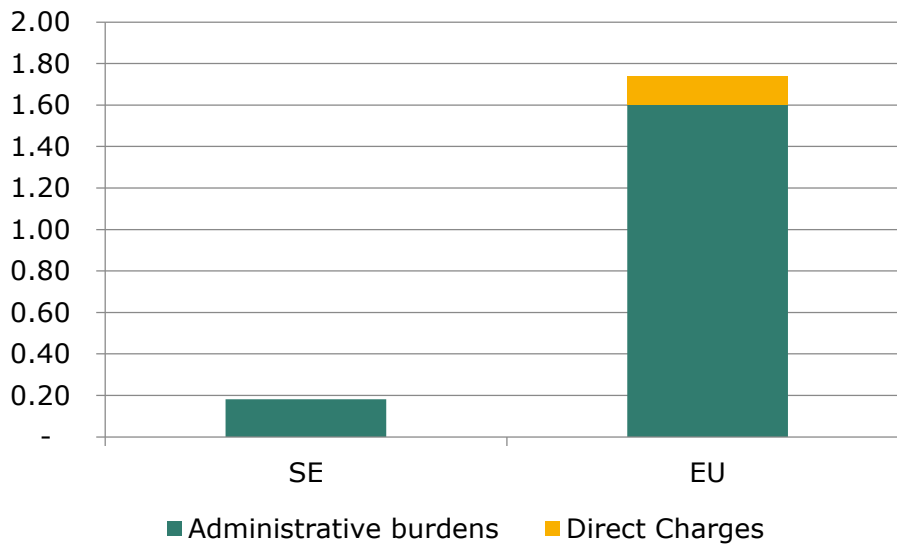
<sup>112</sup> Fees paid to ECHA are excluded from this estimation.

<sup>113</sup> Ibid.

*Direct charges*

Direct charges are of very low relevance for this segment and only reported in a low number of cases. They are estimated to be €0.14/tonne. Direct charges generated by REACH consist of fees paid to ECHA, exclusively for the registration of new substances. None of the companies reported to have updated a registration previously made in the period 2006-15. Fees to ECHA were paid primarily by companies in Northern-Western Europe and to a minor extent in Central-Eastern Europe, while no companies in Southern Europe reported the payment of fees.

**Figure 18. Fired refractories: Regulatory costs generated by REACH Regulation per region (Typical year – Breakdown per cost category)**



*Source: Authors' own elaboration.*

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs generated by REACH on EU producers of fired refractories.



**Table 20. Fired refractories: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0.18	1.63
	Substantive compliance costs	Confidential	Confidential	0	0
	Direct charges	Confidential	Confidential	0	0.14
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0.18*</b>	<b>1.77</b>

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

Source: Authors' own elaboration.

### 5.2.6 Cost assessment CLP – Fired refractories

#### Sample

The sample used for cost estimates in this area of legislation consists of the following plants, spread across the three geographic regions.

**Table 21. Fired refractories: Sample size by geographic region**

Fired refractories /CLP	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	1	1	3	5

Source: Authors' own elaboration.

#### Direct regulatory costs

Direct regulatory costs generated by the CLP Regulation on EU producers of fired refractories are estimated at **€0.60/tonne of production in a typical year**. An explanation of the nature of such costs is that some refractory plants implement cutting *in situ*, which then requires a full assessment downstream by users. The costs only include administrative burdens, which account for the operational costs related to labelling procedures, the costs to provide information on substances and mixtures with hazardous properties and the additional requirements required for their packaging. In SE the costs are estimated to be €0.67/tonne. The BAU factor is at about 40%, indicating that some of

the requirements which can be classified as administrative burdens would also be required by, e.g. downstream clients, in the absence of EU legislation.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated by CLP on EU producers of fired refractories.

**Table 22. Fired refractories: Regulatory costs generated by CLP Regulation (€/tonne – Typical year – averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0.67*	0.60
	Substantive compliance costs	Confidential	Confidential	0	0
	Direct charges	Confidential	Confidential	0	0
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0.67*</b>	<b>0.60</b>

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

Source: Authors' own elaboration.

#### 5.2.7 Cost assessment REACH – Unfired shaped refractories

##### Sample

The sample used for cost estimates for this area of legislation consists of the following plants.

**Table 23. Unfired shaped refractories: Sample size**

Unfired shaped refractories /REACH	EU
Number of plants in the sample	3

Source: Authors' own elaboration.

Only three plants reported data across the EU for this segment. EU data can be presented but needs to be treated with additional care.

*Direct regulatory costs*

Direct regulatory costs of the REACH Regulation for unfired shaped refractories are estimated to be **€2.11/tonne of production output in a typical year at the EU level**. The costs include only administrative burdens. Due to the heterogeneous nature of unfired shaped refractory products, the per-tonne estimates of costs have some variance between individual plants. Regional differences cannot be assessed due to the low response rate. The BAU factor is above 60%, which can mean that even though classified as administrative burdens, some of the activities might also be conducted to serve other stakeholders, e.g. downstream users or workers. According to the ECHA report,<sup>114</sup> many SMEs have the impression that registration is costly for their business. To a large extent, this is due to the evolution of the surrounding economic environment: the investment decisions are made in shorter cycle. As a consequence, the costs will need to be borne over a shorter period of time, which can be a challenge for companies, especially those with a broad portfolio of low tonnage substances such as producers of unfired shaped refractories.<sup>115</sup>

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs generated by REACH on EU producers of unfired shaped refractories.

**Table 24. Unfired shaped refractories: Regulatory costs generated by REACH Regulation (€/tonne – Typical year – averages)**

		EU
Direct regulatory costs	Administrative burdens	1.98*
	Substantive compliance costs	0
	Direct charges	0.13*
Indirect regulatory costs		0
Total regulatory costs		2.11*

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

*Source: Authors' own elaboration.*

<sup>114</sup> European Chemicals Agency (2016), "ECHA report on the operation of REACH and CLP 2016".

<sup>115</sup> Ibid.

### 5.2.8 Cost assessment CLP – Unfired shaped refractories

#### Sample

The sample used for cost estimates for this area of legislation consists of the following plants.

**Table 25. Unfired shaped refractories: Sample size**

Unfired shaped refractories /CLP	EU
Number of plants in the sample	3

*Source: Authors' own elaboration.*

Only three plants reported data across the EU for this segment. EU data can be presented but needs to be treated with additional care.

#### Direct regulatory costs

Direct regulatory costs of CLP Regulation for unfired shaped refractories are estimated to **be €0.30/tonne of production output in a typical year at the EU level.** The costs include only administrative burdens. Due to the heterogeneous nature of unfired shaped refractory products, the per-tonne estimates of costs have some variance between individual plants. Regional differences cannot be assessed due to the low response rate. The BAU factor is at almost 80%, which can mean that even though classified as administrative burdens, some of the activities might also be conducted to serve other stakeholders, e.g. downstream users or workers. The limited number of observations available impose an additional level of care in interpreting these estimates. Part of this difference is also explained by the divergence in the BAU factors indicated by plants.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs generated by CLP on EU producers of unfired shaped refractories.

**Table 26. Unfired shaped refractories: Regulatory costs generated by CLP Regulation (€/tonne – Typical year – averages)**

		<b>EU</b>
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.30*
	<b>Substantive compliance costs</b>	0
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>		0
<b>Total regulatory costs</b>		<b>0.30*</b>

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

*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 ceramics sector. Cost assessments for i) bricks and tiles, ii) ceramic tiles, iii) fired refractories and iv) unfired shaped refractories 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 ceramics producers.
- Section 6.5 provides a cost assessment of energy legislation in relation to use of natural by the ceramics sector. Cost assessment for i) bricks and tiles, ii) ceramic tiles, iii) fired refractories and iv) unfired shaped refractories subsectors 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 ceramics producers.
- Section 6.6 provides a costs assessment of the Energy Efficiency Directive for the i) bricks and tiles, ii) ceramic tiles, iii) fired refractories and iv) unfired shaped refractories sectors.

### **6.1 Overview and relevance of energy policy for the EU ceramics 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 ceramics sector, the recent trends in energy prices are here discussed.

A typical energy industry bill consists of four parts:

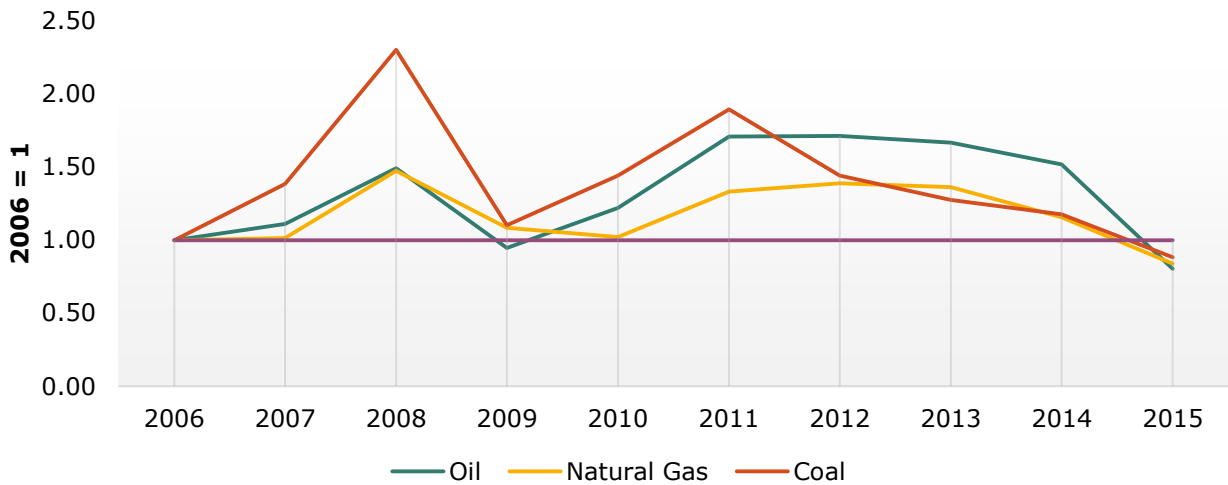
- energy component;
- network costs;
- renewable energy support levies (RES levies) for electricity;
- other taxes, levies and fees and charges.

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 EU<sup>116</sup> and their interconnected price trends have significant impact on electricity prices in the EU. Figure 19 shows the normalised price trends for oil, natural gas and coal in the EU, showing that the three fuels follow similar price trends.

**Figure 19. Normalised price trends of oil, natural gas and coal, 2006-15; 2006=1**



Source: BP (2016).<sup>117</sup>

*Oil price developments 2006-15*

Oil is by far the most consumed fuel in the EU<sup>118</sup> 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:<sup>119</sup>

- **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.
- **2009-13:** the recovery from the global economic crises led to the growing demand for oil and prices rose to around \$100 per barrel.

<sup>116</sup> 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)).

<sup>117</sup> 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](http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf)).

<sup>118</sup> 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)).

<sup>119</sup> 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](http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf)).

- **Since 2013:** in 2013 the prices moderately went down and after 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 EU<sup>120</sup> 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. But gas markets have significantly evolved over the last 15 years, mainly due to the following developments:

- Sophistication of liquefaction technologies and development of 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 natural gas prices in the (import dependent) EU.<sup>121</sup>

### *Coal market developments, 2006-15*

Coal is used mostly to generate electricity and represents the third-most consumed fuel in the EU.<sup>122</sup> It followed a 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 on 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 the ceramics sector. The following legislative acts were identified as having potential to generate a cost impact on the ceramics industry:

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<sup>120</sup> 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)).

<sup>121</sup> 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](http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf)).

<sup>122</sup> 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)).



- **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 ceramics 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 27 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 also needs 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 previously conducted studies were used to assess the validity of the data.

**Table 27. Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Bricks and tiles	23	12	5	6	23 (electricity), 23 (natural gas)
Ceramic tiles	16	4	5	7	16 (electricity), 16 (natural gas)
Fired refractories	11	5	2	4	11 (electricity), 11 (natural gas)
Unfired shaped refractories	4	2	0	2	4 (electricity), 4 (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.<sup>123</sup> 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.<sup>124</sup>

<sup>123</sup> Marcu, A. et al. (2016), "Composition and Drives of energy prices and costs for energy intensive industries", CEPS.

<sup>124</sup> Ibid.

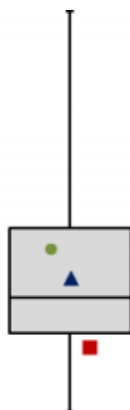
### Data presentation

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 20. 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, dark blue, light blue and red figures present weighted regional averages as well as the EU average.

**Figure 20. 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:**

- **The 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 after 2010 increased more significantly in absolute terms. The primary data collection from ceramics manufacturers shows that, for example, in the bricks and tiles sector costs increased from €7.50/MWh (2006) to €20.40/MWh (2015), representing approximately a 272% increase over 2006-15.
- 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-E<sup>125</sup> and IEA,<sup>126</sup> 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.

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<sup>125</sup> The CCA is a retrospective analysis whereas the ENTSO-E TYNDP looks forward to 2012-30. However, the estimations from ENTSO-E are useful in particular 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](http://www.entsoe.eu/publications/market-reports/Documents/ENTSO-E%20Overview%20of%20Transmission%20tariffs%202015_FINAL.pdf)).

<sup>126</sup> 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](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 ceramics manufacturers, as RES levies increased dramatically over the study period. For example, in the ceramics sector, RES levies increased from €9.30/MWh (2006) to €29.40/MWh (2015), representing approximately a 316% 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 was slowed due to the economic crisis and uncertainty of gas demand. Network costs, however, stayed quite stable before and after the entry into force of the Third Energy Package. For example, in the fired refractories sector, network costs represented €2.07/MWh of the total bill in (2006). By 2015, network costs had increased slightly to €2.53/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 were generated due to EU Internal Market legislation for natural gas** 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 2012-15 (payments to auditors and labour costs) and dividing them by ii) total production in 2012-15.

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 number of plants report 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 the information from responding ceramics plants concerning the impact of energy costs – for both natural gas and electricity – over production costs.<sup>127</sup> As the ceramics 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.

#### Bricks and tiles

What follows is an analysis on the impact of energy costs on production costs in the bricks and tiles sector.

**Table 28. Bricks and tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Bricks and tiles	23	12	5	6	23

Source: Authors’ own elaboration.

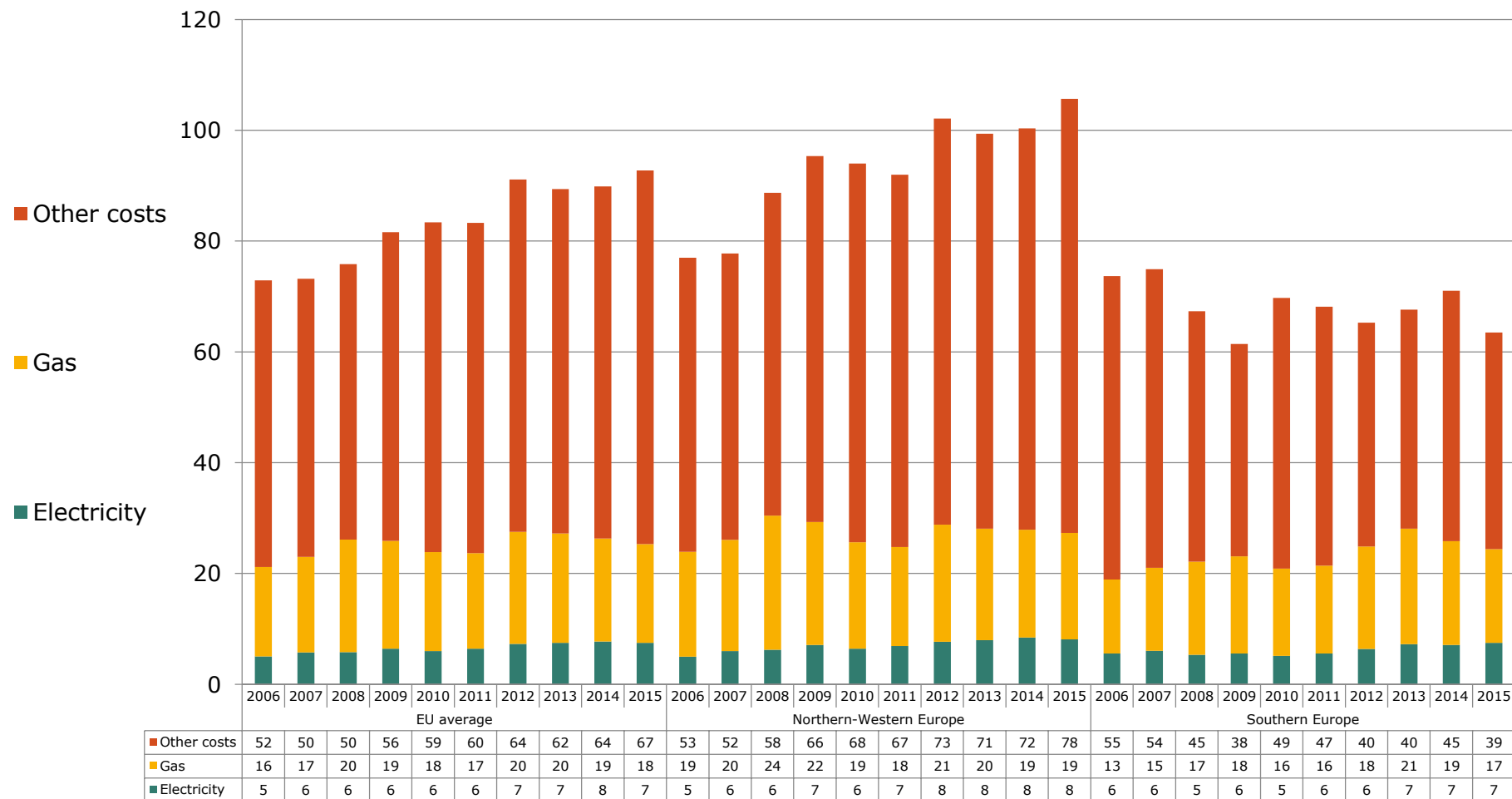
The impact of electricity and gas costs on production costs in the bricks and tiles sector fluctuated somewhat over the study period. The share of electricity costs on total production costs increased: while in 2006 electricity costs represented 6.9% of production costs, in 2015 they represented a share of 8.0% of total production costs. The share of natural gas costs on production costs decreased slightly over time. In 2006, natural gas costs were responsible for a share of 22.1%, decreasing to 19.2% of production costs in 2015. This share of energy costs on production costs for the bricks and tiles industry is in line with a previous study<sup>128</sup> conducted by CEPS, Ecofys and Economisti Associati.

Some slight regional differences were present in the bricks and tiles industry. In the SE region, energy costs (both electricity and natural gas costs) represented a larger share of production costs when compared with the NWE region, where the role of energy costs was less significant. In 2015, the share of total energy costs was at 38.5% of production costs in the SE region and at 25.9% in the NWE region. Data for the CEE region cannot be shown for confidentiality reasons.

<sup>127</sup> Production costs include all costs, both OPEX, CAPEX and other expenses, borne by the plant and directly relating to the manufacturing process.

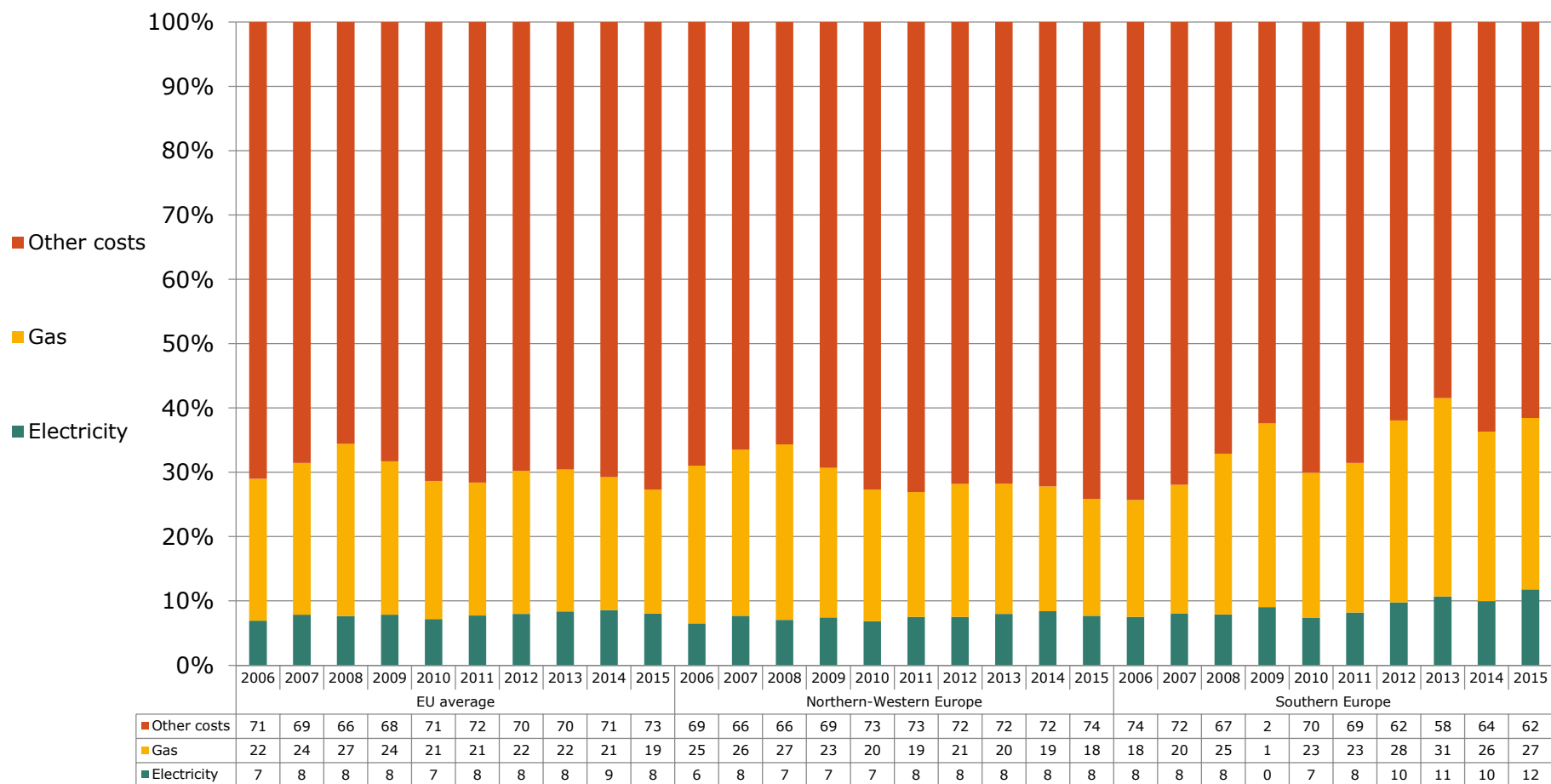
<sup>128</sup> Marcu, A. et al. (2016, forthcoming), “Composition and Drives of energy prices and costs for energy intensive industries.”, CEPS.

**Figure 21. Bricks and tiles: Impact of energy costs on production costs €/tonne of production (2006-15)**



Source: Authors' own elaboration.

**Figure 22. Bricks and tiles: Impact of energy costs on production costs % (2006-15)**



Source: Authors' own elaboration.



*Ceramic tiles*

**Table 29. Ceramic tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
<b>Ceramic tiles</b>	16	4	5	7	16

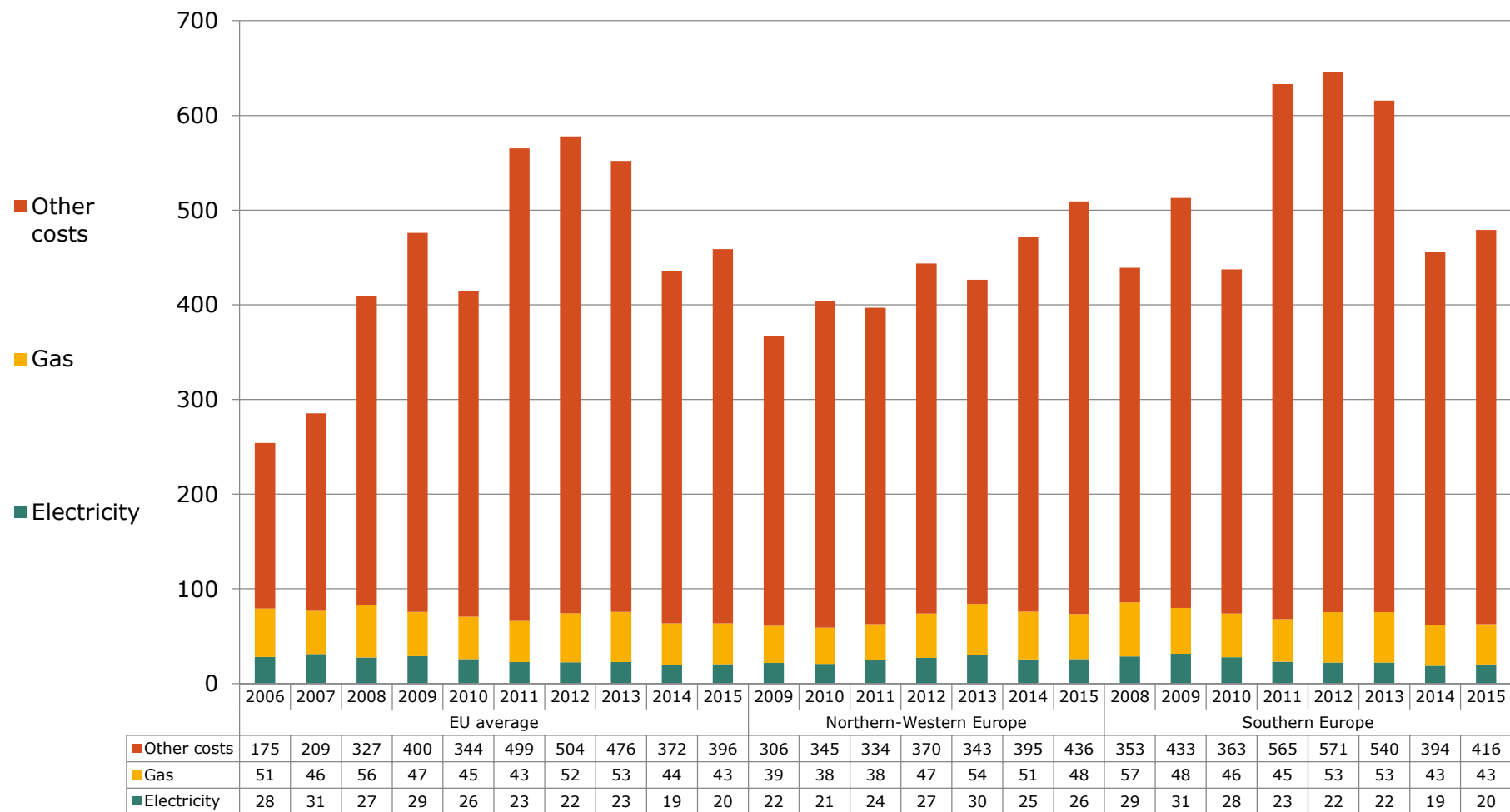
*Source: Authors' own elaboration.*

The impact of electricity and gas costs on production costs in the ceramic tiles sector fluctuated somewhat over the study period. The share of electricity costs on total production costs decreased: while in 2006 electricity costs represented 11.1% of production costs, in 2015 they represented a share of 4.4% of total production costs. The share of natural gas costs of total production costs fluctuated over time. In 2006, natural gas costs were responsible for a share of 20.1%, decreasing to 7.7% in 2011 and going up to 9.4% of total production costs in 2015. This share of energy costs on production costs for the ceramic tiles industry is in line with a previous study<sup>129</sup> conducted by CEPS, Ecofys and Economisti Associati.

Some slight regional differences were present. In the NWE region, energy costs (both electricity and natural gas costs) generally represented a slightly larger share of production costs, in the SE region, the role of energy costs was less significant. In 2015, the share of total energy costs was at 14.4% of production costs in the NWE region and at 13.1% in the SE region. Data for the CEE region cannot be shown for confidentiality reasons.

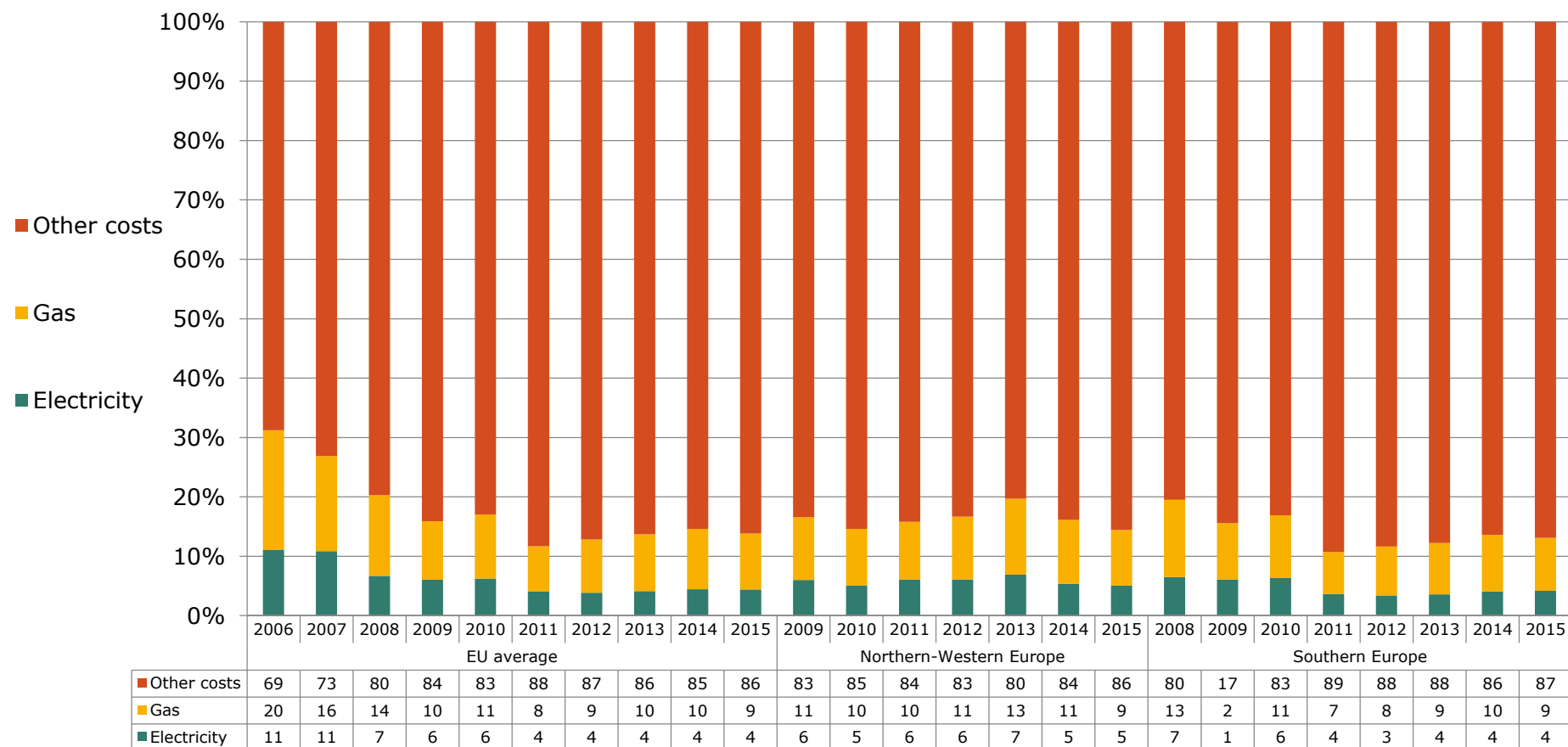
<sup>129</sup> Ibid.

Figure 23. Ceramic tiles: Impact of energy costs on production costs €/tonne of production (2006-15)



Source: Authors' own elaboration.

**Figure 24. Ceramic tiles: Impact of energy costs on production costs % (2006-15)**



Source: Authors' own elaboration.

*Fired refractories*

What follows is an analysis of the impact of energy costs on production costs in the fired refractories subsector.

**Table 30. Fired refractories: Total number of questionnaires received and used in the Chapter**

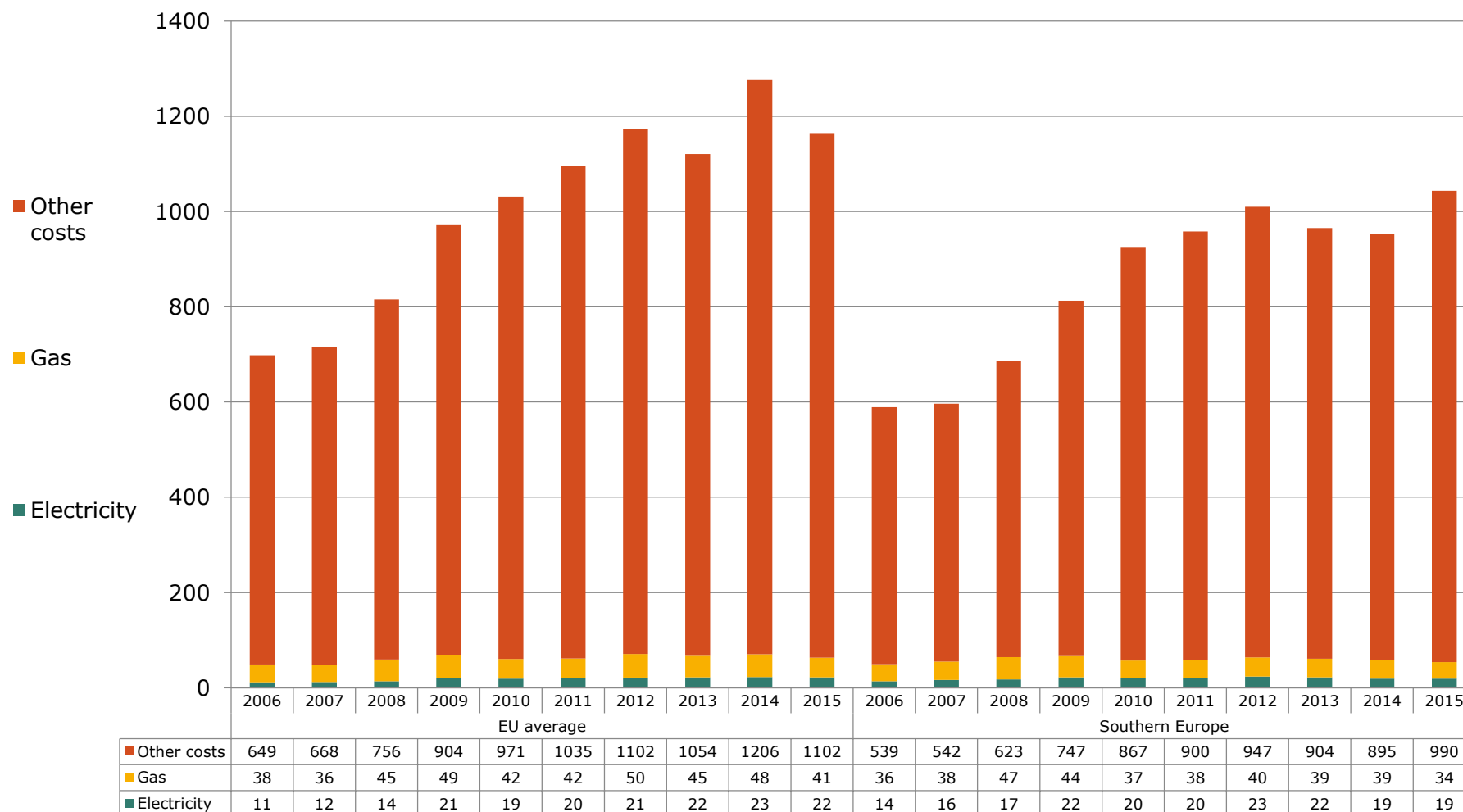
Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
<b>Fired refractories</b>	11	5	2	4	11

*Source: Authors' own elaboration.*

The impact of electricity and gas costs on production costs in the fired refractories sector remained relatively stable over the study period. The share of electricity costs on total production costs increased slightly: while in 2006 electricity costs represented 1.6% of production costs, in 2015 they represented a share of 1.9% of total production costs. Natural gas costs as a share of production costs decreased over the study period. In 2006, natural gas costs were responsible for a share of 5.4%, decreasing to 3.5% of production costs in 2015. This share is relatively low when compared with the ceramic tiles and bricks and tiles industries. This finding was confirmed by industry experts at the Validation Workshop. In fact, production of fired refractories largely relies on raw materials which are thermally treated by upstream players; hence part of the energy costs are already included in costs for raw materials.

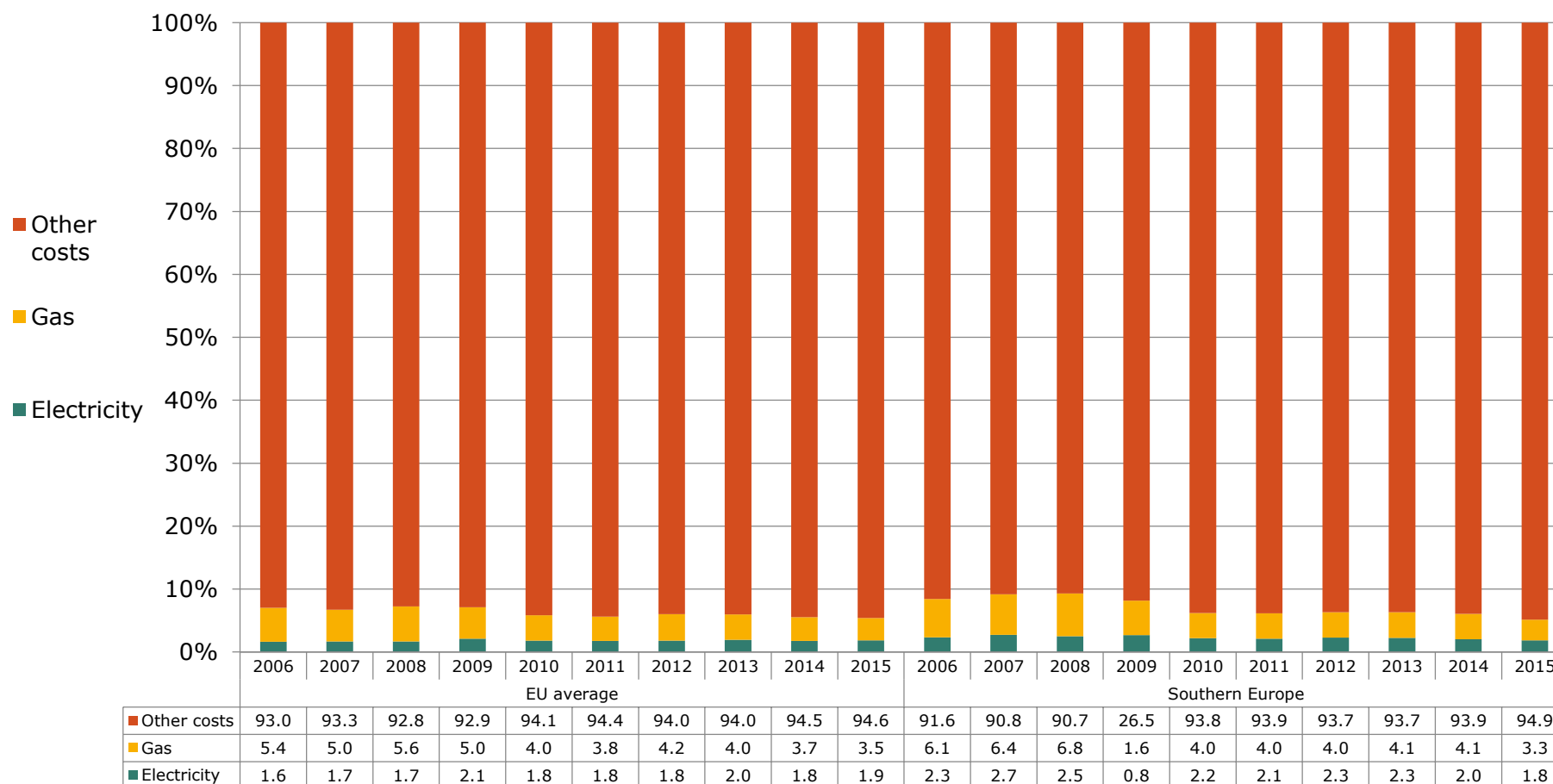
Respondent data shows that in the SE region, energy costs (both electricity and natural gas costs) represented a very similar share of production costs when compared with the EU average. In 2015, the share of total energy costs was at 5.1% of production costs in the SE region and at 5.4% in the EU average. Data for the NWE and CEE regions cannot be shown for confidentiality reasons.

**Figure 25. Fired refractories: Impact of energy costs on production costs €/tonne of production (2006-15)**



Source: Authors' own elaboration.

**Figure 26. Fired refractories: Impact of energy costs on production costs % (2006-15)**



Source: Authors' own elaboration.

Unfired shaped refractories

What follows is an analysis on the impact of energy costs on production costs in the unfired shaped refractories subsector.

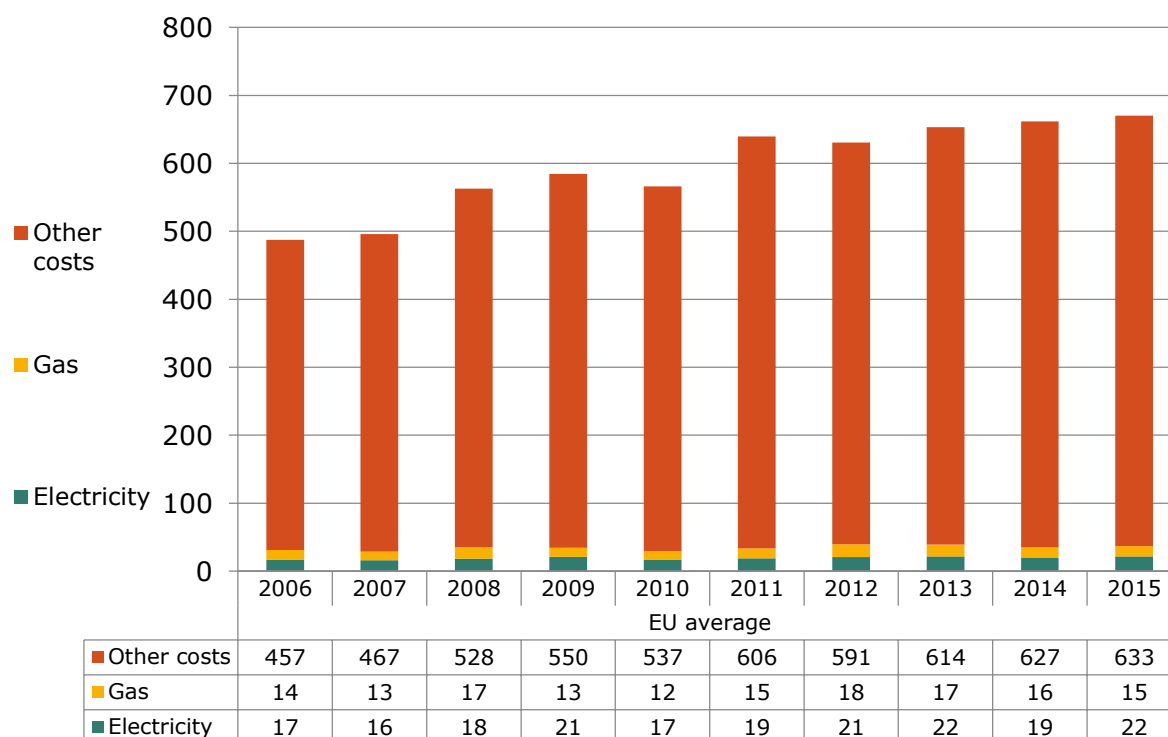
**Table 31. Unfired shaped refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Unfired shaped refractories	4	2	0	2	4

Source: Authors' own elaboration.

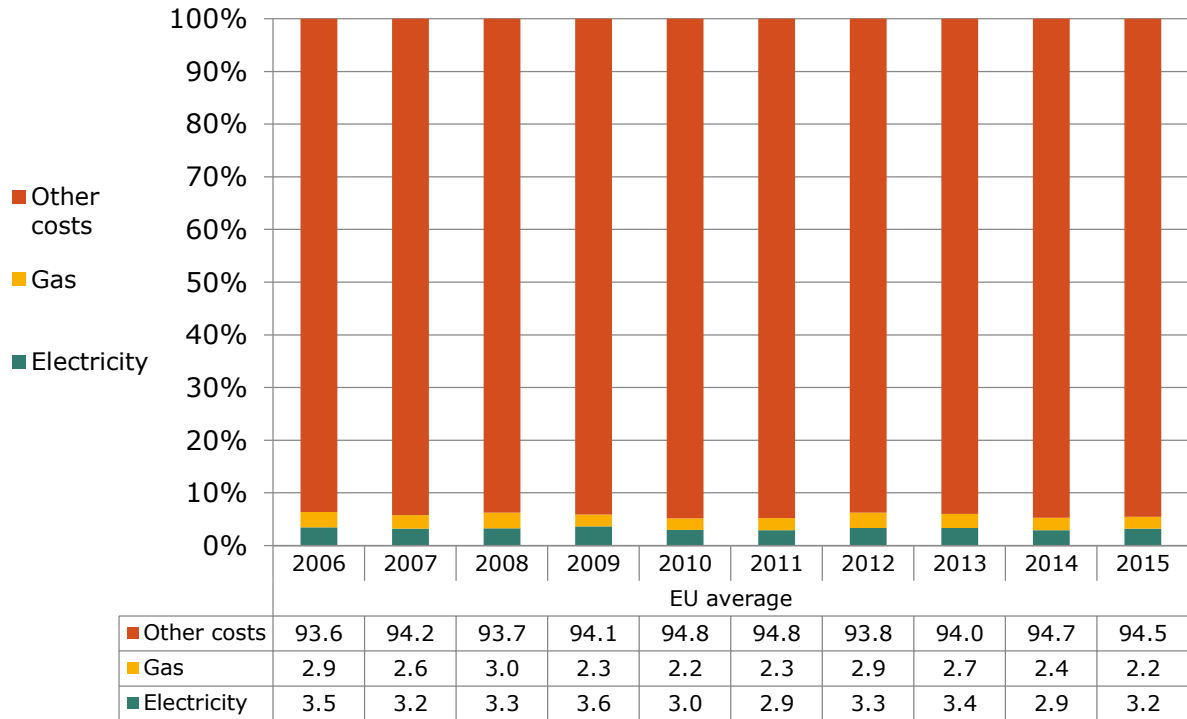
The impact of electricity and gas costs on production costs in the unfired shaped refractories subsector remained relatively stable over the study period. Electricity costs as a share of total production costs decreased slightly: while in 2006 electricity costs represented 3.5% of production costs, in 2015 they represented a share of 3.2%. Natural gas costs as a share of production costs decreased over the study period. In 2006, natural gas costs were responsible for a share of 2.9%, decreasing to 2.2% of production costs in 2015. This share is lower than other ceramics industries, which is to be expected, since the production process is considered relatively less energy-intensive. The unfired shaped refractories industry is not included in the categories of activities covered by the Industrial Emissions Directive (2010/75/EU) and is not required to trade emissions via the EU Emissions Trading Scheme.

**Figure 27. Unfired shaped refractories: Impact of energy costs on production costs €/tonne of production (2006-15)**



Source: Authors' own elaboration.

**Figure 28. Unfired shaped refractories: Impact of energy costs on production costs % (2006-15)**



Source: Authors' own elaboration.



## 6.4 Electricity

Ceramics manufacturing is an energy intensive industry. While natural gas is the main energy carrier in the sector, ceramics manufacturers also use electricity in their production process.<sup>130</sup> A cost assessment of EU legislation on electricity for bricks and tiles, ceramic tiles, fired refractories and unfired shaped refractories sectors 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, whereas these revenues are not accounted for in electricity bill component analyses. Note that reimbursement from renewable energy support and for taxes, fees and levies (excluding VAT) are taken into account in this 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 ceramics 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 supplier.

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 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

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<sup>130</sup> Ibid.

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 2009/28/EC, 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**", which **provide 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 industries where exemptions may be granted; the sectors covered in this Study are among those listed. 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 Renewable 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 the 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 ceramics 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 – Bricks and tiles**

#### *Sample*

A short overview of the number of questionnaires received can be found below in Table 32. In total the sample covers 23 respondents from the bricks and tiles sector. More than three companies from the NWE and SE geographical regions provided data enabling the Research Team to present two regional cost assessments for the bricks and tiles sector. For confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 32. Bricks and tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Bricks and tiles	23	12	5	6	23

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*

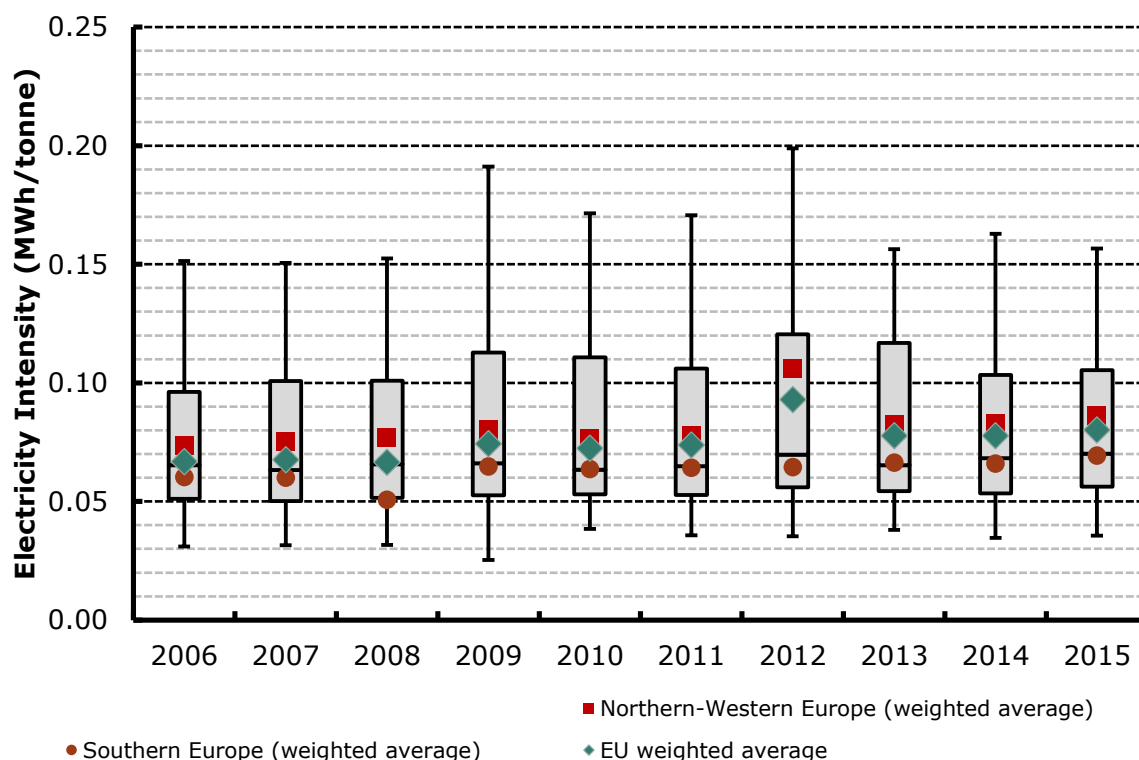
What follows here is an analysis of electricity intensity of production as reported by responding plants. An assessment of the industry's electricity intensity helps to understand what role costs generated by consumption of electricity play for the sector. All plants in the sample provided the relevant information allowing the Research Team to assess the electricity intensity based on the sample of 23 plants. Note that six plants self-generate electricity.

Bricks and tiles manufacturing cannot be described as an electricity-intensive industry, since when compared with the other two sectors in this Study, it is the least electricity-intensive industry. **The respondents' electricity intensity fluctuated very slightly over the period 2006-15, with an EU weighted average for the majority of years remaining between 0.06-0.09 MWh/tonne of production.** The EU weighted average was higher than the median for the majority of years meaning that larger plants in the sample were more electricity-intensive than smaller plants. Crossed-checked with previous European Commission-funded research, these results are in line with literature on electricity intensity of production in the bricks and tiles sector.<sup>131</sup>

The electricity intensity of the NWE region is similar to the EU average. This is because the EU average has a higher weighting factor in this region. The annual weighted mean of observations included in this region remained within 0.07-0.08 MWh/tonne of production, with the exception of 2014, when it peaked at 0.11 MWh/tonne, which appears to make that year an outlier. The weighted average for this region was higher than the EU weighted average by 0-16%. The likely reason for this was decreased production efficiency of plants within this region when compared with combined data for plants in the SE and CEE regions.

The electricity intensity for the SE region remained steady throughout the study period. The annual weighted mean of observations was between 0.05-0.07 MWh/tonne of production. This was below the EU average for all years and the likely reason for this is a result of increased production efficiency of plants when compared to combined data for plants in the SE and NWE regions, or that extrusion processes are more prevalent in NWE plants.

<sup>131</sup> Ecofys (2009), "Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the ceramics Industry" ([https://ec.europa.eu/clima/sites/clima/files/ets/allowances/docs/bm\\_study-ceramics\\_en.pdf](https://ec.europa.eu/clima/sites/clima/files/ets/allowances/docs/bm_study-ceramics_en.pdf)).

**Figure 29. Bricks and tiles: Electricity intensity per tonne of production (2006-15)**

Source: Authors' own elaboration.

### Electricity costs

Almost all plants in the sample provided data to calculate their electricity prices, with the exception of five plants that provided data with a number of years missing. These missing years were extrapolated from other data points within the Study using the methodology described in section 6.2.1. This allowed the Research Team to assess the net electricity costs based on a sample of 23 plants.

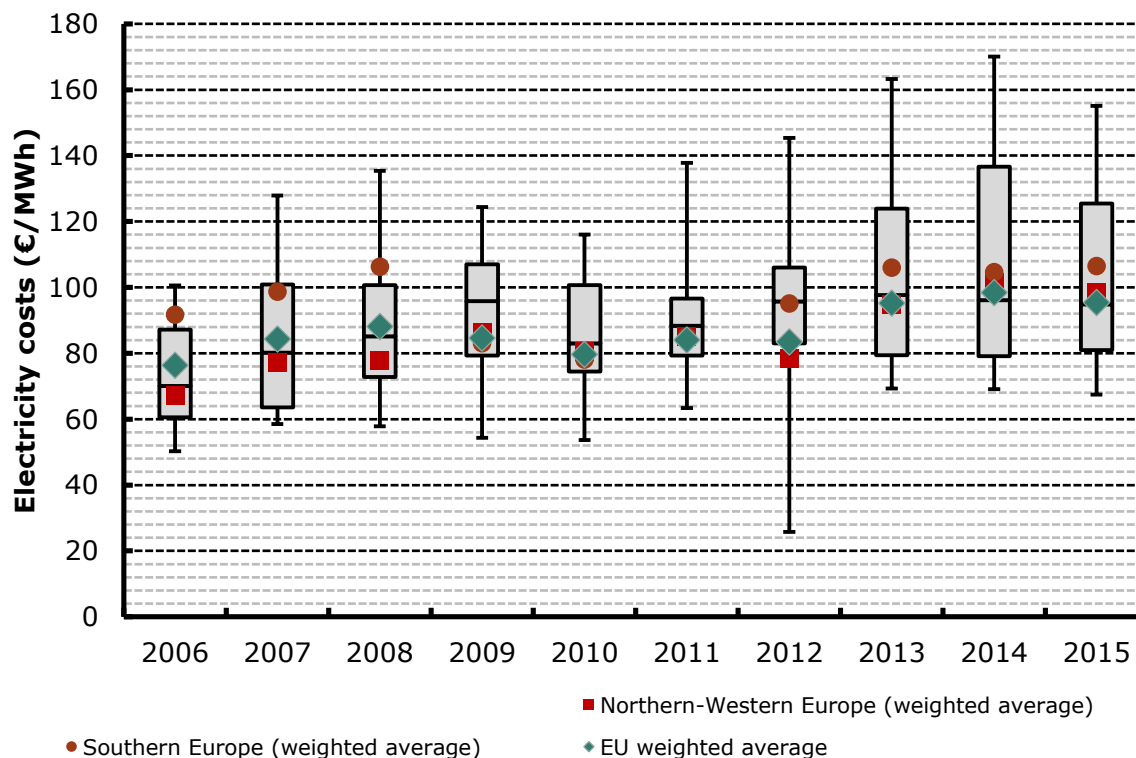
Six plants reported that they received reimbursement from RES levies; two of these plants only received a reimbursement for 2015 and the remaining three received reimbursements only for the latter years in the Study. Five plants received reimbursements from other taxes, fees and levies, while one plant stated they take part in an interruptibility scheme.

**Net electricity costs fluctuated slightly over the period 2006-15. Costs show generally an upward trend for weighted EU averages from 2006 (€76.40/MWh) to 2015 (€95.40/MWh), with two peaks in 2008 (€88.10/MWh) and in 2014 (€98.50/MWh) and a drop in 2010 (€79.70/MWh).** The electricity price fluctuations in the bricks and tiles sector shows a similar trend to natural resource prices as shown in section 6.2.1.

The NWE regional price assessment shows a similar trend to EU-weighted averages, which is due to a larger weighting factor given to this region. For the earlier years in the study period, 2006-08, NWE producers report paying average electricity costs that are lower than the EU average by up to 12%. After 2008, however, the data shows that NWE producers report paying average electricity costs that are similar to or higher by up to 3% than the EU average.

The SE regional price assessment also shows a similar trend to the EU-weighted average, but unlike the NWE region, plants in the SE region report higher electricity prices in both the earlier and later years in the study period. In the years 2006-08 electricity prices in the SE region are higher than the weighted average by approximately 17-20%; similarly, in the years 2010-15, electricity prices in the SE region are higher than the weighted average by approximately 6-13%. For the latter years, higher costs in this region are mostly a result of higher regulatory costs in electricity bills, as shown in the absolute costs of components in Figure 32.

**Figure 30. Bricks and tiles: Electricity costs 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 in electricity bills from respondents in our sample show a similar trend to natural resource prices, shown in section 6.1.1, and are the largest price component seen in electricity bills.

Regulatory components have a large impact on the electricity price paid by respondents. Figure 31 shows the relative costs of the four components of electricity bills. **The share of regulatory components has been on the rise and this is a result of increasing regulatory costs coupled with the energy component cost decreasing over the studied period. As a comparison, the EU average of the regulatory components in 2006 was at 29.9%. This share increased over the 10-year period to 50.9%.**

All EU average regulatory component costs increased after 2006, while the energy component in electricity bills from respondents in our sample decreased and displayed a

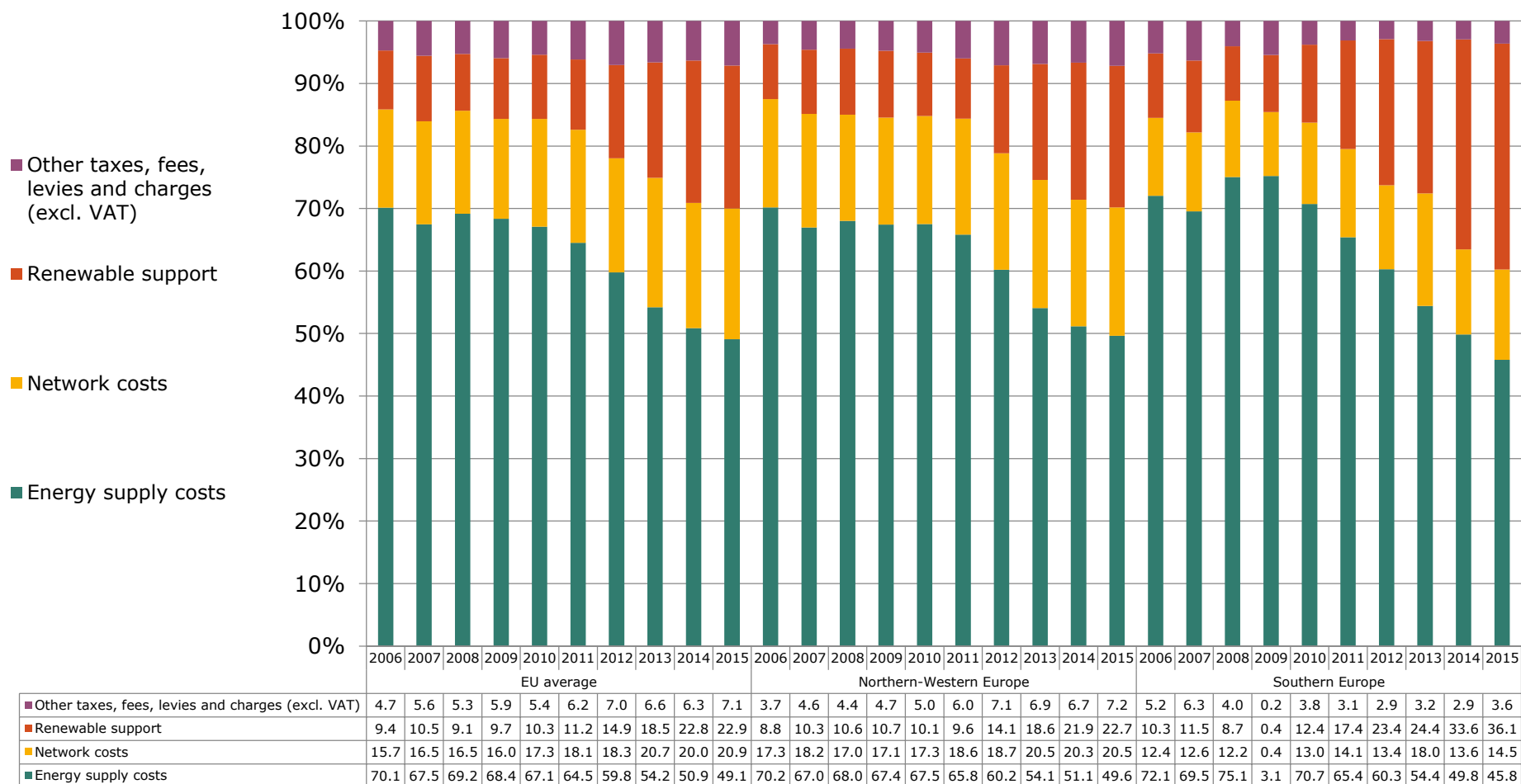
similar trend to natural resource prices, shown in Figure 19. Figure 32 shows that the share of other taxes, fees and levies on average EU electricity costs increased from €3.70/MWh in 2006 to €6.40/MWh in 2015. Similarly, the costs of renewable levies on electricity bills also increased significantly from just €7.50/MWh to €20.40/MWh, which was the result of renewable support schemes providing long-term contracts and therefore these costs increased on a yearly basis as more and more generators were accredited. **Respondents also reported network costs were increasing, from €12.50/MWh in 2006 to €18.70/MWh in 2015.** This was likely a result of infrastructure developments to increase interconnection between Member States and in response to the accelerated diffusion of variable renewables connecting to distribution grids, which has the additional cost of system management.

The impact of the different regulated components shows a parallel trend in the NWE region when observed beside the EU-weighted average, as can be seen from the graph in Figure 31. All plants in our sample report that the share of regulatory components was increasing, and a similar rate of increase was seen in both the EU average and the NWE average. **In 2006 the share of regulatory components made up 29.9% of electricity bills and this increased to 50.9% in 2015; similarly, in the NWE region the share was 29.8% in 2006 and increased to 50.4% in 2015. This was mostly a result of the substantial growth of network costs and RES levy costs.** The impact of regulatory components in the SE region was larger in the later years, ranging from 27.9% in 2006 to 54.2% in 2015.

Although relative values show a very similar trend, it appears that absolute values were higher in the SE region when compared with the EU average. This was mostly a result of higher regulatory costs. The data shows that in 2015, the renewable support component cost in the SE region was 110% more than the EU average in the same year. Whereas in 2015 data from plants show that the energy component costs and renewable support costs in the NWE region were similar to the EU average. This could be a result of a number of factors: a higher penetration of supported renewables in this region, renewable levies being hidden in respondent electricity bills from other regions or a combination of both.

The data on electricity bill components shows that while the price of the energy component remained quite stable, the share of regulatory costs increased. Therefore, the recent fluctuations in electricity costs, particularly the overall increase in the study period, were largely a result of changes in the regulatory component.

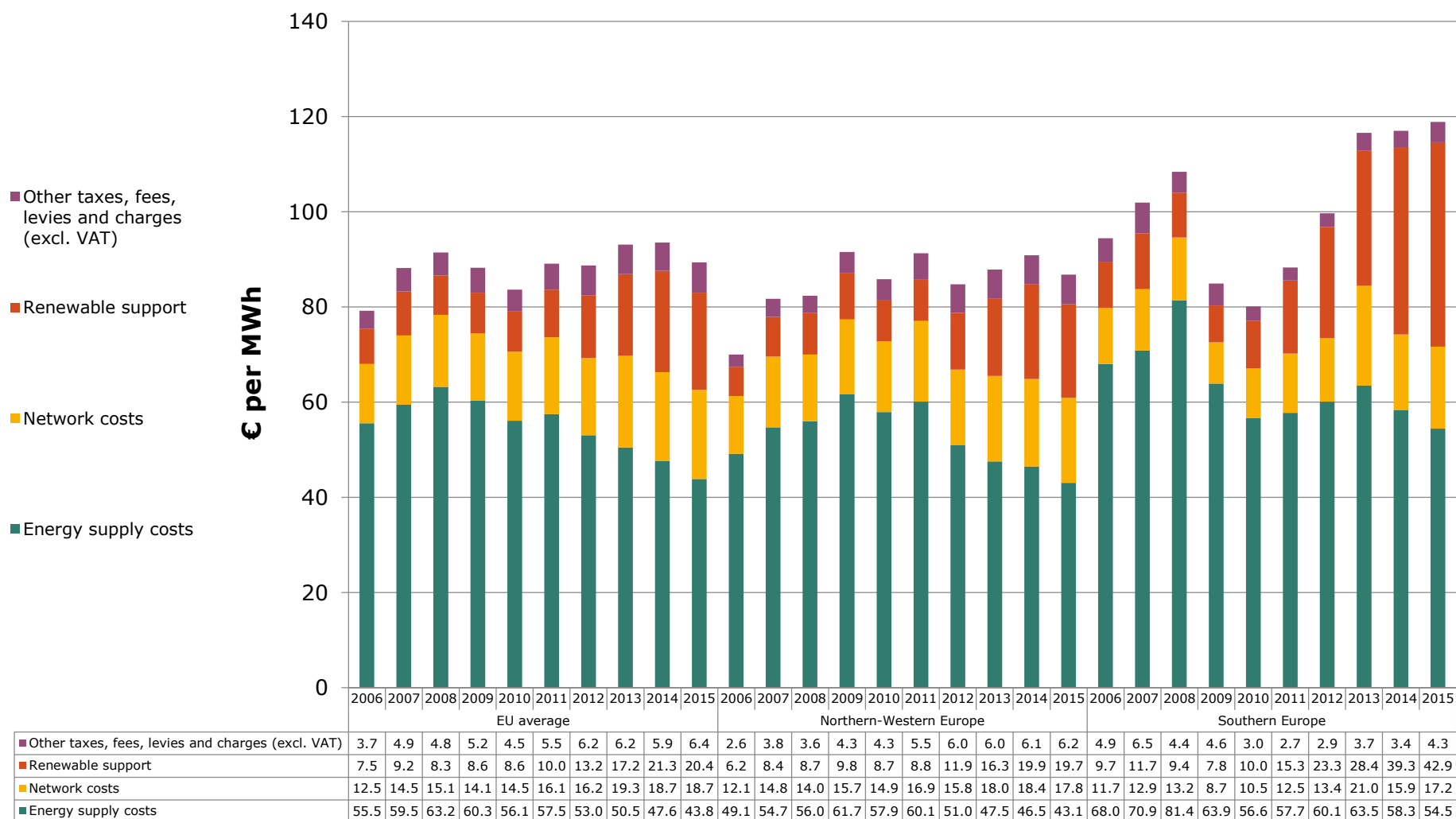
**Figure 31. Bricks and tiles: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.



**Figure 32. Bricks and tiles: 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 at the 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 has 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 €0.03/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 of 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. **At the EU level, the costs increased from €0.43/tonne of production in 2006 to €2.22/tonne of production in 2015.**

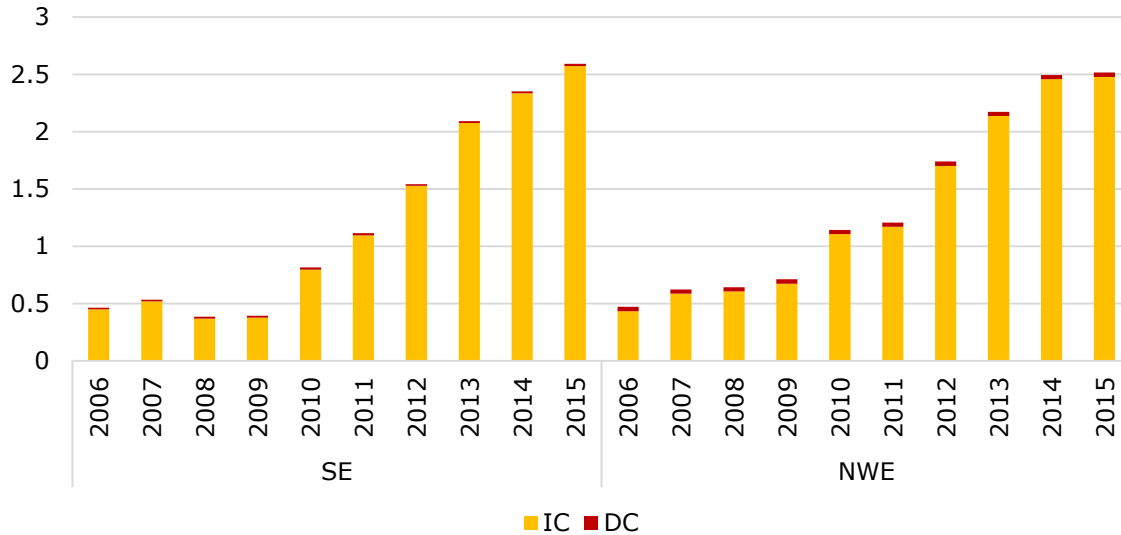
Indirect regulatory costs increased significantly over the study period. This was directly a result of increasing renewables support and network costs on electricity bills. There was a general trend across all regions of increasing regulatory costs and this was mostly caused by an increasing share of variable renewables in the system.

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 into higher renewable support costs.

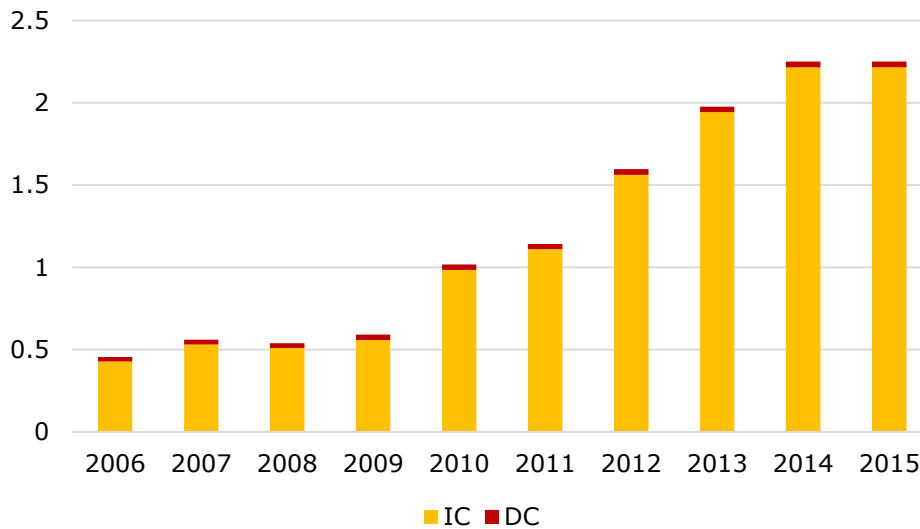
As shown in Figure 32, the RES component increased in 2014 and 2015. In the absence of data on the evolution on national exemption schemes, a cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no strong conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

**Figure 33. Bricks and tiles: Cumulative regulatory costs of electricity legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 34. Bricks and tiles: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 33 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.

**Table 33. Bricks and tiles: Cumulative regulatory costs of electricity legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	Confidential	0	0
	Substantive compliance costs	0	Confidential	0	0
	Direct charges	0.04	Confidential	0.02	0.03
Indirect regulatory costs		2.48	Confidential	2.57	2.22
Total regulatory costs		<b>2.52</b>	<b>Confidential</b>	<b>2.59</b>	<b>2.25</b>

Source: Authors' own elaboration.

#### 6.4.4 Cost assessment – Ceramic tiles

##### Sample

A brief overview of the number of questionnaires received can be found below in Table 34. In total the sample covers 16 respondents from the ceramic tiles sector. More than three companies from the NWE and SE geographical regions provided data enabling the Research Team to present two regional cost assessments for the ceramic tiles sector. For confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 34. Ceramic tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Ceramic tiles	16	4	5	7	16

Source: Authors' own elaboration.

Note that not all plants provided data for the entire 2006-15 period. Yet, the Research Team used estimates to improve the quality of data (see methodology section in this Chapter).

### *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. All plants in the sample provided the relevant information allowing the Research Team to assess the electricity intensity based on the sample of 16 plants. Note that two plants self-generate electricity.

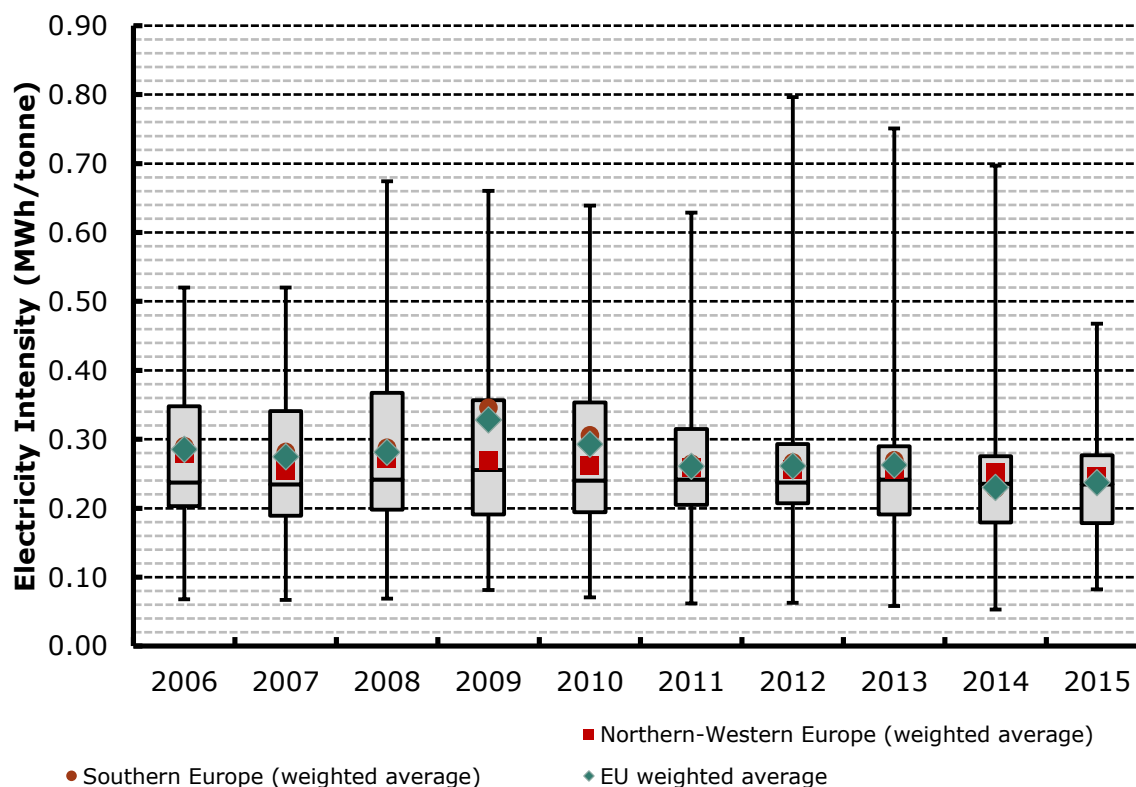
Ceramics manufacturing cannot be described as an electricity-intensive industry. **The respondents' electricity intensity fluctuated very slightly over the period 2006-15, with peaks in 2009 and 2013, with an EU-weighted average remaining between 0.23-0.33 MWh/tonne of production.** The EU-weighted average was higher than the median in most years, meaning that larger plants were more electricity-intensive than smaller plants. Crossed-checked with previous European Commission-funded research, these results are in line with literature on electricity intensity of production in the ceramic tiles sector.<sup>132</sup>

The NWE region shows a more stable electricity intensity over the study period. The annual weighted mean of the observations included in this region remained within 0.25-0.28 MWh/tonne of production. The weighted average for this region was lower than the EU-weighted average by 2-17%, except for 2014 and 2015; the likely reason for this was increased production efficiency of plants within the NWE region when compared with combined data for plants in the SE and CEE regions.

The SE region shows values similar to the EU-weighted average. The annual weighted mean was generally higher than the weighted mean for NWE plants and remained between 0.27-0.35 MWh/tonne of production. The weighted average for this region was higher than the EU-weighted average for all years by 0-5%.

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<sup>132</sup> Ibid.

**Figure 35. Ceramic tiles: Electricity intensity per tonne of production (2006-15)**

Source: Authors' own elaboration.

### Electricity costs

Almost all plants in the sample provided data to calculate their electricity prices, with the exception of five plants that provided their questionnaires with data missing from a number of missing. These missing years were extrapolated from other data points, as described in section 6.2.1. Estimating data points allowed the Research Team to assess the net electricity costs based on all 16 plants in this sector that provided questionnaires.

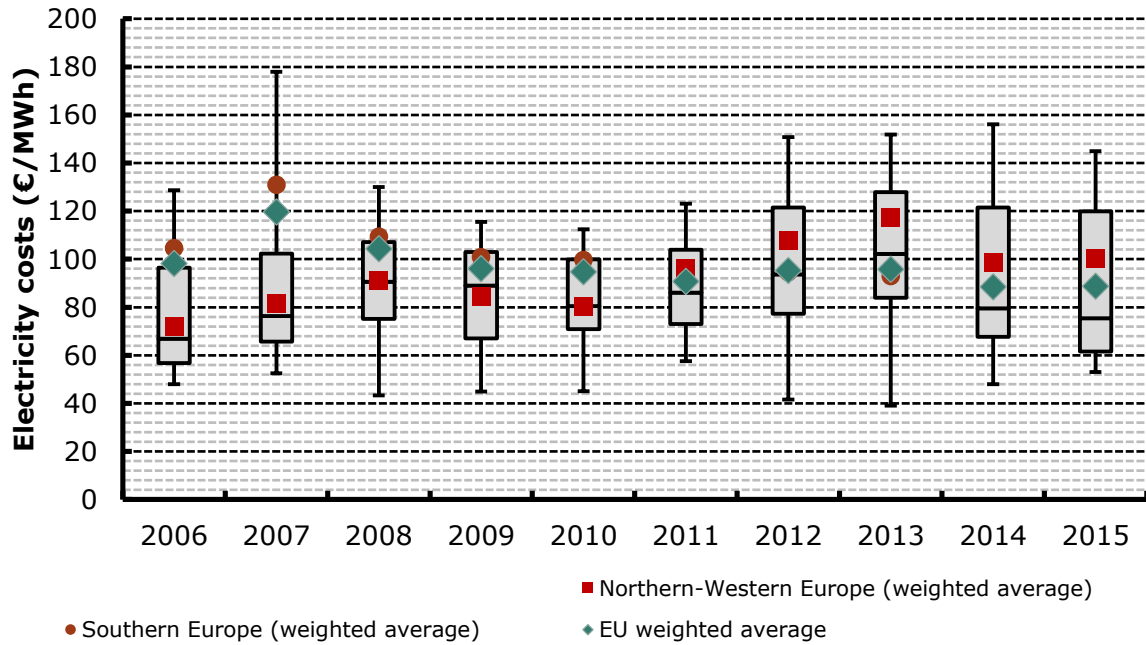
Three plants reported that they received reimbursement from RES levies or from other taxes, fees and levies, while no plants stated they take part in an interruptibility scheme.

Figure 36 shows that net electricity costs fluctuated over the period 2006-15. **Costs show a downward trend for EU-weighted average from 2006 (€98.10/MWh) to 2015 (€88.70/MWh), with two peaks, one in 2007 (€119.70/MWh) and one in 2013 (€95.70/MWh) and a drop in 2011 (€90.80/MWh).** Data also shows decreasing net electricity costs from 2013. The electricity price fluctuations in the ceramic tiles sector, as shown in Figure 36, followed a similar trend to natural resource prices presented in Figure 19.

The NWE regional price assessment demonstrates a similar trend to EU-weighted average from 2008 onwards. Values in 2006 and 2007 were much lower than the EU-weighted average and this was likely due to divergences in regulated components and higher fragmentations of national policies. In 2006-10, NWE producers incurred average costs lower than the EU average, from approximately 27% in 2006 to 15% in 2010. From 2011 onwards, producers in the NWE region incurred average costs higher than the EU average by between 5%-23%.

The SE regional price assessment exhibits a similar trend to the EU weighted average, with more similar comparable prices when compared with the NWE region. The average price fluctuated from €131/MWh in 2007 to €89/MWh in 2014. The difference between the EU average and the SE average remained between 0-6%.

**Figure 36. Ceramic tiles: Electricity costs 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 of the electricity bill.** It fluctuated between €79.80/MWh in 2006 and €46.80/MWh in 2015. The fluctuations in our sample show a similar trend to natural resource prices, shown in section 6.1.1. This is because the energy component generally reflects wholesale market prices that subsequently follow natural resource prices; similar to natural resource trends, respondent data shows the energy component to be decreasing.

Regulatory components had a large impact on the electricity price paid by respondents. The share of regulatory components has been on the rise and this is a result of these component costs increasing, coupled with the energy component costs decreasing over the study period, as shown in Figure 38. **As a comparison, the impact of the regulatory component was in 2006 at 23.9% and has increased over the 10-year period to 51.9% of the electricity price in 2015.** However, the overall electricity price decreased after 2013 due to falling energy supply costs, which outweighed the increase in regulatory costs.

**While the share of other taxes and levies on average EU prices stayed relatively stable in the period 2006-15, the share of renewable support increased significantly and the share of network costs increased slightly.** The data on electricity bill components shows that while the price of the energy components fell, the share of regulatory costs increased.

Figure 37 shows the relative costs of the four components of electricity bills. Data from respondents shows that in 2006, renewable support represented 8.9% of the electricity bill for EU ceramic tiles manufacturers while in 2015 the figure was at 29.7%. This threefold rise in renewable support costs was a result of the increase in national renewables support schemes implemented throughout the EU mostly as a result of EU legislation. Data also shows that network costs accounted for 9.1% of the total energy bill and this share increased to 18.1% in 2015. This was the result of a twofold rise in network costs from €9.50/MWh in 2006 to €17.60/MWh in 2015, as shown Figure 38. This was likely due to infrastructure developments to increase interconnection between Member States as well as in response to the accelerated diffusion of variable renewables connecting to distribution grids, which has an additional cost of system management.

The impact of the regulated components varies slightly in the NWE region when compared with the EU weighted average. RES levy costs show a very similar share of the electricity bill in this region when compared with the EU weighted average.

The impact of regulated components in the SE region shows very similar shares when compared with the EU weighted average. From respondent data, renewable support costs were lower in the SE region when compared with the NWE region. This is contrary, however, to the diffusion rate of variable renewables in these regions. The share of variable renewable primary production of electricity of total production was 11.7% in the SE region and 3.4% in the NWE region in 2014. Therefore, one would expect renewables support costs to be much higher in the SE region. The reason for the inconsistency was likely a result of renewable support costs being hidden in electricity bills. For example, in Spain, electricity bills have a component called "Access to network" (ATR payment), which includes the access to networks, CHP and renewable compensation. It is likely that respondents included these costs under the "network costs" components as such; renewable support costs are essentially hidden in network costs.

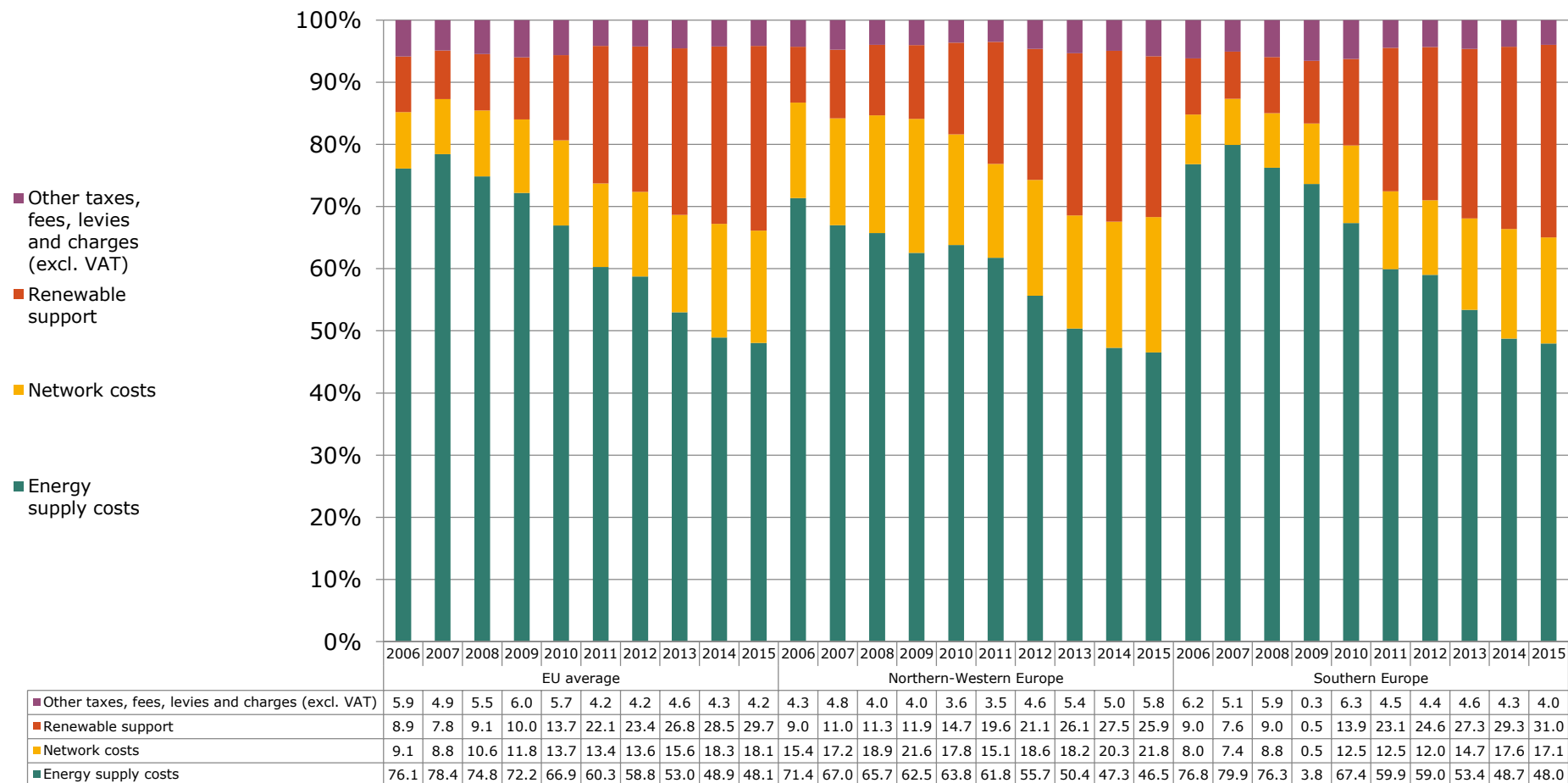
The trend that the share of regulatory components is increasing is also seen in the NWE weighted average, however, when compared with the EU weighted average, individual components show different shares. **In 2006, the average share of regulatory components, from respondent data, in the NWE region represented 28.6%, while in 2015 this share was 53.5%.** This is a result of three cost developments in electricity bill component. Firstly, network costs increased from €12.40/MWh in 2006 to €23.80/MWh, which was likely due to the reasons described previously. Secondly, respondent data from plants in the NWE region show the RES levy cost component increased significantly from €7.20/MWh to €28.30/MWh in 2015. Thirdly, the non-regulatory energy supply cost component decreased slightly over the study period from €57.50/MWh to €50.80/MWh. In this region, the share of other taxes, levies and charges remained relatively stable over the period, at between 3.5%-5.8% of total electricity costs.

Similarly, the trend of increasing shares of regulatory component costs out of total electricity costs is also seen in the SE region. Over the period, the average share of regulatory components increased by almost 29 percentage points from 23.2% in 2006 to 52% in 2015. As observed in the NWE region, this was a result of increasing renewable support and network costs coupled with decreasing energy component costs. Renewable support costs increased from €10.10/MWh in 2006 to €30.50/MWh in 2015 and network costs increased from €8.90/MWh in 2006 to €16.80/MWh in 2015. In the SE region, average energy component costs decreased from €85.70/MWh in 2006 to €47.20/MWh in 2015.

The data on electricity bill components shows that while the price of the energy components remained quite stable, the share of regulatory costs increased. Therefore, the recent fluctuations in electricity costs, particularly the increase, discussed previously in this Chapter, were largely a result of changes in the regulatory component.

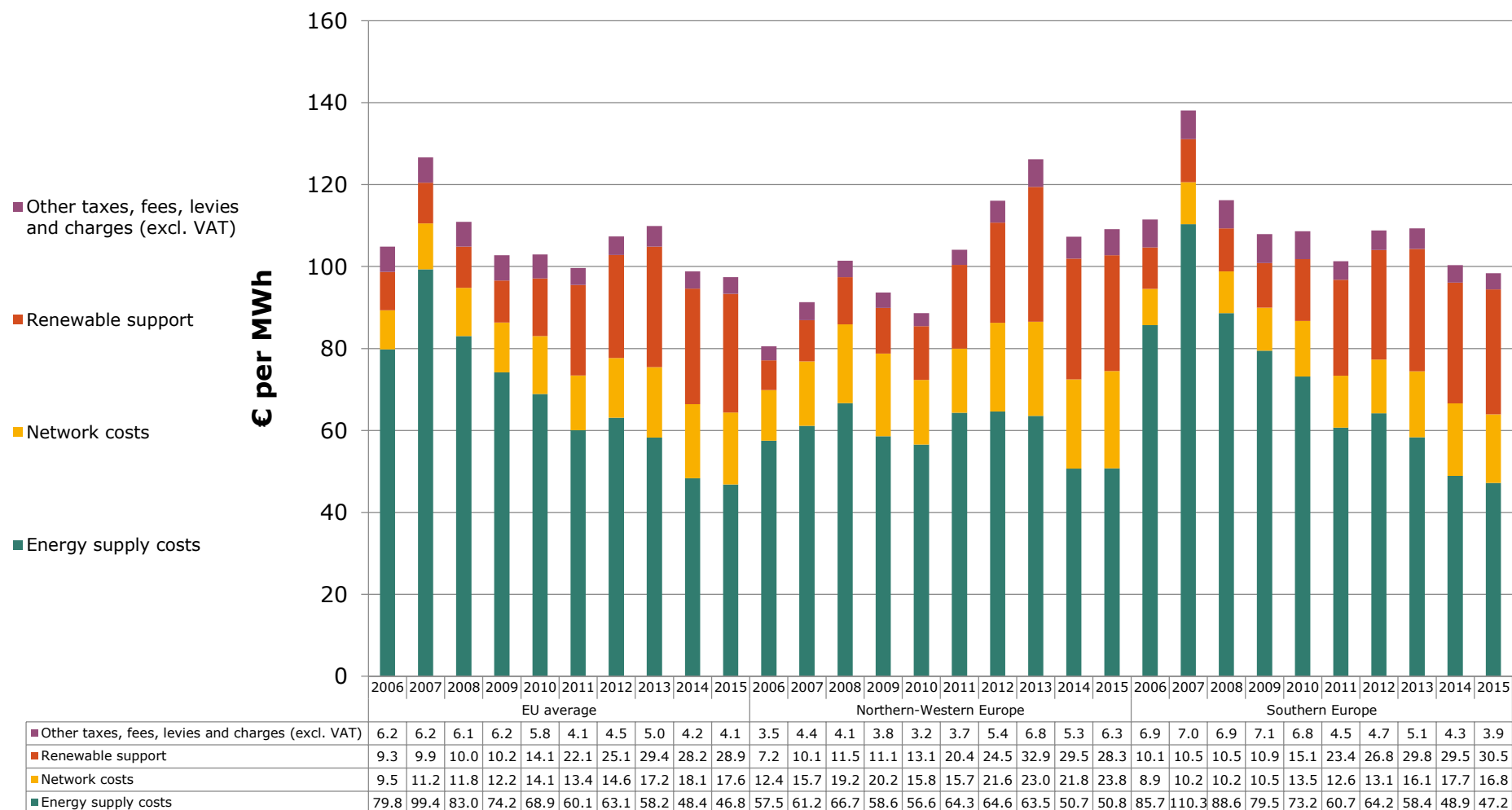


**Figure 37. Ceramic tiles: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.

**Figure 38. Ceramic tiles: 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 have generated more costs for the sector than the EU minimum. **In 2015, the average costs generated by the Energy Taxation Directive were €0.12/tonne of production at 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 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 passed on to the electricity bills and added to the network cost component.

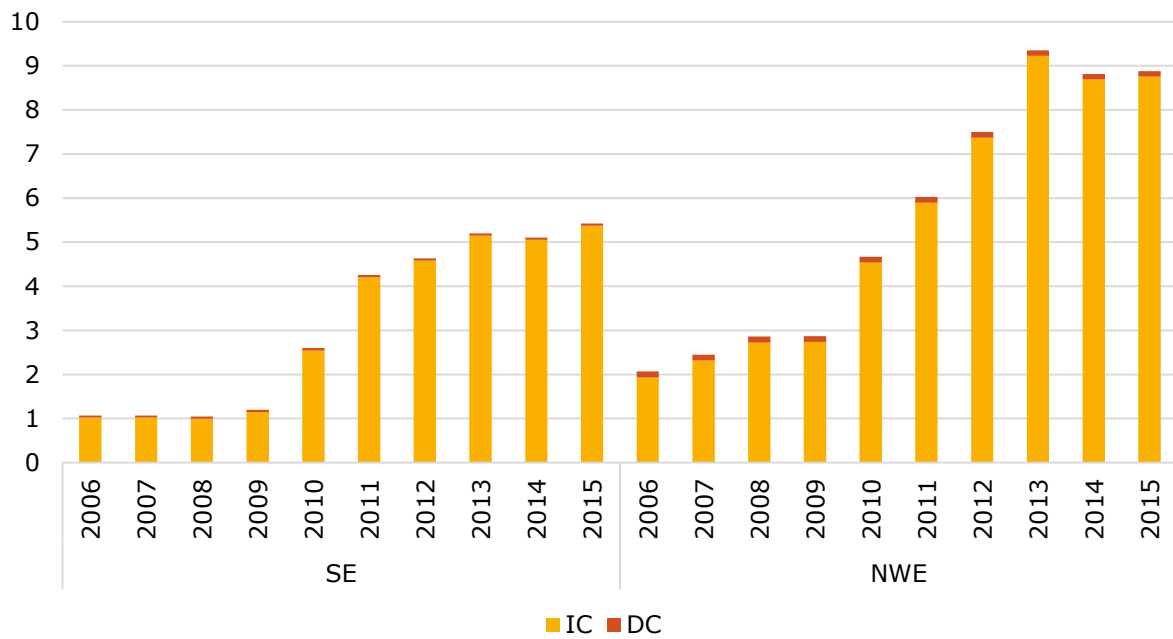
The graphs below show indirect and direct costs generated by the Energy Taxation Directive, Internal Market for electricity legislation and the Renewable Energy Directive. **At the EU level, indirect costs increased throughout the period from €1.13/tonne of production in 2006 to €5.73/tonne of production in 2015.** Note that in some Member States, energy-intensive industries are exempted from paying renewable support levies and in those cases, the costs described above can be lower.

Indirect regulatory costs have increased significantly over the study period. This is directly a result of increasing renewables support and network costs on electricity bills. There was a general trend across all regions of increasing regulatory costs and this was mostly caused by an increasing share of variable renewables in the system.

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.

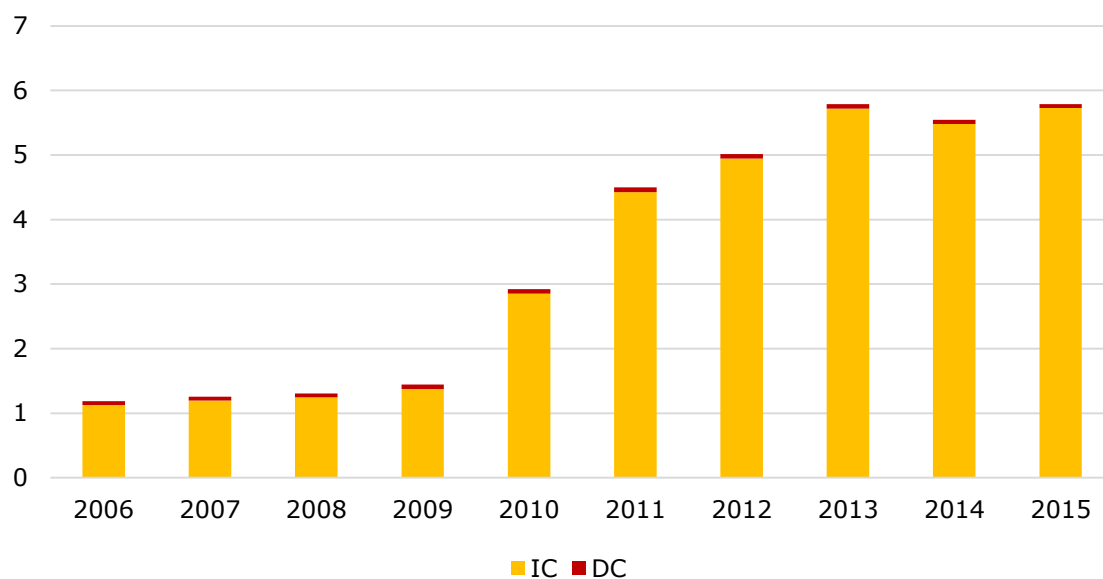
As shown in Figure 38, the RES component increased in the period 2014-15. In the absence of data on the evolution of national exemption schemes, a cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no solid conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

**Figure 39. Ceramic tiles: Cumulative regulatory costs of electricity legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 40. Ceramic tiles: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 35 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's production, which has recovered following the economic crisis.

**Table 35. Ceramic tiles: Cumulative regulatory costs of electricity legislation for 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	<i>Confidential</i>	0	0
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0.12	<i>Confidential</i>	0.05	0.06
Indirect regulatory costs		8.76	<i>Confidential</i>	5.38	5.73
Total regulatory costs		<b>8.88</b>	<b><i>Confidential</i></b>	<b>5.43</b>	<b>5.79</b>

Source: Authors' own elaboration.

#### 6.4.5 Cost assessment – Fired refractories

##### Sample

A short overview of the number of questionnaires received can be found below in Table 36. In total the sample covers 11 respondents from the fired refractories subsector. More than three companies from the SE geographical region provided data enabling the Research Team to present one regional cost assessment for the fired refractories sector. For confidentiality reasons, a regional cost assessment for the NWE and CEE regions could not be presented.

**Table 36. Fired refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Fired refractories	11	5	2	4	11

*Source: Authors' own elaboration.*

##### Electricity prices and costs

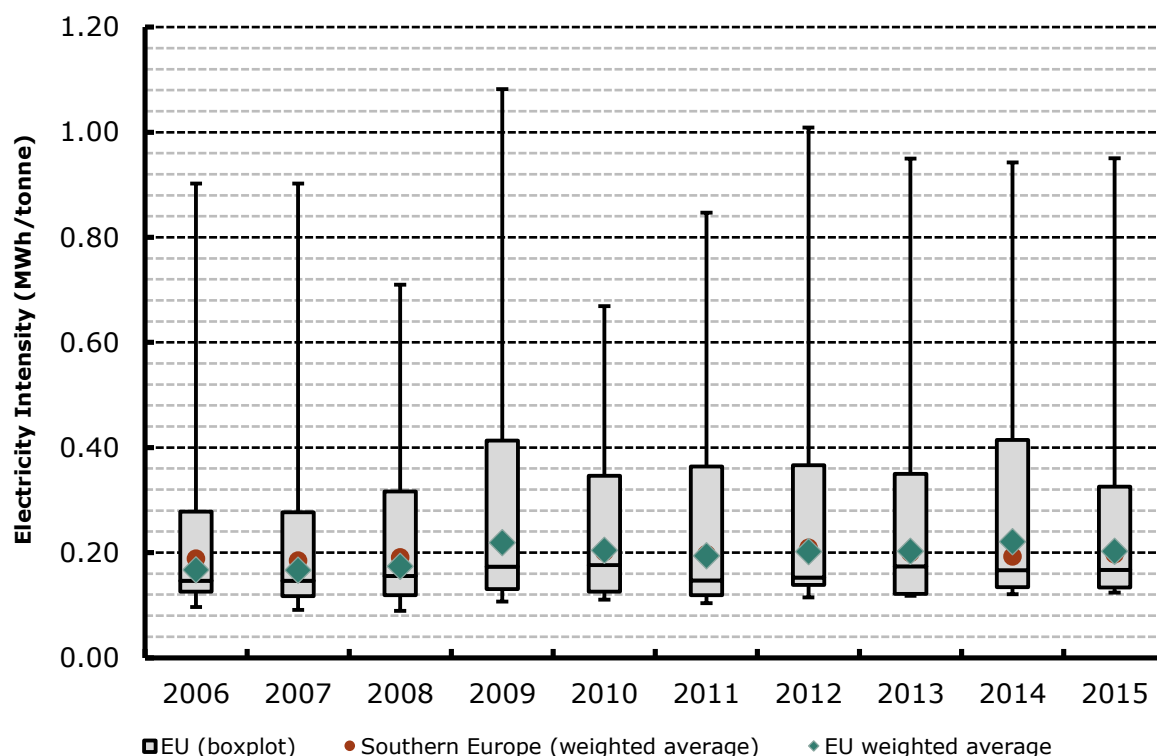
All electricity costs reported in this section, and used throughout the analysis are net costs: reimbursements from interruptibility schemes, renewable support reimbursements and self-generated electricity sold to the grid have been taken into account.

##### 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 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 the sample of 11 plants. Note that in the sample, no plants self-generate electricity.

Fired refractories cannot be described as an electricity-intensive industry. **Respondent data shows electricity intensity remained stable over the period 2006-15, with an EU weighted average for the majority of years of between 0.17-0.22 MWh/tonne of production.** Crossed-checked with previous European Commission-funded research, these results are in line with literature on electricity intensity of production in the fired refractories sector.<sup>133</sup> The EU weighted average was higher than the median for the majority of years, meaning that larger plants in the sample were generally more electricity-intensive than smaller plants.

<sup>133</sup> Ibid.

**Figure 41. Fired refractories: Electricity intensity per tonne of production (2006-15)**

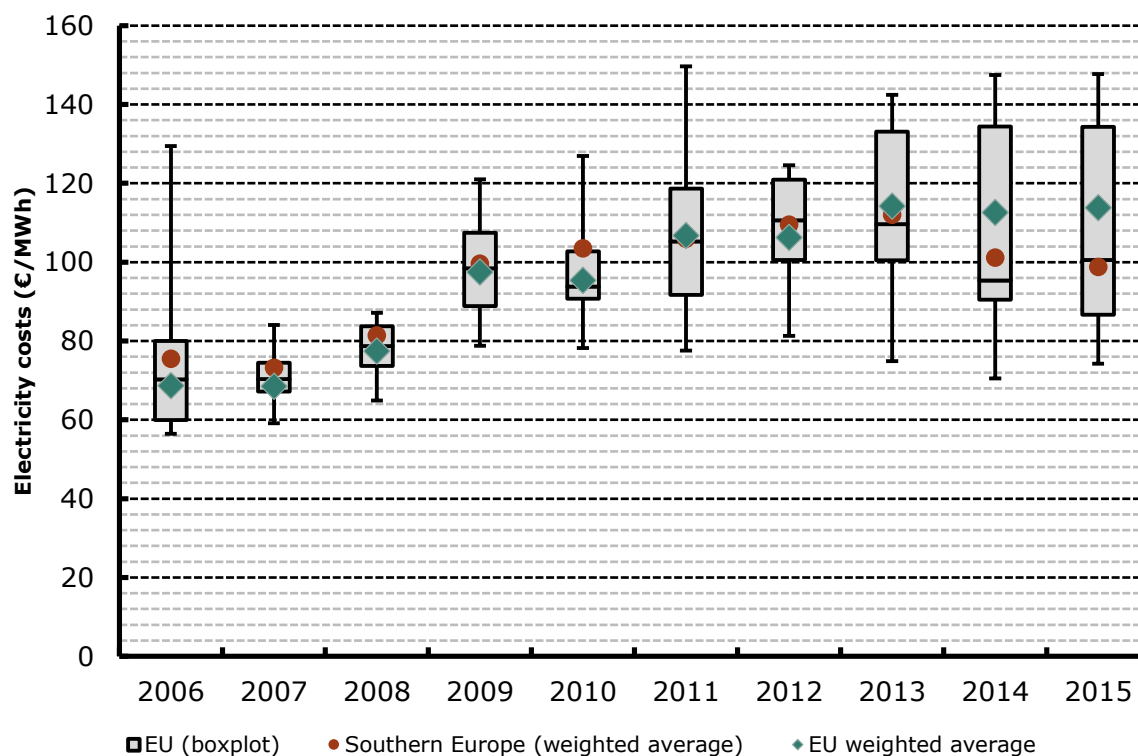
Source: Authors' own elaboration.

### Electricity costs

With the exception of one year, all annual plant data in the sample to calculate electricity prices was provided. The missing year was extrapolated from other data points within the Study using the methodology described in section 6.2.1, allowing the Research Team to assess the net electricity costs based on a sample of 11 plants.

**Net electricity costs in the fired refractories industrial sector increased over the period 2006-15. EU weighted average net costs increased by 66% from €68.60/MWh in 2006 to €113.80/MWh in 2015.** The electricity price in this sector did not fit the trend seen in natural resource prices, as shown in Figure 42, and this was likely a result of changes in regulatory cost components having an impact on net electricity costs.

The SE regional price assessment shows a similar trend to EU weighted averages, except for the latter years of the study period where the price reported by plants in the SE region were lower than the EU weighted average. After 2013, the data shows that SE producers reported paying average electricity costs lower than the EU average by up to 13%.

**Figure 42. Fired refractories: Electricity costs 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 price component in electricity bills. Data from respondents in our sample shows a similar trend to natural resource prices, in section 6.1.1; supply costs decreased from 2011, which reflects wholesale electricity market prices that in turn reveals natural resource prices.

Regulatory components have a large impact on the electricity price paid by respondents. Figure 43 shows the relative costs of the four components of electricity bills. The share of regulatory components were on the rise and this was a result of increasing regulatory costs coupled with the decreasing energy component cost over the study period. As a comparison, the EU average of the regulatory component in 2006 represented a share of 35.7% and this increased over the 10-year period to 55.4%.

All EU average regulatory component costs increased since 2006, while the energy component in electricity bills from respondents in our sample decreased. **Figure 44 shows the cost of other taxes, fees and levies on average EU electricity costs increased from €5.50/MWh in 2006 to €6.80/MWh in 2015.** The costs of renewable levies on electricity bills, which have had the greatest share of the regulatory components in this sector since 2011, also increased, though more significantly, from just €6.40/MWh to €36.30/MWh. This was a consequence of renewable support schemes providing long-term contracts; these costs therefore accumulated annually as more and more generators are becoming accredited under support schemes. While respondents reported that network costs were also increasing, from €13.20/MWh in 2006 to €22.50/MWh in 2015, this increase was at a lower rate than renewable levies. This increase was likely a result of

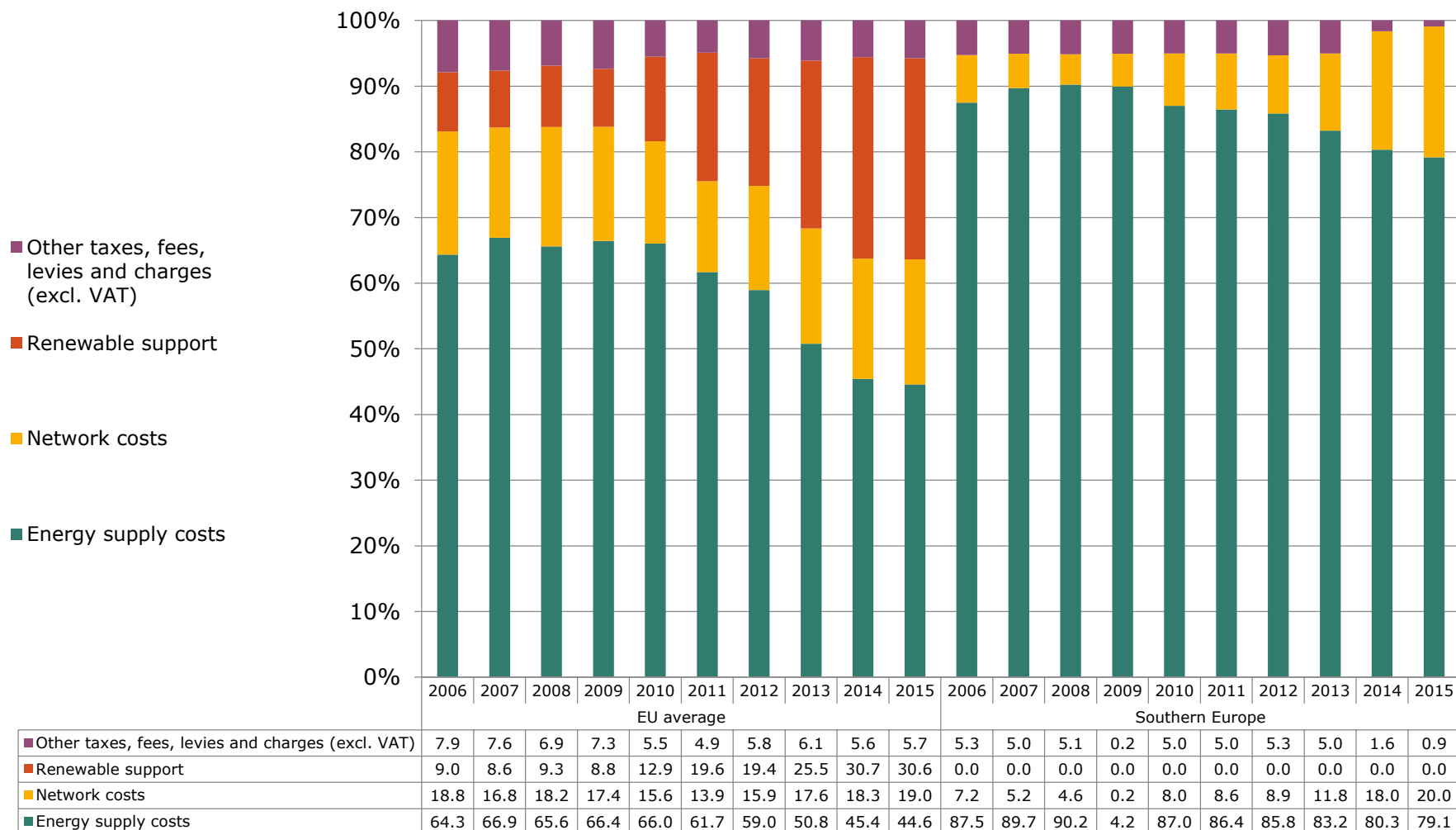


infrastructure developments to increase interconnection between Member States and to respond to the accelerated diffusion of variable renewables connecting to distribution grids. This second point also requires further management of the system, which bears additional costs.

Data from respondents in the SE region shows a very different picture. The electricity component has a larger share in electricity prices in this region when compared with the EU average. The electricity component share was 79.1% in the SE region in 2015 and in the same year the EU average electricity component was 44.6%. The impact of regulated components in the SE region also shows divergent values when compared with the EU weighted average. In particular, the most interesting component is the renewable support component, which appears to be missing from electricity bills in this region. It is important to note that all plants included in the analysis from this region operate in Spain. Spanish electricity bills have a component called "Access to network" (ATR payment), which includes the access to networks, CHP and renewable compensation. It is likely that respondents included these costs either under the "network costs" or "energy supply costs" components. As such, renewable support costs are hidden as other regulatory costs, but they still affect net electricity prices.

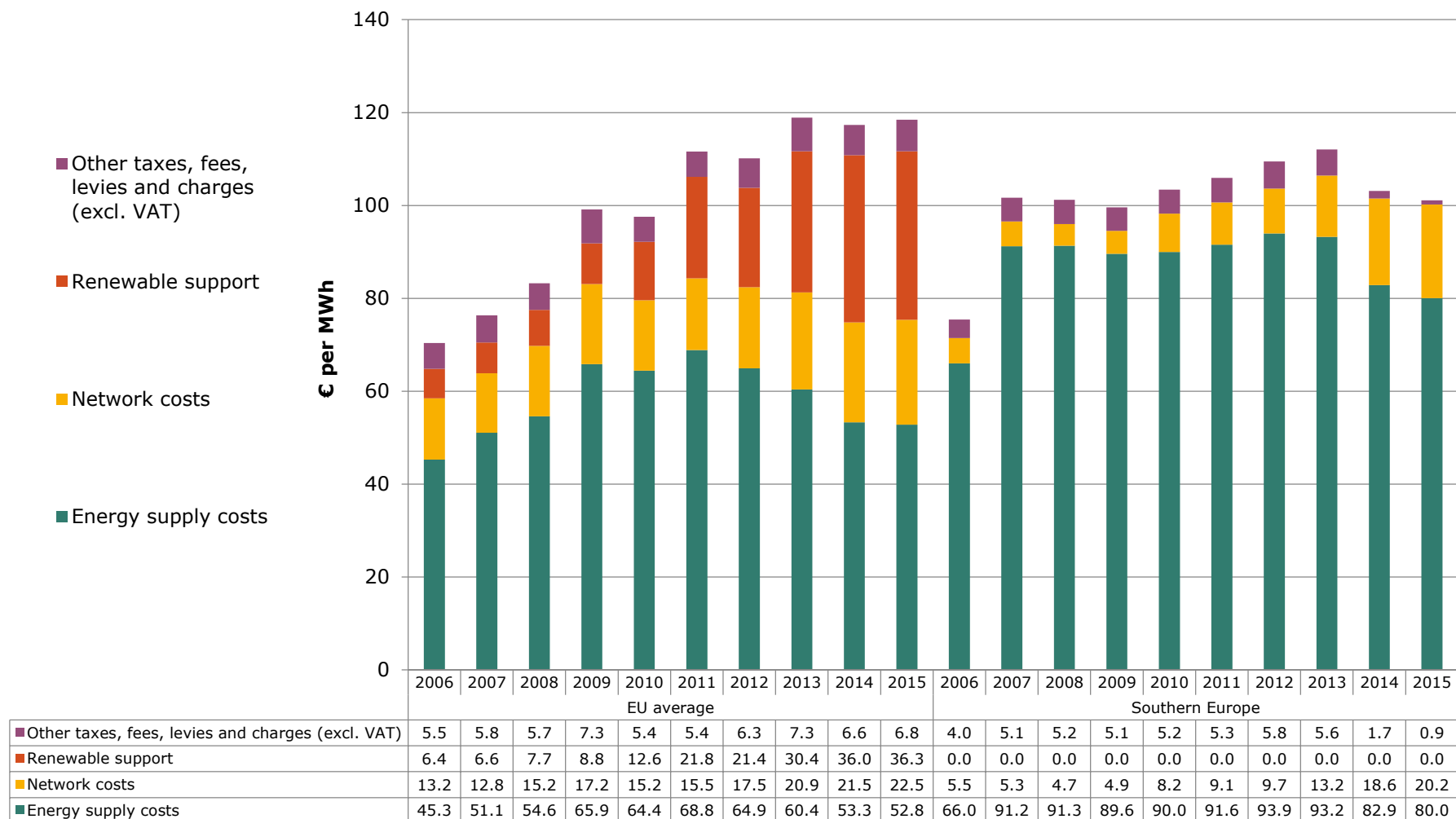
The data on electricity bill components shows that while the price of the energy components remained quite stable, the share of regulatory costs increased. Therefore, the fluctuations in electricity costs in the later years under study discussed previously in this Chapter, particularly the increase, were largely a result of changes in regulatory components.

**Figure 43. Fired refractories: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.

**Figure 44. Fired refractories: 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 has stayed the same throughout the study period. 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 €0.10/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 of the relevance of EU energy legislation, this section addresses i) 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 passed on to the electricity bills and added to the network cost component.

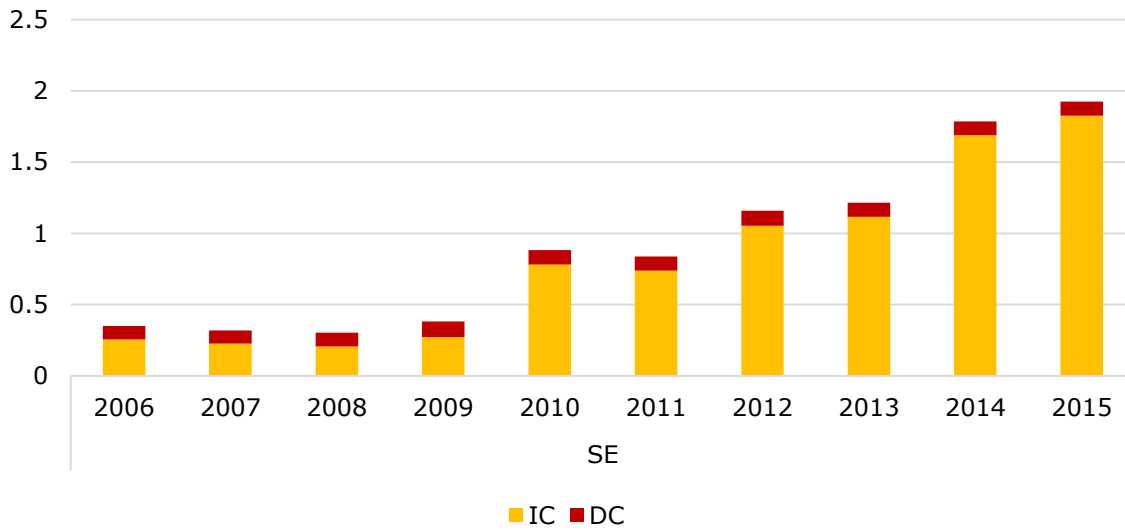
The graphs below show indirect costs generated by the Internal Market legislation and the Renewable Energy Directive. **At the EU level, the costs continuously increased from €1.16 /tonne of production in 2006 to €6.96/tonne of production in 2015.** Indirect costs are much lower in the SE region, which is a result of hidden renewable support costs in electricity bills for Spanish plants, as described earlier in the Study. Indirect regulatory costs increased significantly over the study period. This was directly a result of increasing renewables support and network costs on electricity bills. There was a general trend across all regions of increasing regulatory costs and this was mostly caused by an increasing share of variable renewables in the system.

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.

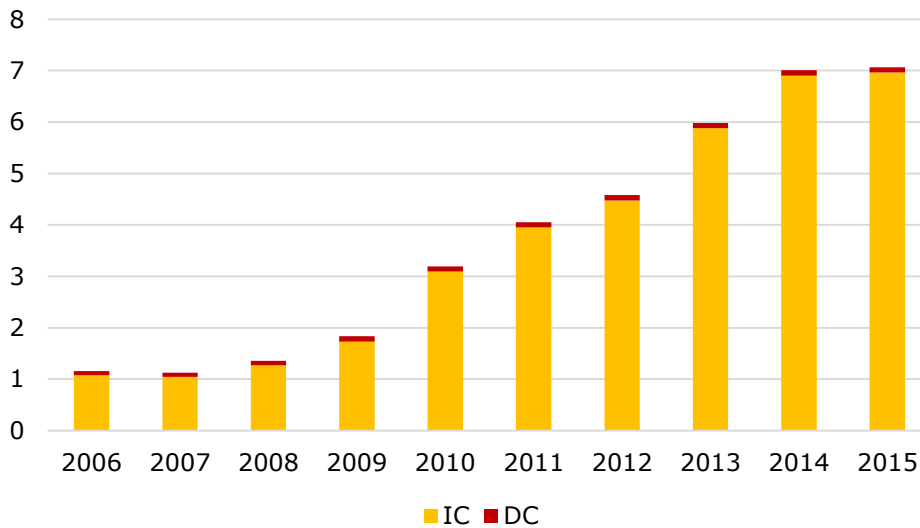
As shown in Figure 44, the RES component increased in 2014-15, from €35.96/MWh to €36.28/MWh. In the absence of data on the evolution of national exemption schemes, a cost impact of State Aid Guidelines is possible but cannot be quantified. At any rate, no solid conclusion can be drawn due to the limited time (2014-15) that State Aid Guidelines have been in place.

**Figure 45. Fired refractories: Cumulative regulatory costs of electricity legislation 2006-15, SE region (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 46. Fired refractories: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 37 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's production, which has recovered following the economic crisis.

**Table 37. Fired refractories: Cumulative regulatory costs of electricity legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0	0
	Substantive compliance costs	Confidential	Confidential	0	0
	Direct charges	Confidential	Confidential	0.10	0.10
Indirect regulatory costs		Confidential	Confidential	1.83	6.96
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>1.93</b>	<b>7.06</b>

Source: Authors' own elaboration.

#### 6.4.6 Cost assessment – Unfired shaped refractories

##### Sample

A short overview of the number of questionnaires received can be found below in Table 38. In total the sample covers four respondents from the unfired shaped refractories subsector. The Research Team are unable to present a regional cost assessment for the unfired shaped refractories sector for any of the three regions, because fewer than three companies in each region provided data.

**Table 38. Unfired shaped refractories: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants	Number of questionnaires used
	Total EU	
Unfired shaped refractories	4	4

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*

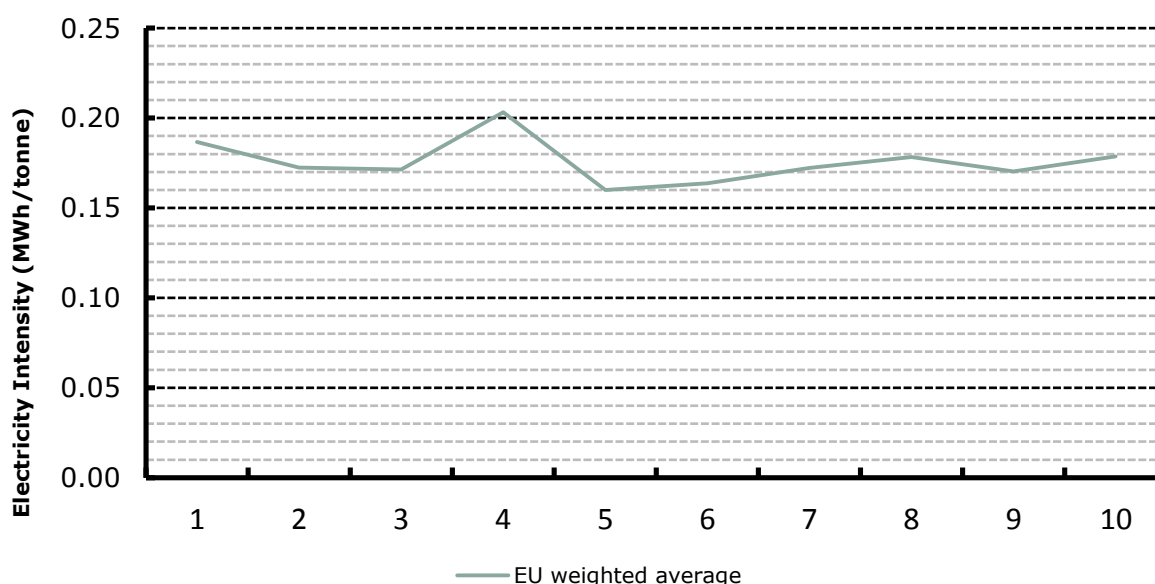
Two plants reported that they received reimbursement from RES levies and these reimbursements were reportedly received for all years in the study period (2006-15). No plants reported to have received reimbursements from other taxes, fees and levies or took part in an interruptibility scheme.

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 unfired refractories manufacturers, data cannot be displayed via a box plot. Instead, a line graph is used. All plants in the sample provided data to calculate their electricity prices. This allowed the Research Team to assess the net electricity costs based on a sample of four plants. Note that in the sample, no plants self-generate electricity.

Unfired shaped refractories cannot be described as an electricity-intensive industry. **Respondents’ electricity intensity remained stable over the period 2006-15, with an EU weighted average for the majority of years between 0.16-0.20 MWh/tonne of production.** The EU weighted average was higher than the median for the majority of years meaning that larger plants in the sample were generally more electricity-intensive than smaller plants.

**Figure 47. Unfired shaped refractories: Electricity intensity per tonne of production (2006-15)**



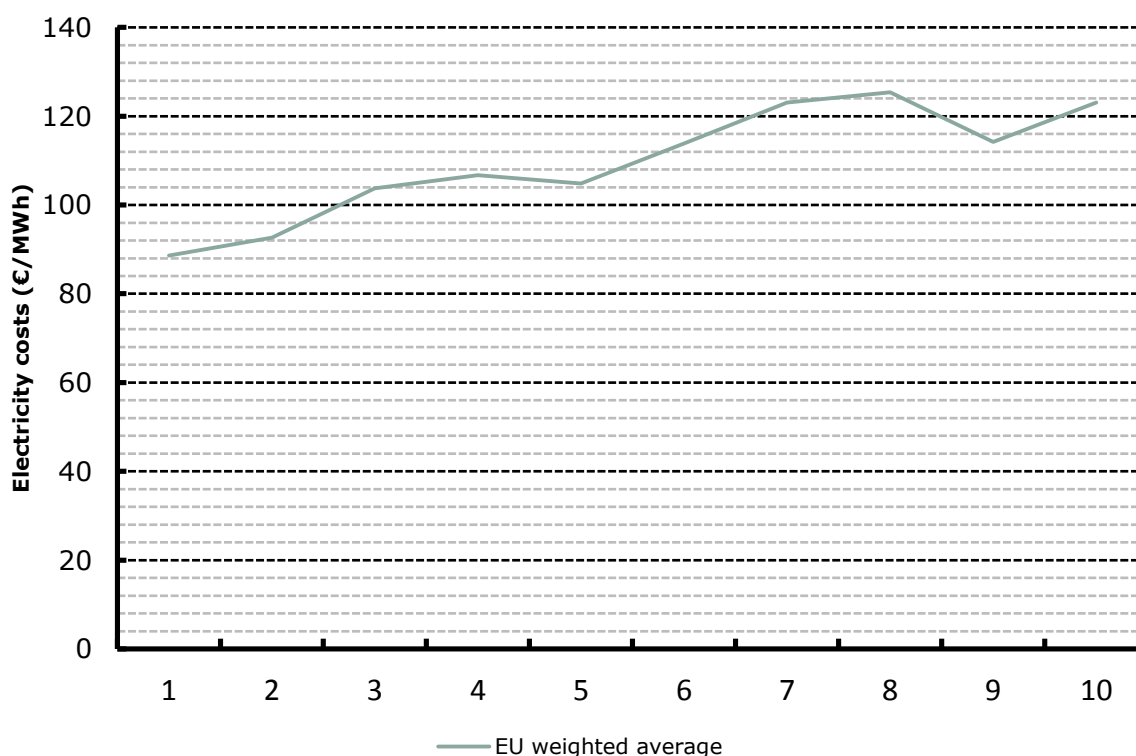
*Source: Authors’ own elaboration.*

Electricity costs

All annual plant data in the sample to calculate electricity prices was provided, allowing the Research Team to assess the net electricity costs based on a sample of four plants.

**Net electricity costs in the unfired shaped refractories industrial sector rose over the period 2006-15. EU weighted average net costs increased by 39% from €88.60/MWh in 2006 to €123/MWh in 2015.** The electricity price in this sector does not fit the trend seen in natural resource prices, as shown in Figure 48, and this was likely a result of changes in regulatory cost components having an impact on net electricity costs.

**Figure 48. Unfired shaped refractories: Electricity costs 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 price component in electricity bills. Data from respondents in our sample shows a similar trend to natural resource prices, in section 6.1.1; supply costs decreased since 2012, which reflects wholesale electricity market prices that in turn reveals natural resource prices.

Regulatory components have a large impact on the electricity price paid by respondents. Figure 49 shows the relative costs of the four components of electricity bills. The share of regulatory components was on the rise and this was a result of increasing regulatory costs coupled with the decreasing energy component cost over the studied period. **As a**

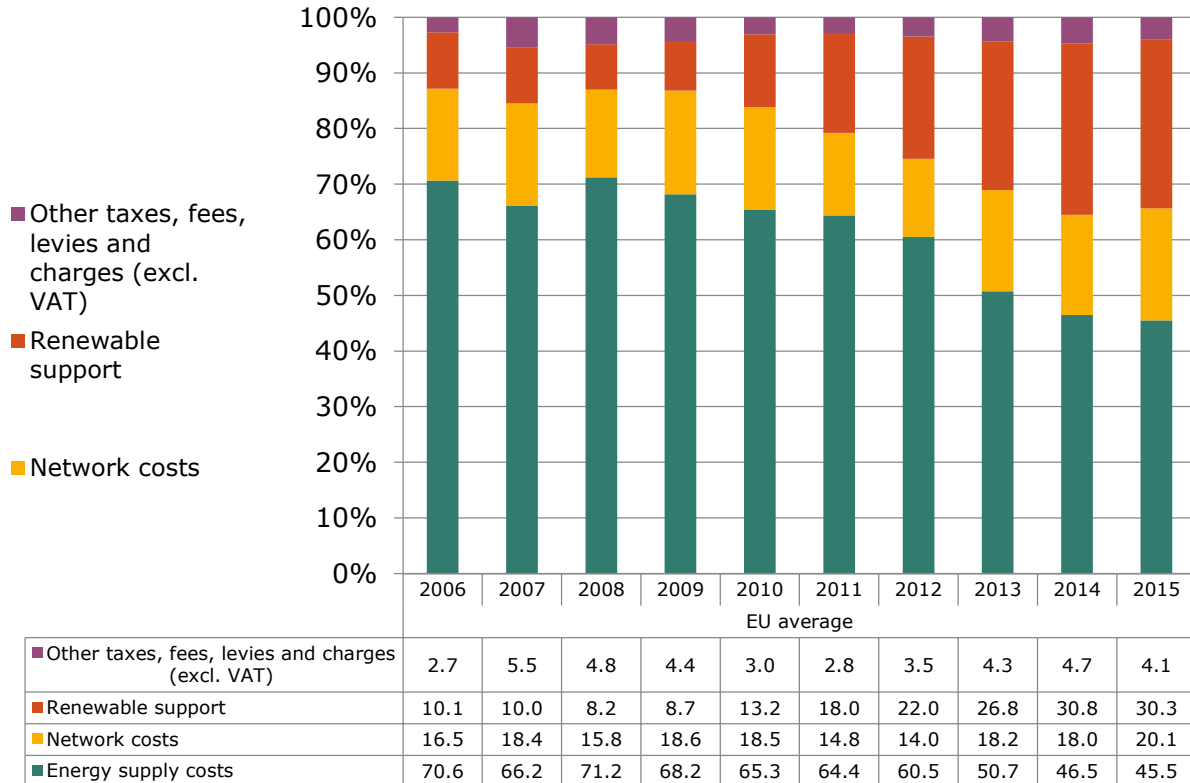


comparison, the EU average of the regulatory component in 2006 represented a share of 29.4%. This share increased over the 10-year period to 54.5%.

All EU average regulatory component costs increased since 2006, while the energy component in electricity bills from respondents in our sample decreased. Figure 50 shows the **cost of other taxes, fees and levies on average EU electricity costs increased from €2.40/MWh in 2006 to €5.30/MWh in 2015**. The costs of renewable levies on electricity bills, which have had the greatest share of the regulatory components in this sector since 2011, also increased, significantly, from just €8.80/MWh to €39.30/MWh. This was a consequence of renewable support schemes providing long-term contracts; these costs therefore accumulate annually as more and more generators become accredited under support schemes. **While respondents reported that network costs also increased, from €14.50/MWh in 2006 to €26.10/MWh in 2015, this increase was at a lower rate than renewable levies.** This was likely a result of infrastructure developments to increase interconnection between Member States and to respond to the accelerated diffusion of variable renewables connecting to distribution grids. This second point also requires additional management of the system, which bears additional costs.

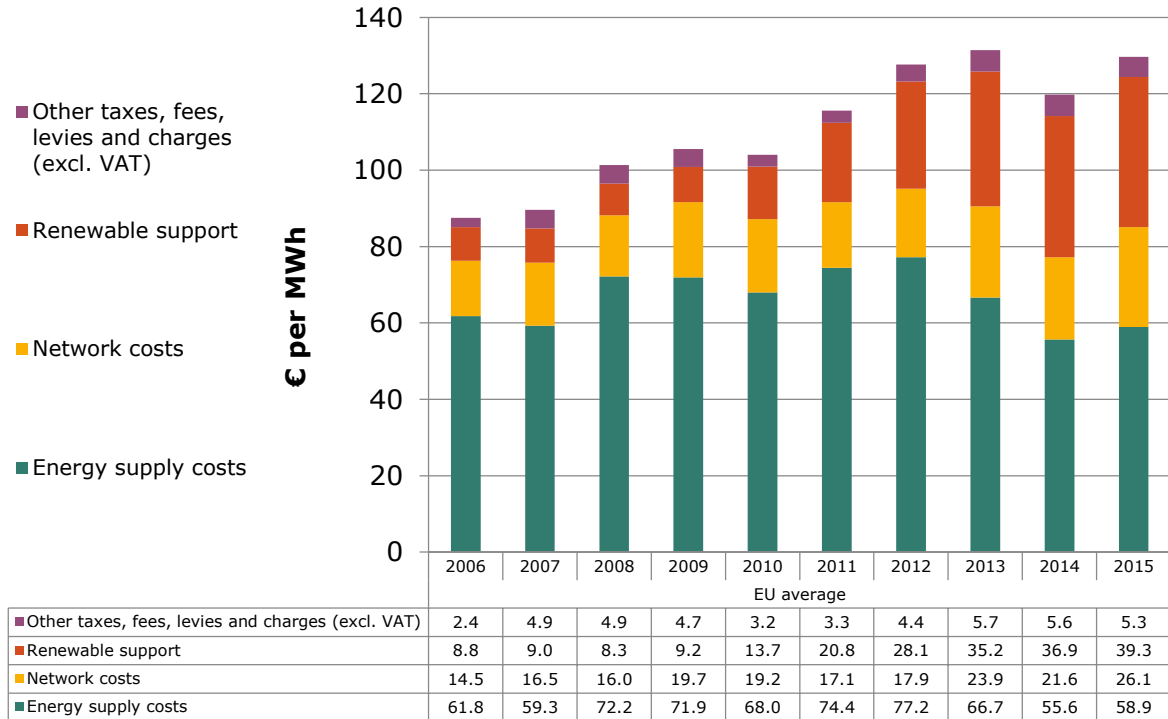
The data on electricity bill components shows that while the price of the energy components remained quite stable, the share of regulatory costs increased. Therefore, the recent fluctuations in electricity costs discussed previously in this Chapter, particularly the increase, were largely a result of changes in regulatory components.

**Figure 49. Unfired shaped refractories: Relative costs of components of the electricity bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.

**Figure 50. Unfired shaped refractories: 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 €0.09/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 addresses i) 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:

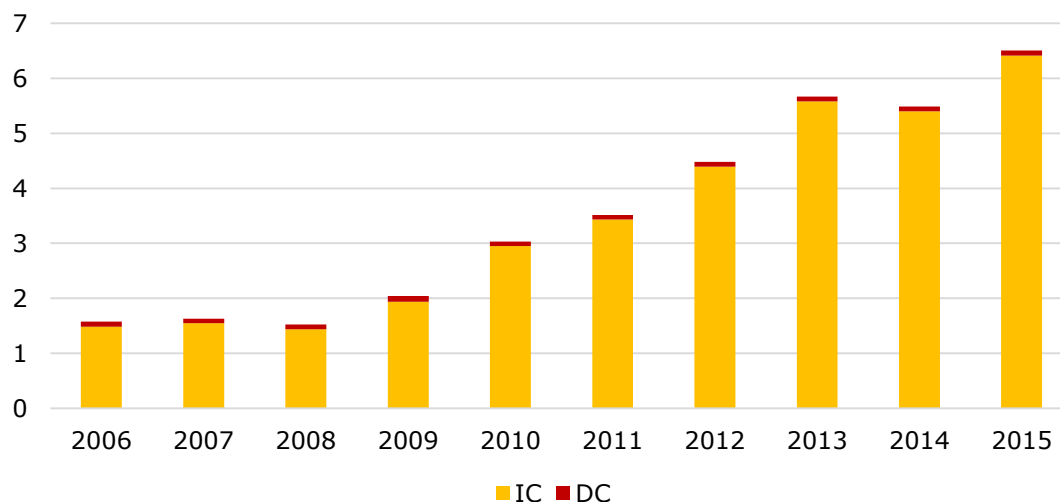
- By specific renewable energy support levies added to electricity bills.
- By the need to reinforce networks for the system of integration on renewable energy. These costs are also passed on to the electricity bills and added to the network cost component.

The graphs below show indirect costs generated by the Internal Market legislation and the Renewable Energy Directive. **At the EU level, the costs increased continuously over the period, from €1.48/tonne of production in 2006 to €6.41/tonne of production in 2015.**

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 50, the RES component increased in 2014-15. In the absence of data on the evolution of 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 51. Unfired shaped refractories: Cumulative regulatory costs of electricity legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 39 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's production, which has recovered following the economic crisis.

**Table 39. Unfired shaped refractories: Cumulative regulatory costs of electricity legislation 2015 (€/tonne of production)**

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	0
	Direct charges	0.09
Indirect regulatory costs		6.41
Total regulatory costs		<b>6.50</b>

*Source: Authors' own elaboration.*

## 6.5 Gas

Ceramics manufacturing is an energy-intensive industry and uses natural gas as its main energy carrier.<sup>134</sup> A cost assessment of EU legislation on gas for bricks and tiles, ceramic tiles, fired refractories and unfired shaped refractories producers are presented in this section.

The price of natural gas is split 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 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 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 on for the entire period 2006-15.

### 6.5.1 Description of the Acts

What follows is a description of natural gas related legislation with an expected cost impact on the ceramics 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 gas**

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<sup>134</sup> Marcu, A. et al. (2016, forthcoming), "Composition and Drives of energy prices and costs for energy intensive industries", CEPS.

**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 can generate costs, categorised in this Study as direct charges.

The Directive sets minimum rates for EU-wide harmonised taxation for natural gas, the minimum tax rate amounts to €0.15/GJ, which converted into megawatt hours is 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 ceramics industry players.

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

### **6.5.3 Cost assessment – Bricks and tiles**

#### *Sample*

A short overview of the number of questionnaires received can be found below in Table 40. In total the sample covers 23 respondents from the bricks and tiles sector. More than three companies from the NWE and SE geographical regions provided data enabling the Research Team to present two regional cost assessment for the bricks and tiles sector. Due to confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 40. Bricks and tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Bricks and tiles	23	12	5	6	23

Source: Authors' own elaboration.

### Gas prices and costs

Natural gas is the main energy source for the bricks and tiles sector. 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.

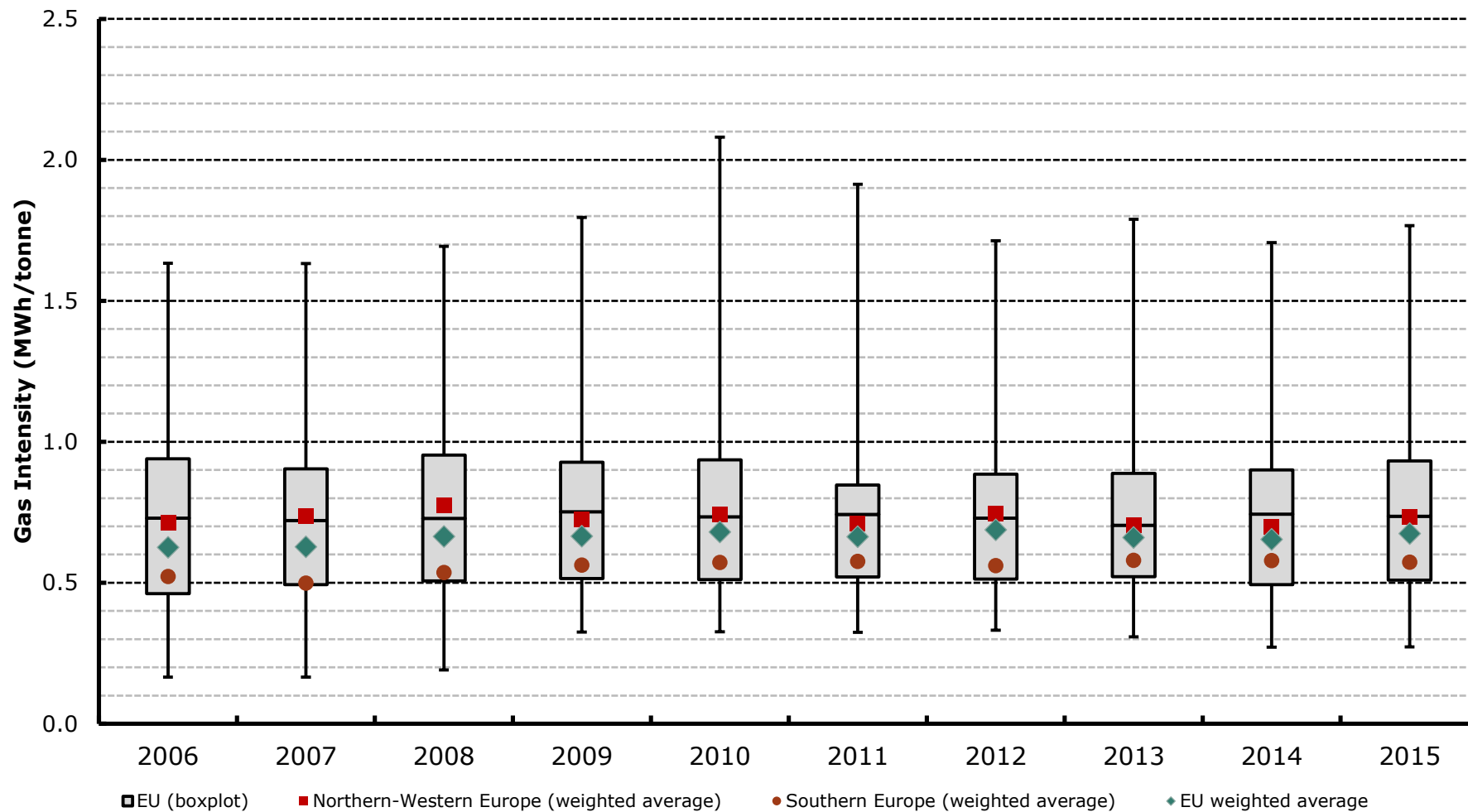
### Gas intensity

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 23 plants.

Bricks and tiles manufacturing is a natural gas-intensive production process, but it is less intensive than the other two sectors studied in this Study. **Plants reported homogeneous natural gas intensities that remained relatively stable over the period 2006-15, with an EU weighted average around 0.63-0.68 MWh/tonne of production.** The EU weighted average of electricity intensity was at 0.07 MWh/tonne of production at 2006 and 0.08 MWh/tonne of production in 2015. In all years, the weighted EU average was below the median, which reflects the lower natural gas intensity of larger plants.

From the data received, **plants in the NWE region appear to have higher natural gas intensities on average when compared to the EU weighted average. Weighted average natural gas intensities for this region also remained stable and varied from 0.70 MWh/tonne of production to 0.78 MWh/tonne of production.** This might be a result of lower plant efficiency measures in other regions. On average, data from respondents shows plants in the SE region have lower natural gas intensities on average when compared with the EU weighted average, ranging from 0.50-0.58 MWh/tonne of production.

Figure 52. Bricks and tiles: Natural gas intensity per tonne of production (2006-15)



Source: Authors' own elaboration.



### *Gas costs*

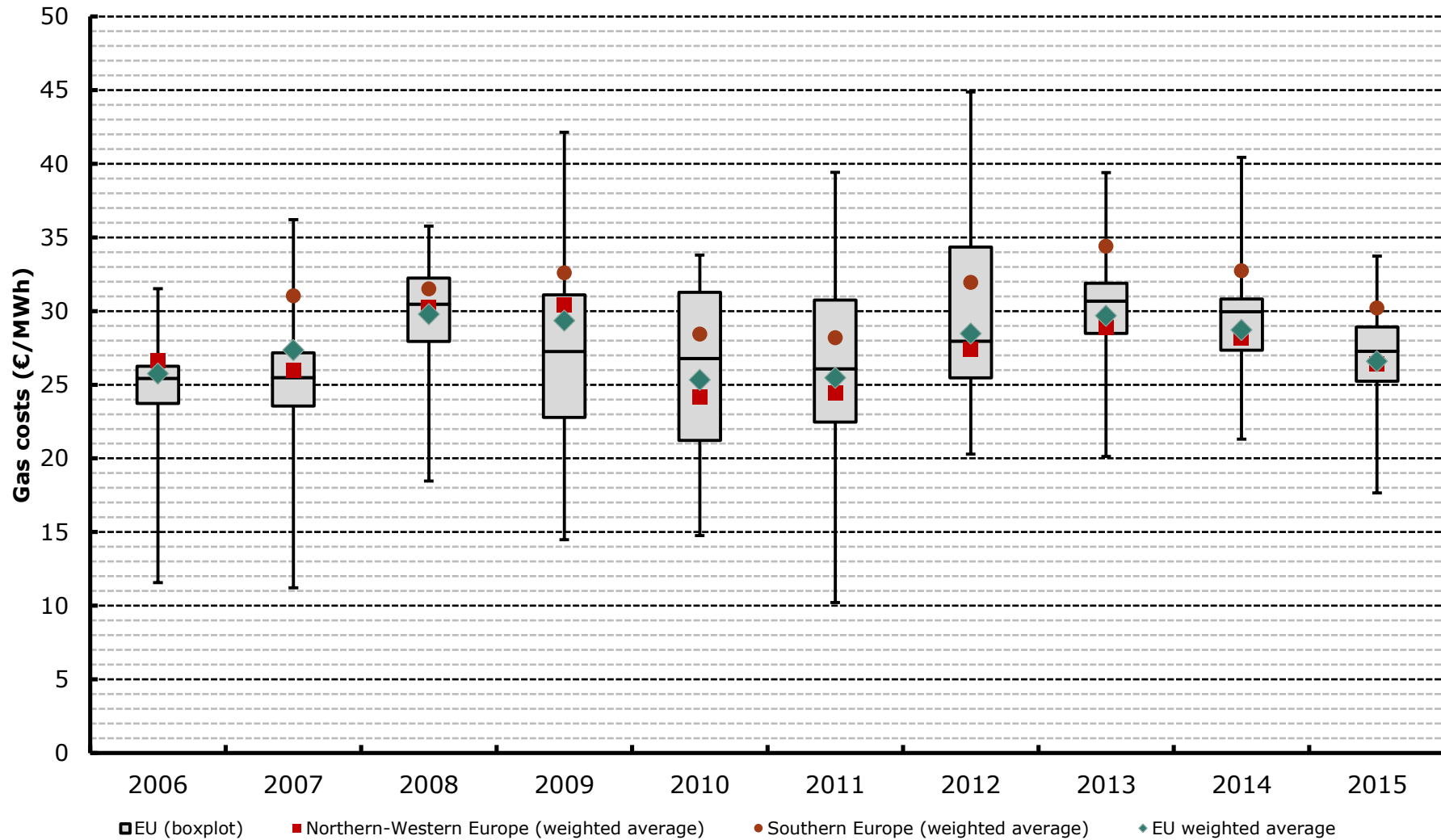
This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Eight plants in the NWE region reported reimbursements from taxes. For many of these plants, these reimbursements were in the later years of the study period.

**The weighted average of natural gas cost for EU ceramics producers fluctuated over the study period of 2006-15. Costs peaked in 2008 at €29.80/MWh, decreasing in 2010 to €25.30/MWh, then peaked again in 2013 to €29.70/MWh and finally decreased slightly in 2015 to €26.60/MWh.** This trend is similar to natural gas wholesale prices, as shown in section 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. While data collected from bricks and tiles manufacturing plants confirm a similar trend to global gas prices, the costs reported by plants are higher than the global price developments described in section 6.1.1 would suggest.

Data from NWE respondents show some differences when compared with the EU weighted means of all respondents in our sample. **Plants in the NWE region reported generally lower natural gas costs of between 0-5% lower, except for 2006, 2008 and 2009, when NWE plants reported average costs of 1-4% above the EU average.** However, we consider this variance minimal and in fact the EU weighted average and NWE average follow a very similar trend.

Similarly, data from SE respondents shows some differences when compared to the EU weighted average of all respondents in our sample. **Plants in this region reported higher than EU weighted average natural gas costs by between 0-16%.** Although this variance is larger than the NWE region, we still consider it minimal.

Figure 53. Bricks and tiles: 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 86-91% of the natural gas bill in the bricks and tiles industry in the period 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 in 2008 at €27.30/MWh and again in 2013 at €28.00/MWh. Since then, it declined to €24.40/MWh in 2015. **Network costs at EU level decreased over the study period from €2.59/MWh in 2006 to €1.61/MWh in 2015.** Taxes, fees and levies increased slightly over the study period from €1.22/MWh in 2006 to €1.34/MWh in 2015.

Regional level analysis shows slight differences between the NWE and SE regions and the EU weighted average in regulatory component costs. **In the NWE region, similar to the EU weighted average, network costs have almost halved over the study period, from €2.04/MWh in 2006 to €1.32/MWh in 2015. In the SE region, contrary to the EU weighted average and the NWE region, network costs increased from €1.18/MWh in 2006 to €1.57/MWh in 2015.** In the NWE region, other taxes, levies, fees and charges, also decreased but at a much slower rate when compared with network costs, from €1.86/MWh in 2006 to €1.73/MWh in 2015. Conversely, in the SE region, other taxes, levies, fees and charges increased from €0.74/MWh in 2006 to €1.03/MWh in 2015. The differences seen in other taxes and levies are likely to be a result of the various national government tax schemes in place. The differences seen in network costs is a result of the different network operating companies functioning in Member States.

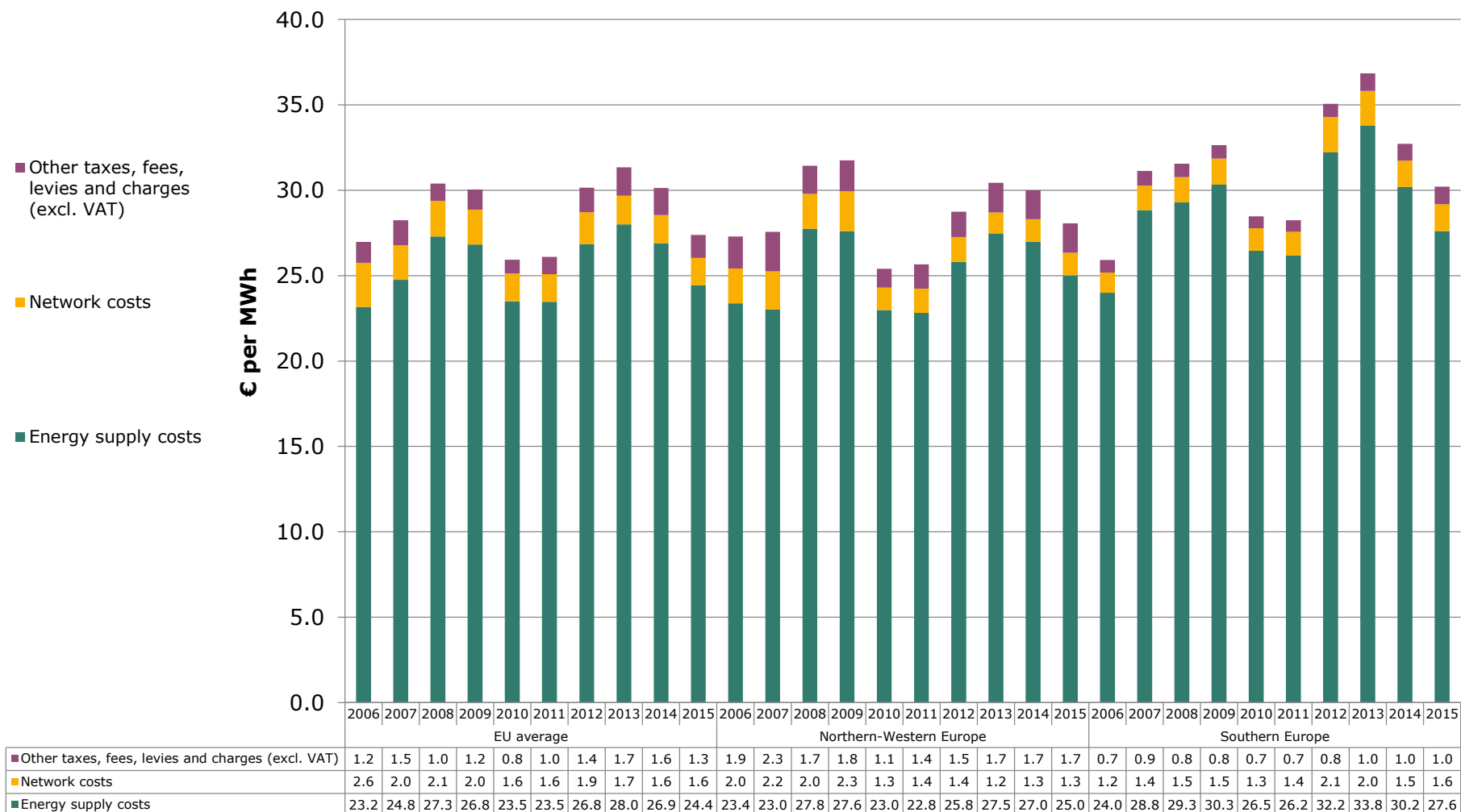
Data received from respondents on their natural gas cost components show that unlike in the case of electricity, the energy component is the driver of the natural gas costs. In all regions, regulatory costs present less than 12% of the natural gas cost. Part of the network costs as well as taxes generated 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 54. Bricks and tiles: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.

Figure 55. 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 remain 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 bricks and tiles industry. As a result, these charges may not be entirely represented 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 bricks and tiles sector. Following the analysis of the relevance of EU energy legislation to the bricks and tiles sector, this Chapter addresses indirect compliance costs generated by Internal Market legislation

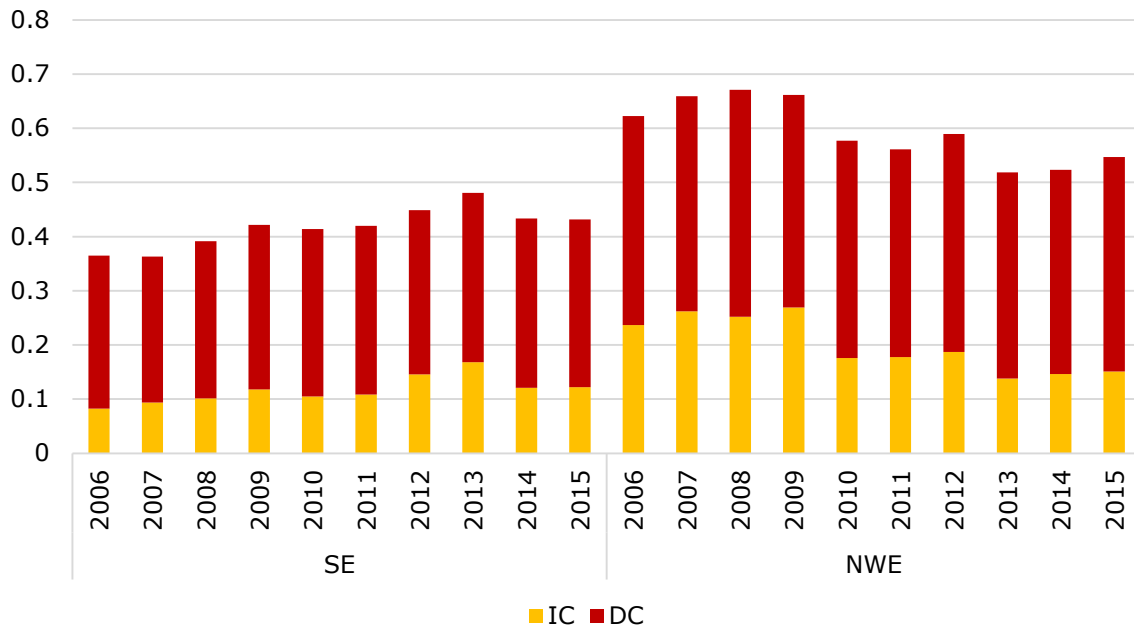
Two legislative acts and repealed acts on the internal energy market have the potential to generate indirect regulatory costs for the ceramics sector:

- 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.

**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 Directives are included.

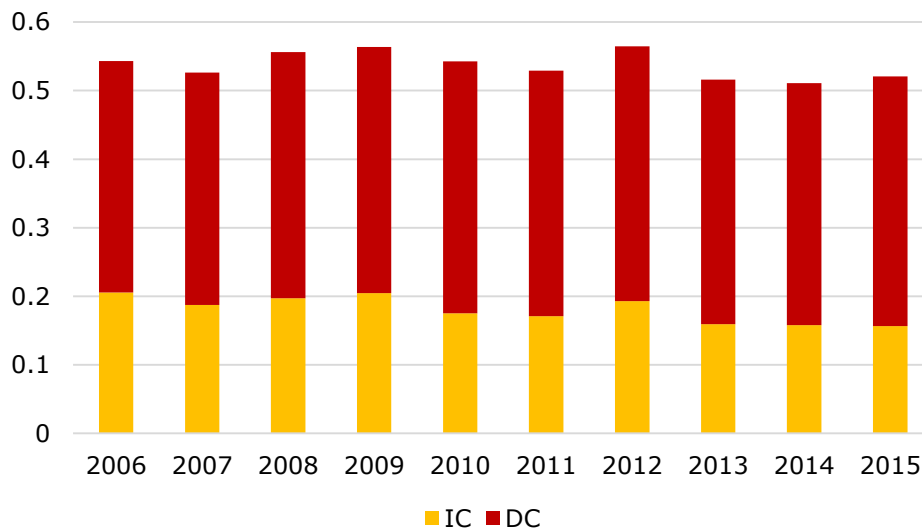
The potential costs generated by the legislation translate into higher network costs for the industry. This is due to the need to finance new infrastructure. The investment costs are passed on to network costs both via i) transmission tariffs and ii) distribution tariffs.

**Figure 56. Bricks and tiles: Cumulative regulatory costs of natural gas legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 57. Bricks and tiles: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 41 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's production, as it has recovered following the economic crisis.

**Table 41. Bricks and tiles: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	<i>Confidential</i>	0	0
	Substantive compliance costs	0	<i>Confidential</i>	0	0
	Direct charges	0.40	<i>Confidential</i>	0.31	0.36
Indirect regulatory costs		0.15	<i>Confidential</i>	0.12	0.16
Total regulatory costs		<b>0.55</b>	<b><i>Confidential</i></b>	<b>0.43</b>	<b>0.52</b>

Source: Authors' own elaboration.

#### 6.5.4 Cost assessment – Ceramic tiles

##### Sample

A short overview of the number of questionnaires received can be found below in Table 42. In total the sample covers 16 respondents from the ceramic tiles sector. More than three companies from the NWE and SE geographical regions provided data, enabling the Research Team to present two regional cost assessments for the ceramic tiles sector. Due to confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 42. Ceramic tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Ceramic tiles	16	4	5	7	16

Source: Authors' own elaboration.

##### Gas prices and costs

Natural gas is the main energy source for the ceramic sector. 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*

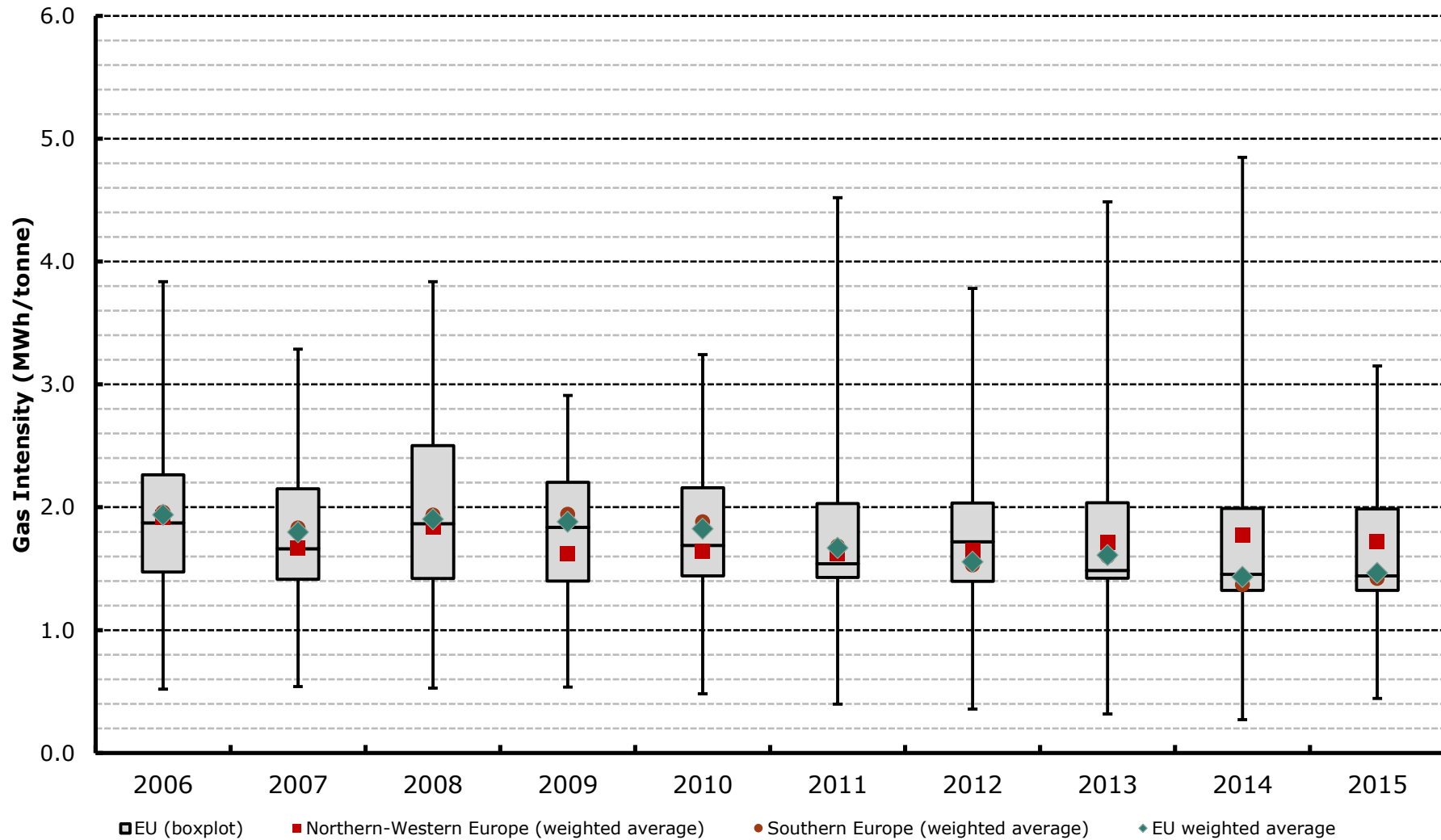
What follows is an analysis of natural gas intensity of production as reported by responding plants.

All plants in the sample provided the relevant information allowing the Research Team to assess gas intensity based on the sample of 16 plants.

Ceramics manufacturing has a natural gas-intensive production process. This is manifested by the data received from respondents. **Plants reported homogeneous natural gas intensities that remained relatively stable over the period 2006-15, with an EU weighted average around 1.55-1.94 MWh/tonne of production.** The EU weighted average of electricity intensity was at 0.29 MWh/tonne of production in 2006 and 0.24 MWh/tonne of production in 2015. In most years, the weighted EU average was above the median, which reflects the higher natural gas intensity of large plants.

From the data received, plants in both the NWE and SE regions appear to have comparable gas intensities on average when compared to the EU weighted average.

Figure 58. Ceramic tiles: Natural gas intensity per tonne of production (2006-15)



Source: Authors' own elaboration.

### *Gas costs*

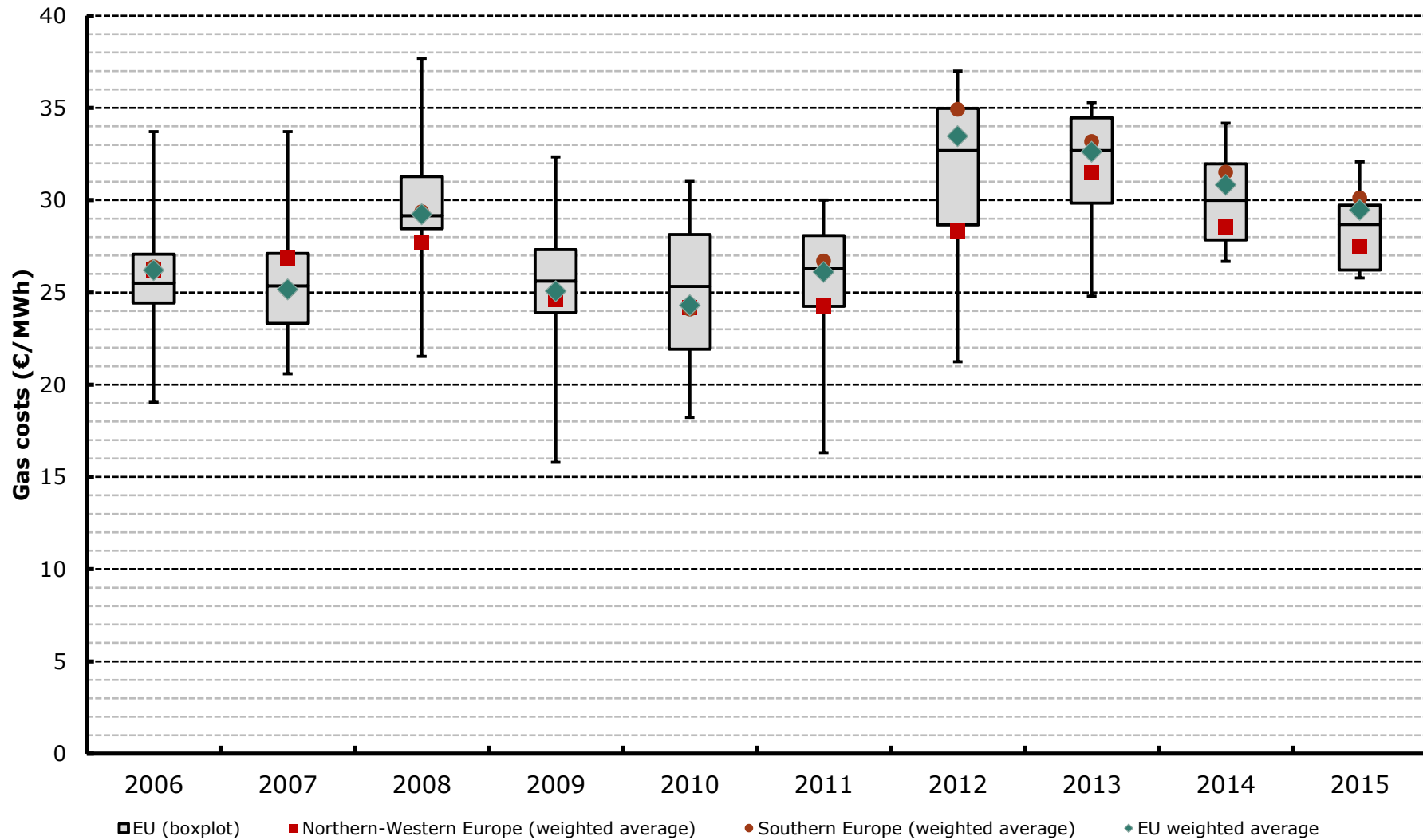
This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Three plants in the NWE region reported reimbursements from taxes.

The weighted average of natural gas cost for EU ceramics producers fluctuated over the study period of 2006-15. **Costs peaked in 2008 at €29.20/MWh, decreased in 2010 to €24.30/MWh, peaked again in 2012 at €33.50/MWh, and decreased slightly in 2015 to €29.50/MWh.** This trend is similar to natural gas wholesale prices, as shown in section 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. While data collected from ceramic tile manufacturing plants confirms a similar trend to global gas prices, the costs reported by plants are higher than the global price developments described in section 6.1.1 would suggest.

Data from NWE respondents shows some differences when compared with the EU weighted means of all respondents in our sample. **Plants in this region reported generally lower natural gas costs, between 0-15% lower, except for 2006 and 2007, when NWE plants reported average costs of 0-7% above the EU average.** However, we consider this variance minimal, with the EU weighted average and NWE average following a very similar trend.

Respondent data from SE plants shows some, albeit minor, differences when compared with the EU weighted means of all respondents in our sample. **Plants in this region reported generally higher natural gas costs, between 0-4% higher, except for 2009 and 2010, when SE plants reported average costs of 0-1% below the EU average.** Similar to the NWE region, we consider this variance minimal, with the EU weighted average and SE average following a very similar trend.

Figure 59. Ceramic tiles: Cost of natural gas paid by respondents (2006-15)



Source: Authors' own elaboration.

### *Components of the gas bill*

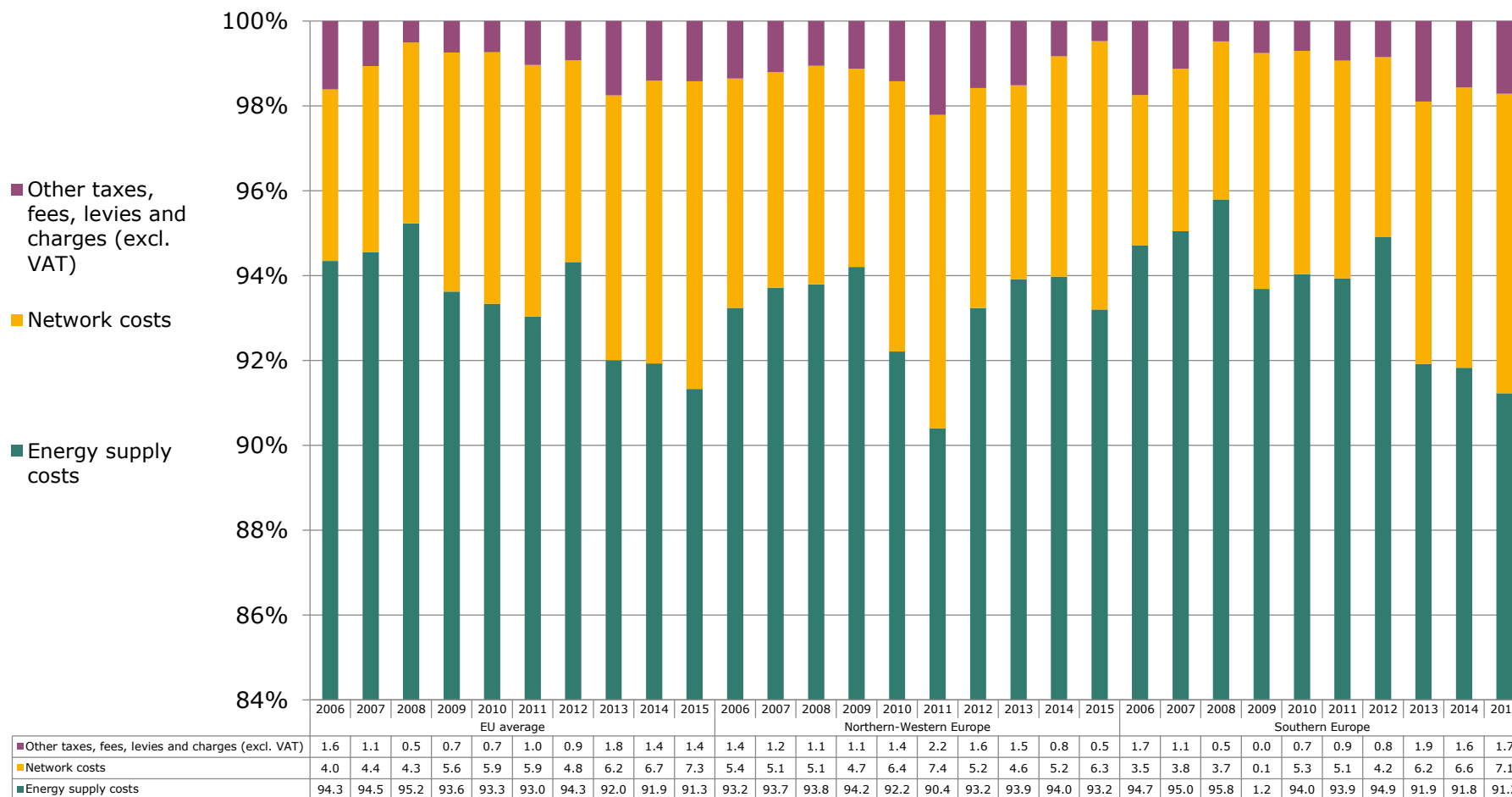
In this section, the components of the price paid by respondents for natural gas are discussed.

The energy component has the biggest impact on the price of natural gas at EU level, representing around 90.4-95.2% of the natural gas bill in the ceramics industry in the period 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 peaked in 2008 at €28.36/MWh and again in 2012 at €32.04/MWh. It then declined to €27.50/MWh in 2015. Network costs at EU level almost doubled in cost over the study period, from €1.08/MWh in 2006 to €2.18/MWh in 2015. Taxes, fees and levies remained stable over the study period at €0.43/MWh in 2006 and in 2015.

Regional level analysis shows slight differences between the NWE and SE regions compared with the EU weighted average in regulatory component costs. **In the NWE region, network costs represent a similar share of the natural gas bill when compared with the EU weighted average, at 6.3% in 2015. In the SE region, network costs made up 7.1% of electricity bills in 2015.**

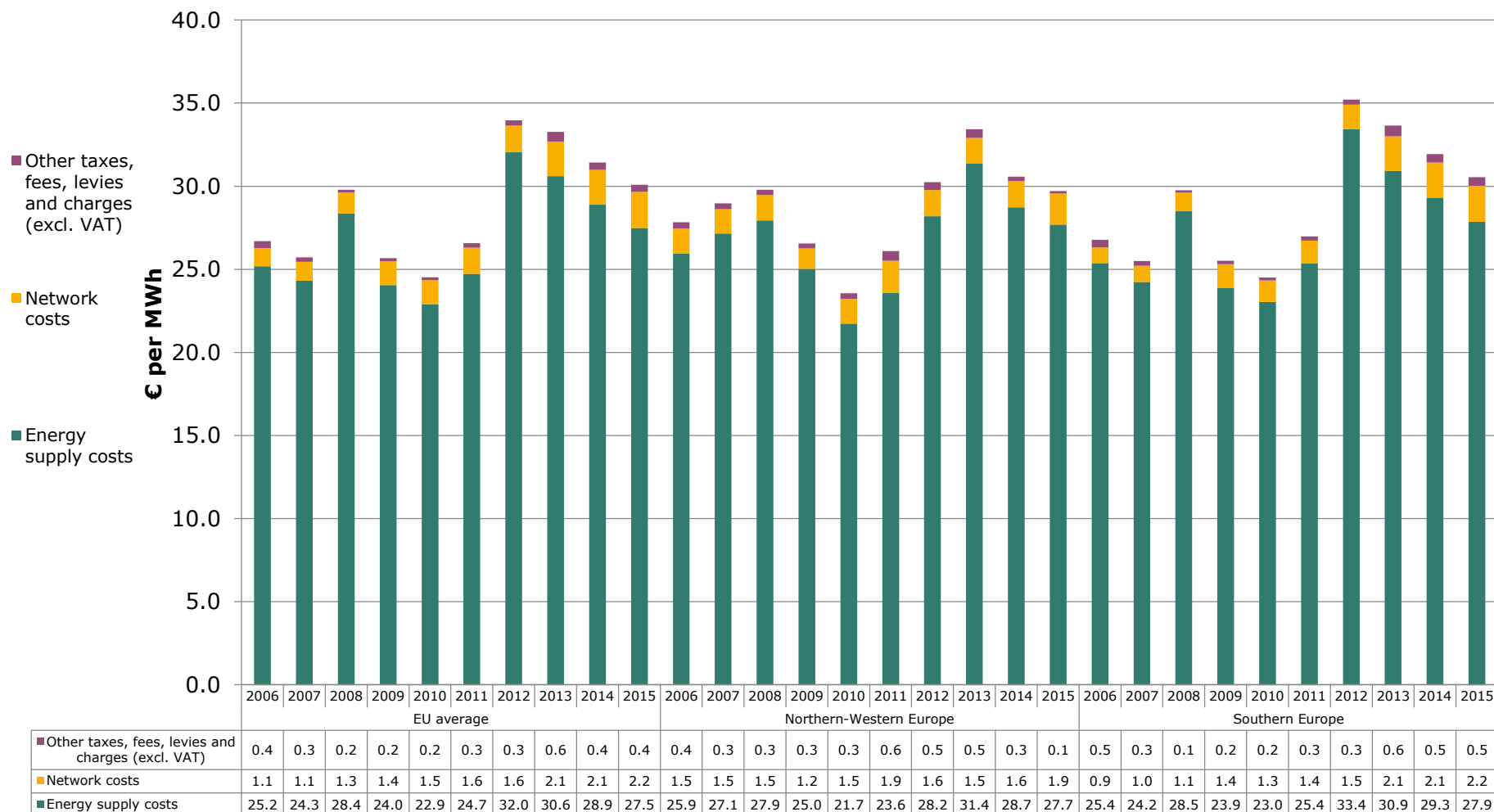
Data received from respondents on their natural gas cost components shows that unlike in the case of electricity cost components, the energy component is the driver of the natural gas costs. **In all regions, regulatory costs present less than 10% of the natural gas cost.** Part of the network costs 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.

Figure 60. Ceramic tiles: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)



Source: Authors' own elaboration.

**Figure 61. Ceramic tiles: 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. 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 ceramic tiles industry. As a result, these charges may not be entirely represented 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 ceramics sector. Following the analysis of the relevance of EU energy legislation to the ceramics sector, this Chapter looks at indirect compliance costs generated by the Internal Market legislation.

Two legislative acts and repealed acts on internal energy market have the potential to generate indirect regulatory costs for the ceramics sector:

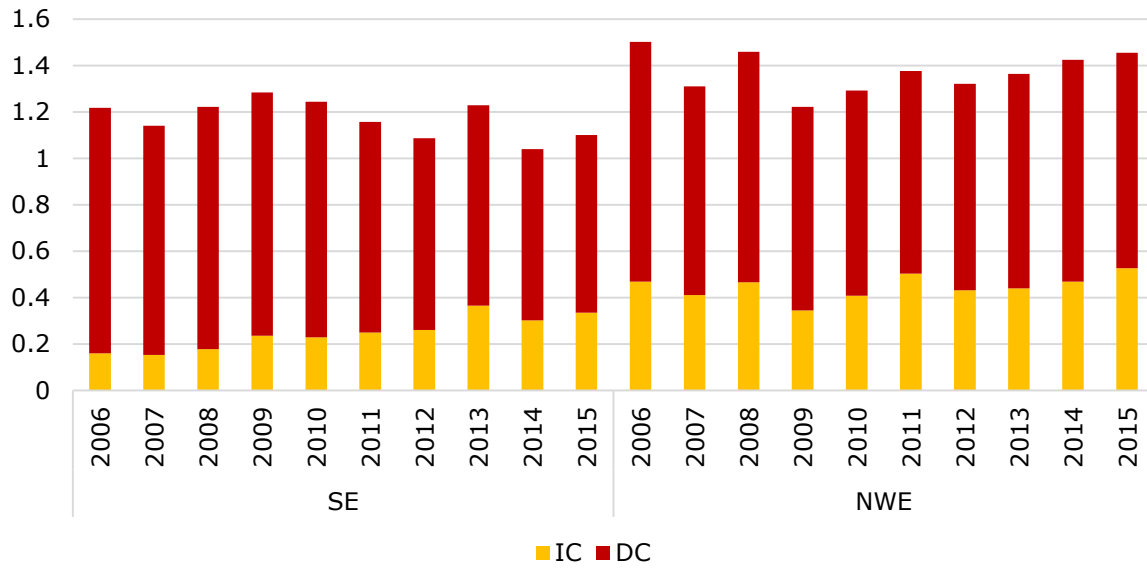
- Directive 2009/73/EC which aims at creating common rules for the generation, transmission and distribution of gas repealing Directive 2003/55/EC;
- Regulation (EC) No 715/2009 which aims at setting fair rules for cross-border exchanges in gas, repealing Regulation (EC) No 1775/2005.

**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 Directives are included.

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. The investment costs are passed on to network costs both via i) transmission tariffs and ii) distribution tariffs.

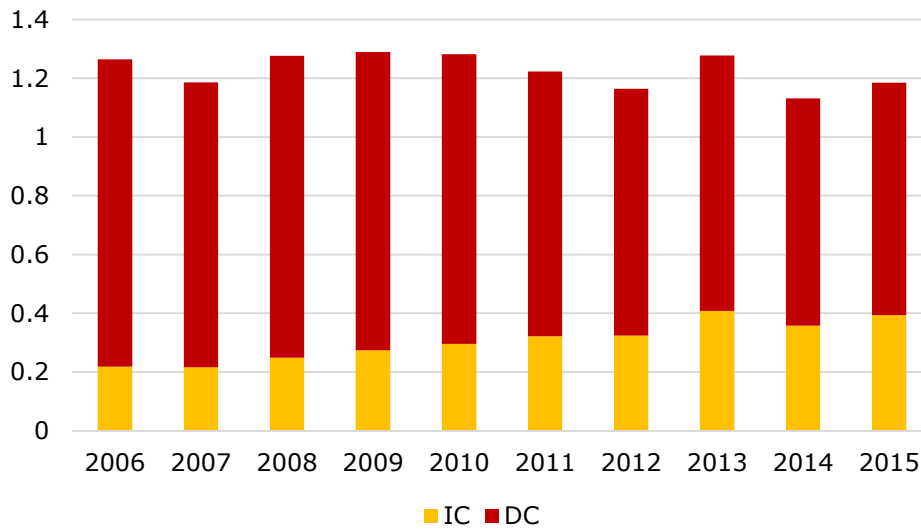


**Figure 62. Ceramic tiles: Cumulative regulatory costs of natural gas legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 63. Ceramic tiles: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 43 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's production, as it has recovered following the economic crisis.

**Table 43. Ceramic tiles: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	Confidential	0	0
	Substantive compliance costs	0	Confidential	0	0
	Direct charges	0.93	Confidential	0.77	0.79
Indirect regulatory costs		0.53	Confidential	0.33	0.39
Total regulatory costs		<b>1.46</b>	<b>Confidential</b>	<b>1.10</b>	<b>1.18</b>

Source: Authors' own elaboration.

### 6.5.5 Cost assessment – Fired refractories

#### Sample

A short overview of the number of questionnaires received can be found below in Table 44. In total the sample covers 11 respondents from the fired refractories subsector. More than three companies from the SE geographical region provided data enabling the Research Team to present one regional cost assessment for the fired refractories sector. Due to confidentiality reasons, a regional cost assessment for the CEE and NWE regions could not be presented.

**Table 44. Fired refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Fired refractories	11	5	2	4	11

Source: Authors' own elaboration.

#### Gas prices and costs

Natural gas is the main energy source for the ceramics sector and therefore 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*

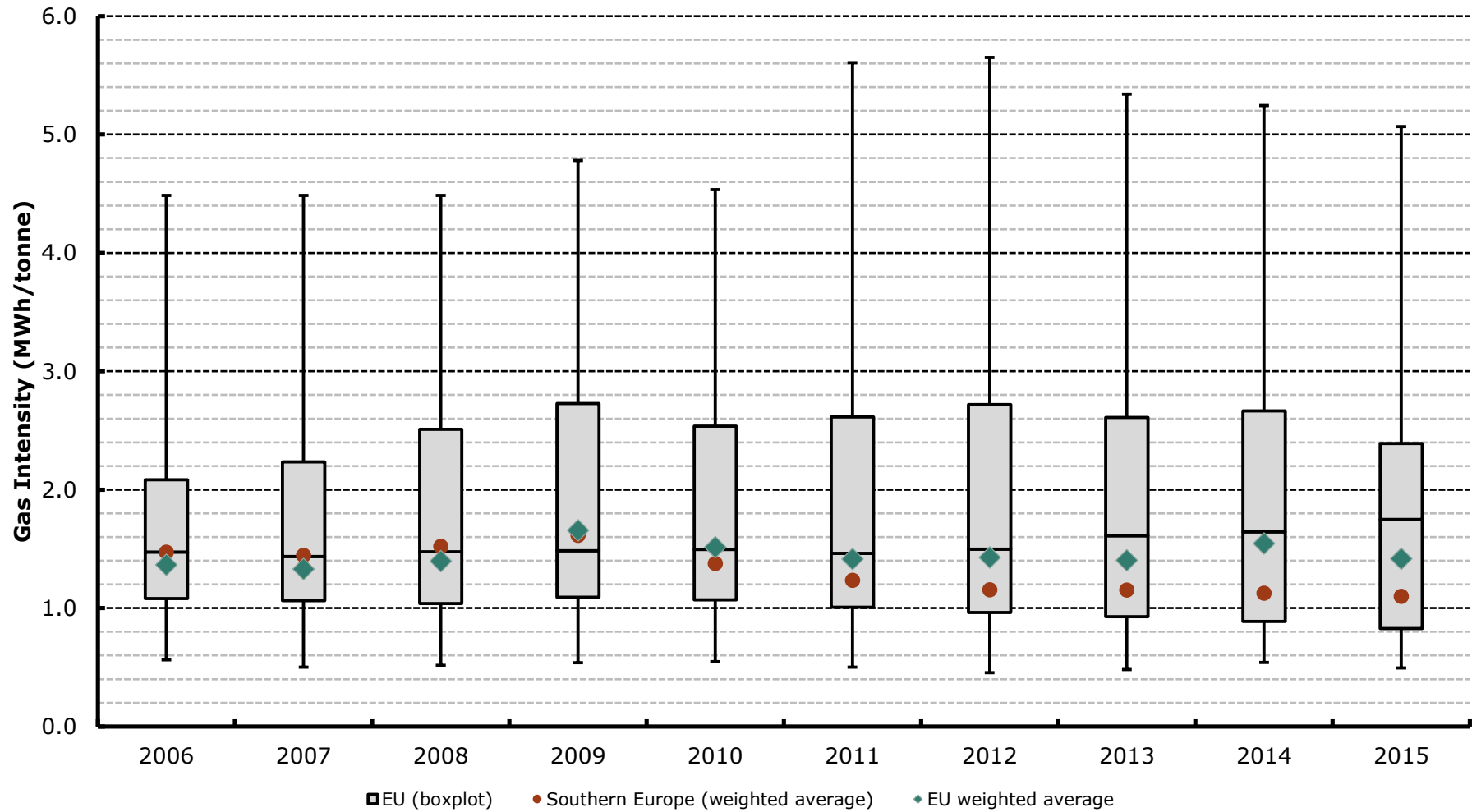
What follows is an analysis of natural gas intensity of production as reported by responding plants.

The refractories sector is a natural gas-intensive production process. This is manifested by the data received from respondents. Natural gas intensity fluctuated to some extent over the period 2006-15, with an EU weighted average ranging between 1.33-1.65 MWh/tonne of production. The EU weighted average of electricity intensity was 0.17 MWh/tonne of production in 2006, and 0.20 MWh/tonne of production in 2015. The fluctuations are likely to be explained by variations in production output rather than investments into energy efficiency. The data does not, however, confirm this assumption.

Plants reported heterogeneous natural gas intensities. The largest variation between plants was in 2009, when the difference between the minimum and the maximum value was 4.24 MWh/tonne of production. The smallest variation between two plants, in 2011, was 2.71 MWh/tonne of production. It is likely, as the variation in costs decreases from 2009 onwards, that an individual plant with high gas intensity improved its gas intensity over the study period.

From the data received, **plants in the SE region appear to have had lower natural gas intensities when compared to the EU weighted average. Weighted average natural gas intensities for this region also remained stable and varied from 1.47 MWh/tonne of production in 2006 to 1.10 MWh/tonne of production in 2015.** This might be a result of lower plant efficiency measures in other regions.

Figure 64. Fired refractories: Natural gas intensity per tonne of production (2006-15)



Source: Authors' own elaboration.

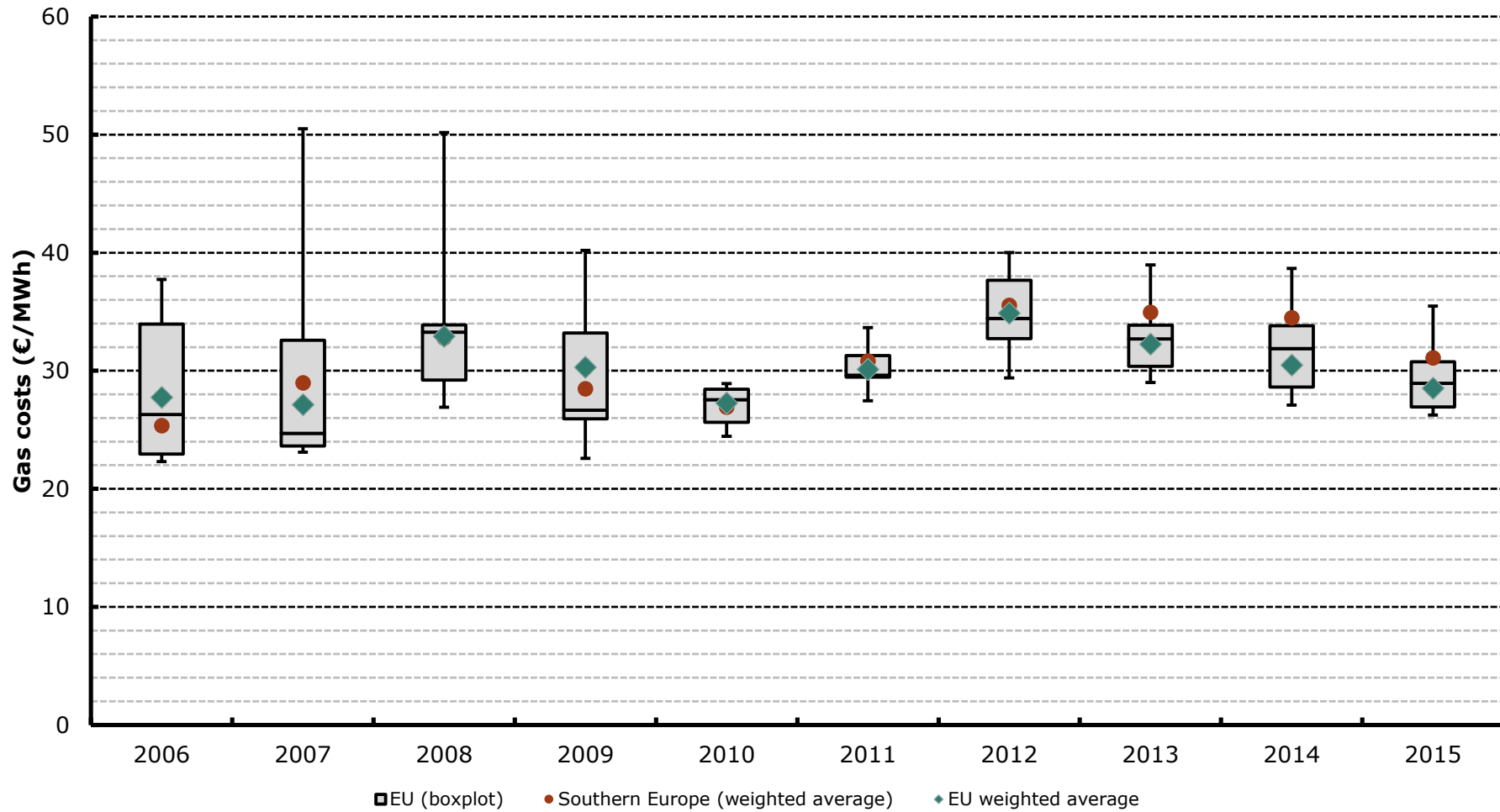
### *Gas costs*

This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Six plants out of a sample of 11 plants reported reimbursements from taxes or levies.

The weighted average natural gas cost for EU fired refractory producers fluctuated over the study period of 2006-15. Costs increased to €32.90/MWh in 2008, decreased to €27.30/MWh in 2010, increased to €34.90/MWh in 2012, and decreased to €28.50/MWh in 2015. This trend is similar to natural gas wholesale prices, as shown in Figure 19. 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. While data collected from fired refractory manufacturing plants confirms a similar trend to global gas prices, the costs reported by plants were higher than the global price developments described in section 6.1.1 would suggest. Median costs were higher than the EU weighted average, showing that plants with larger production have lower natural gas costs.

Figure 65 shows that natural gas costs varied across years and across plants. The EU median varied between €24.50/MWh (2007) and €34.40/MWh (2012). In 2010, the smallest variation in costs was observed, €4.50/MWh between the maximum and the minimum value, while the differences between the lowest and highest cost were greatest in 2009 (€17.60/MWh between the maximum and the minimum value). After 2009, there was less cost divergence compared to the beginning of the study period.

Figure 65. Fired refractories: Cost of natural gas paid by respondents (2006-15)



Source: Authors' own elaboration.

### *Components of the gas bill*

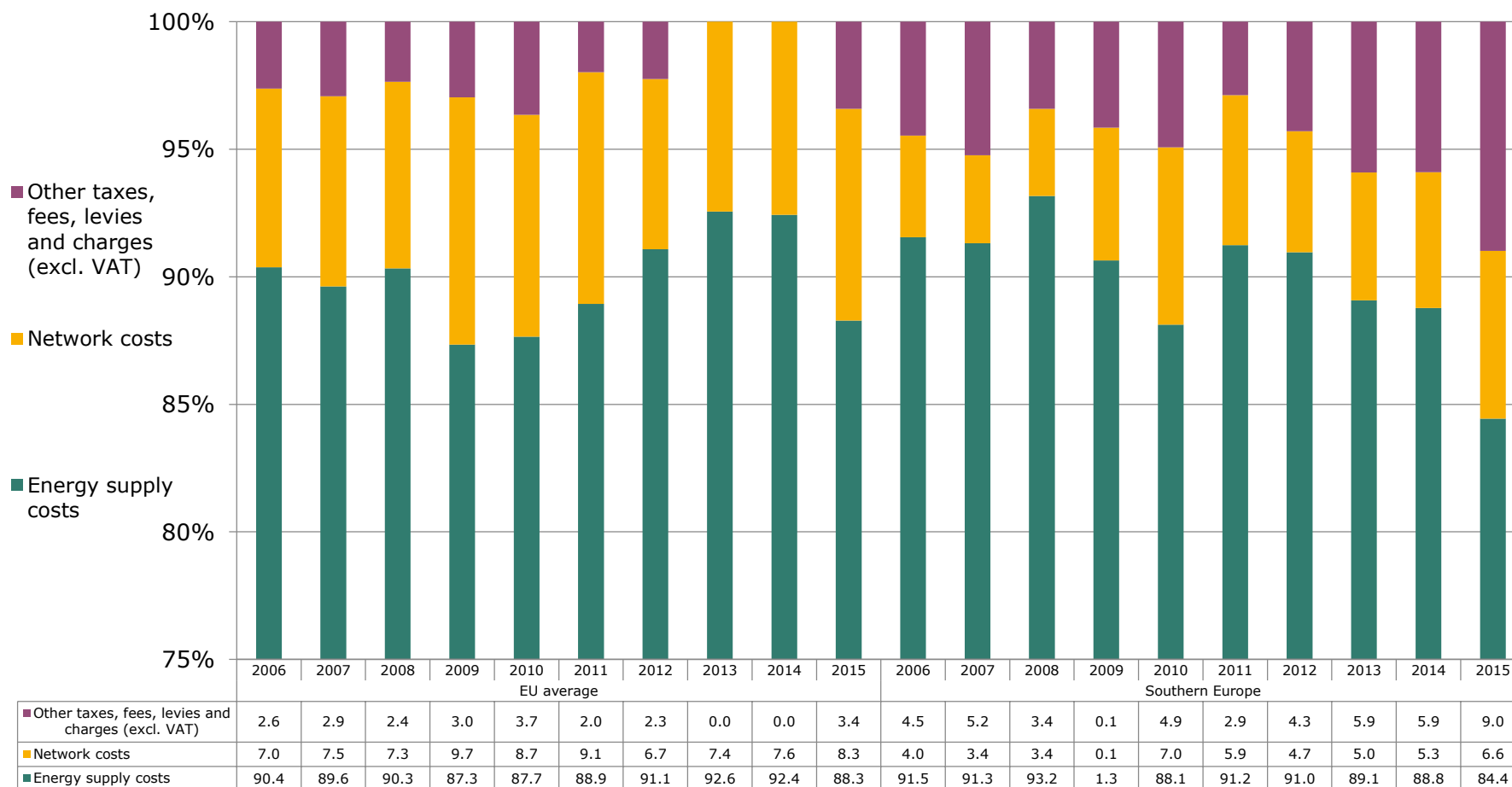
In this section, the components of the price paid by respondents for natural gas are discussed.

The energy component has the biggest impact on the price of natural gas at EU level, representing around 87.3-92.6% of the natural gas bill 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 in 2012 at €33.47/MWh and declined to €26.89/MWh in 2015. Network costs at EU level show fluctuations and a slight increase from €2.07/MWh in 2006 to €2.53/MWh in 2015. On average, taxes, fees and levies present a modest share of the natural gas bill with a small increase. While in 2006 taxes and levies represented €0.78/MWh, in 2015 they stood at €1.04/MWh.

**The regulatory component represented a small share of the natural gas bill, accounting for approximately 7.4-12.7%. Both regulatory components peaked in 2009, when the network costs were €3.10/MWh and taxes and levies €0.95/MWh.** While no clear trend can be observed in relation to network costs and the taxes and levies, both regulatory components were higher in 2015 than in 2006.

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 in the section.

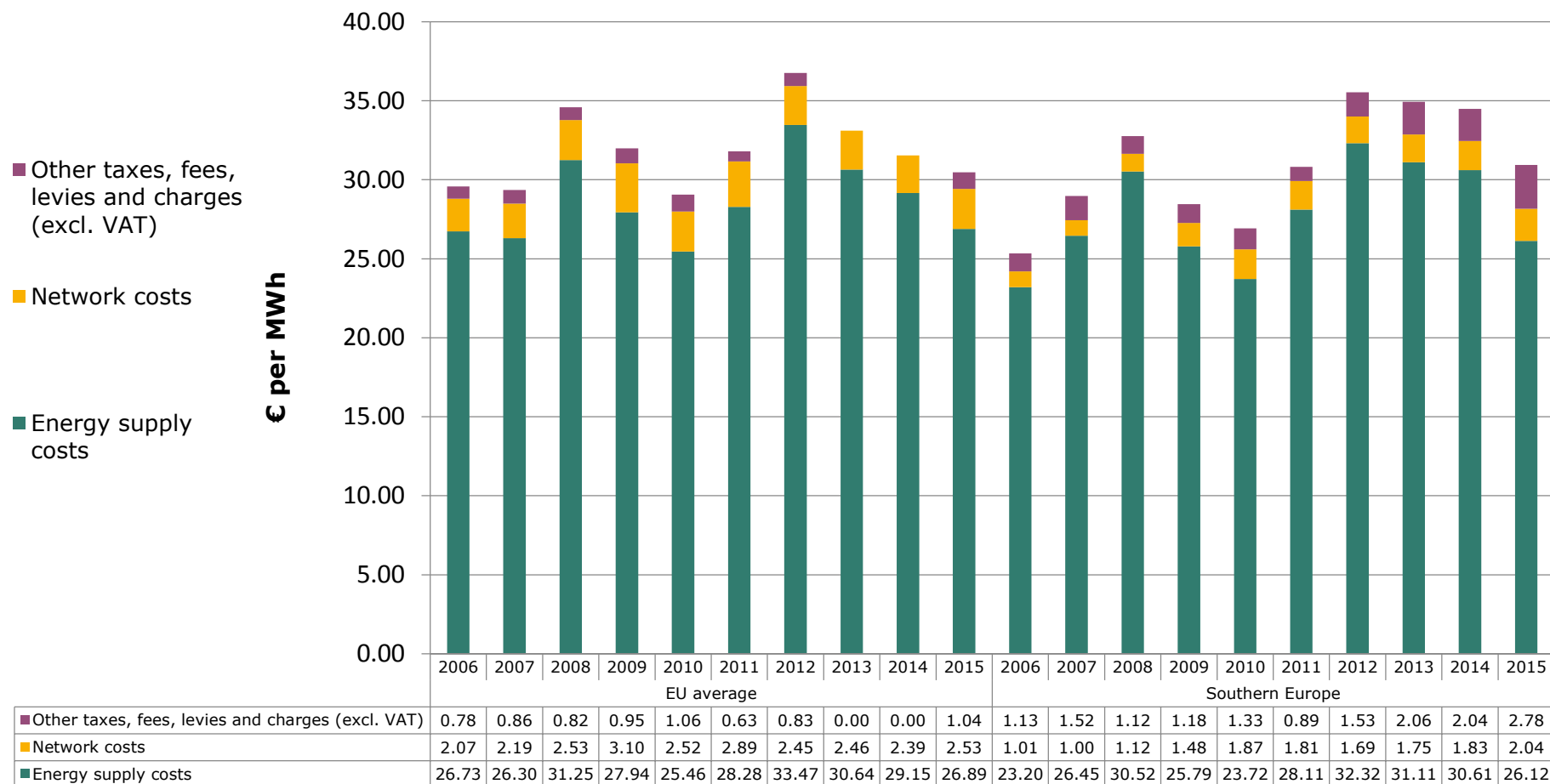
**Figure 66. Fired refractories: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.



**Figure 67. Fired refractories: 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 one-half of all regulatory costs of natural gas legislation.** These charges remain 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 fired refractories industry. As a result, these charges may not be entirely represented 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 fired refractories sector. Following the analysis of the relevance of EU energy legislation to the fired refractories sector, this Chapter addresses indirect compliance costs generated by Internal Market legislation

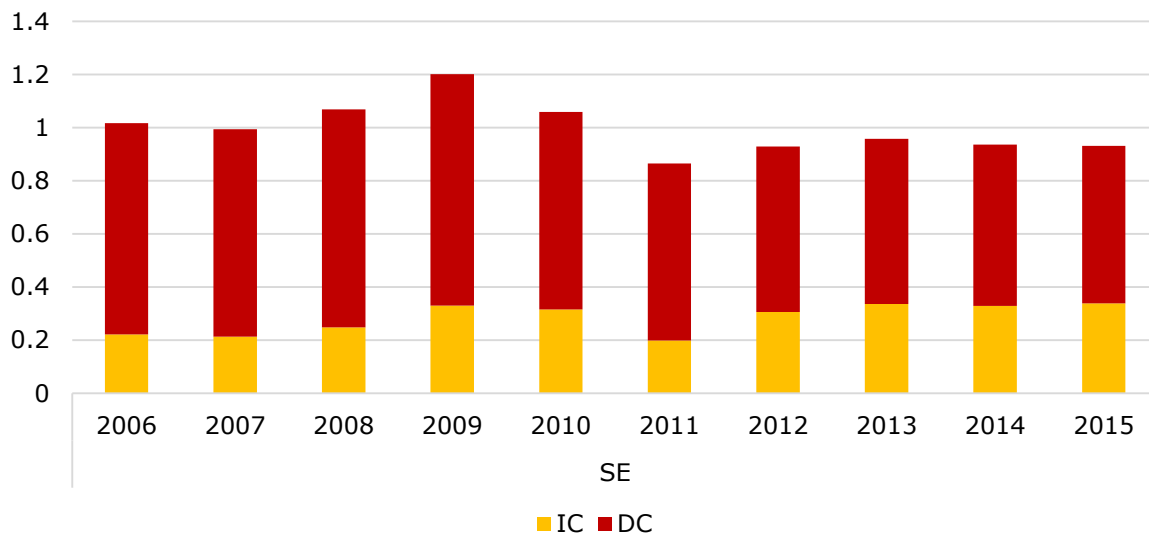
Two legislative acts and repealed acts on internal energy market have the potential to generate indirect regulatory costs for the ceramics sector:

- 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.

**Indirect charges attributable to EU legislation are approximately one-half 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 Directives are included.

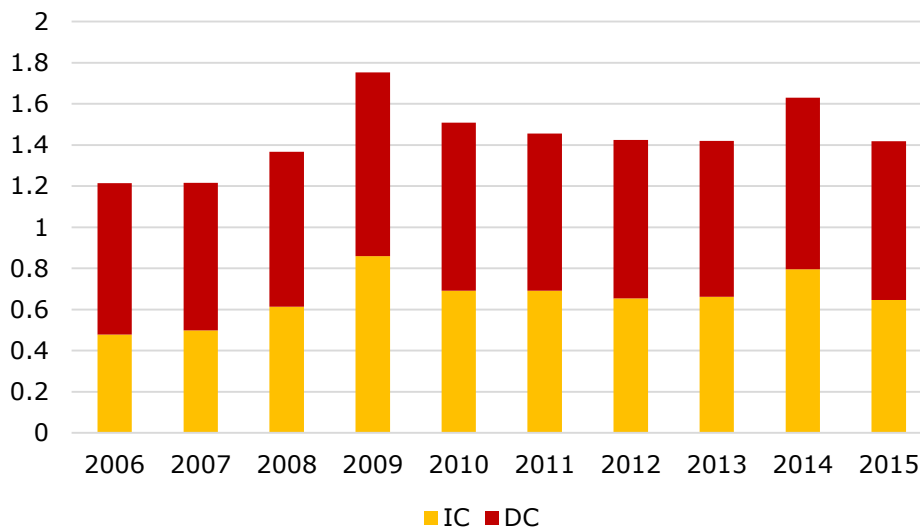
The potential costs generated by the legislation translate into higher network costs for the industry. This is due to the need to finance new infrastructure. The investment costs are passed on to network costs both via i) transmission tariffs and ii) distribution tariffs.

**Figure 68. Fired refractories: Cumulative regulatory costs of natural gas legislation 2006-15 for the SE region (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 69. Fired refractories: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 45 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's production, as it has recovered following the economic crisis.

**Table 45. Fired refractories: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0	0
	Substantive compliance costs	Confidential	Confidential	0	0
	Direct charges	Confidential	Confidential	0.59	0.77
Indirect regulatory costs		Confidential	Confidential	0.34	0.65
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0.93</b>	<b>1.42</b>

Source: Authors' own elaboration.

### 6.5.6 Cost assessment – Unfired shaped refractories

#### Sample

A short overview of the number of questionnaires received can be found below in Table 46. In total the sample covers four respondents from the unfired shaped refractories. The Research Team are unable to present a regional cost assessment for the unfired shaped refractories sector for any of the three regions, because fewer than three companies provided data.

**Table 46. Unfired shaped refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Unfired shaped refractories	4	4

Source: Authors' own elaboration.

#### Gas prices and costs

Natural gas is the main energy source for the ceramics sector and therefore 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*

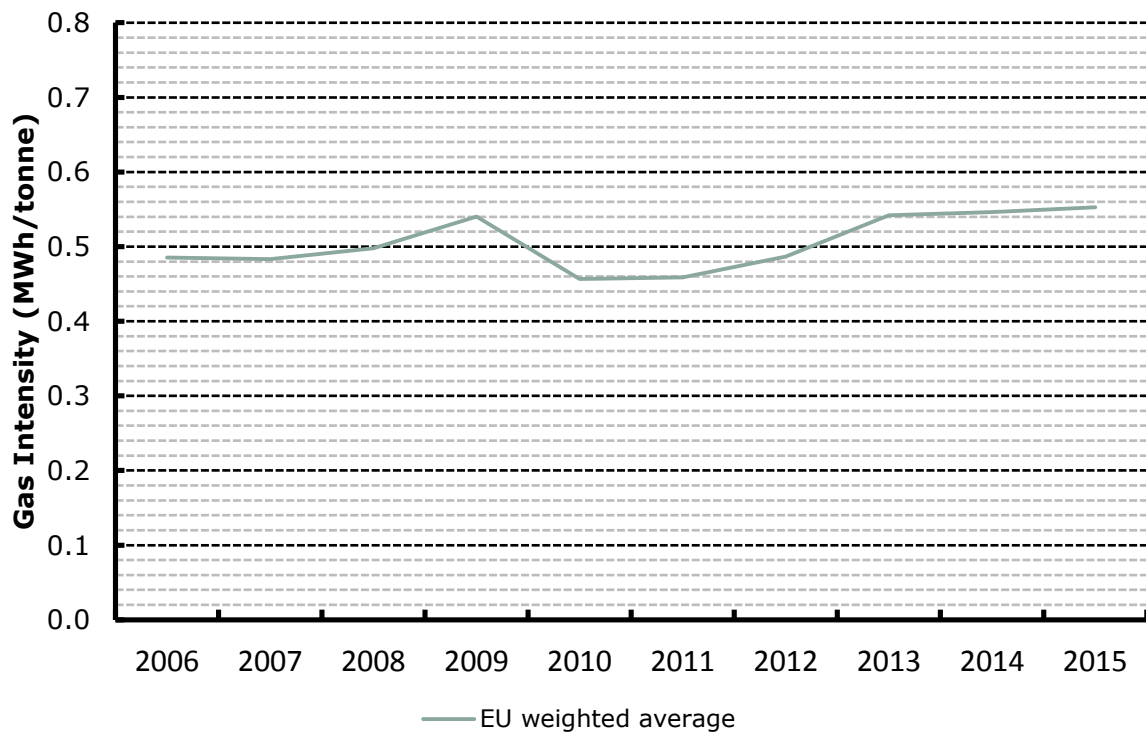
What follows is an analysis of natural gas intensity of production as reported by responding plants.

The refractories sector has a natural gas-intensive production process. This is manifested by the data received from respondents. **Natural gas intensity stayed relatively stable over the period 2006-15, with an EU weighted average ranging between 0.46-0.55 MWh/tonne of production. The EU weighted average of electricity intensity was 0.49 MWh/tonne of production in 2006, and 0.55 MWh/tonne of production in 2015.** The fluctuations are likely to rather be explained by variations in production output than investments into energy efficiency. The data does not, however, confirm this assumption.

Plants reported heterogeneous natural gas intensities. The largest variation between plants was in 2012, when the difference between the minimum and the maximum value was 1.07 MWh/tonne of production. The smallest variation between two plants, in 2014, was 0.86 MWh/tonne of production.

Due to small sample size, no solid conclusion can be drawn. Due to confidentiality reasons, regional averages are not presented.

**Figure 70. Unfired shaped refractories: Natural gas intensity per tonne of production (2006-15)**



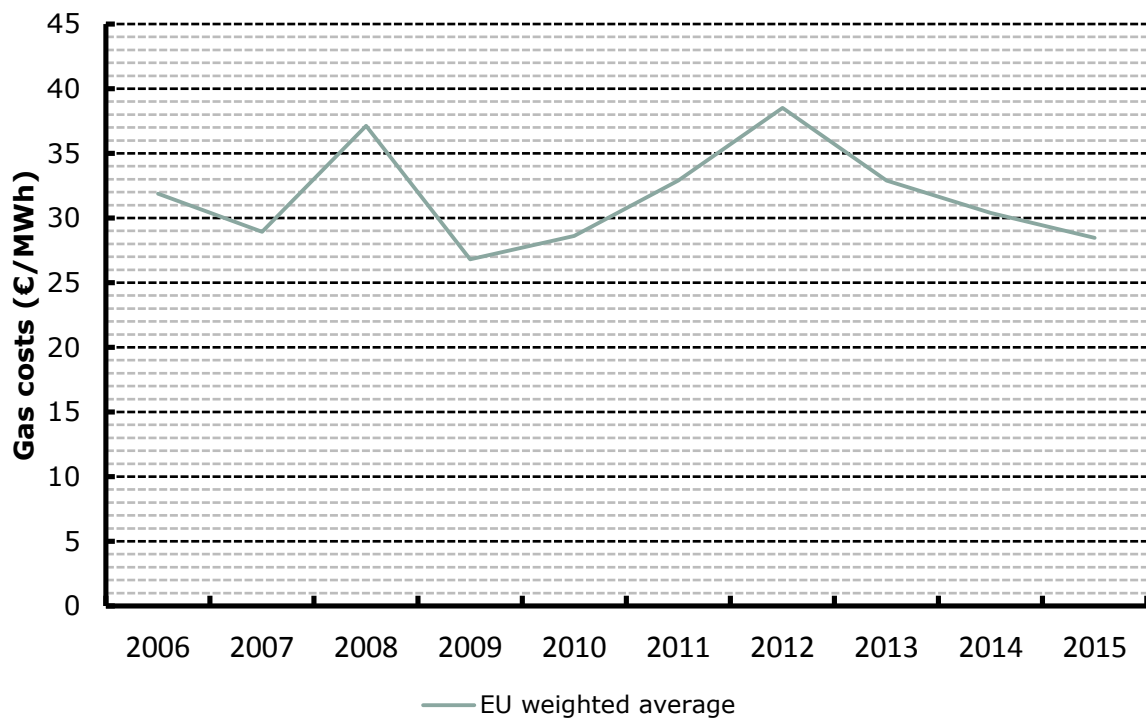
*Source: Authors' own elaboration.*

*Gas costs*

This section presents net gas costs accounting for reimbursements from taxes reported by responding plants. Two plants out of a sample of four plants reported reimbursements from taxes or levies.

The weighted average of natural gas costs for EU unfired shaped refractory producers fluctuated over the study period 2006-15. Costs increased from €31.9/MWh in 2006 to €37.10/MWh in 2008, decreased to €26.80/MWh in 2010, increased to €38.50/MWh in 2012, and decreased to €28.50/MWh in 2015. This trend is similar to natural gas wholesale prices, as shown in Figure 19. 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. While data collected from unfired shaped refractory manufacturing plants confirms a similar trend to global gas prices, the costs reported by plants are higher than the global price developments described in section 6.1.1 would suggest.

**Figure 71. Unfired shaped refractories: 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 86-92% of the natural gas bill 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 €35.40/MWh in 2012, then declined to €25.30/MWh in 2015. Network costs at EU level show fluctuations and a slight increase from €2.30/MWh in 2006 to €2.60/MWh in 2015. On average, taxes, fees and levies remained relatively stable: while in 2006 taxes and levies represented €0.62/MWh, in 2015 they stood at €0.55/MWh.

The regulatory component represented a small share of the natural gas bill, accounting for approximately 8-14%. Both regulatory components peaked in 2009, when the network costs were €2.52/MWh and taxes and levies €1.21/MWh. No clear trend can be observed in relation to network costs and the taxes and levies, as overall the regulatory component was around €3/MWh both in 2006 and in 2015.

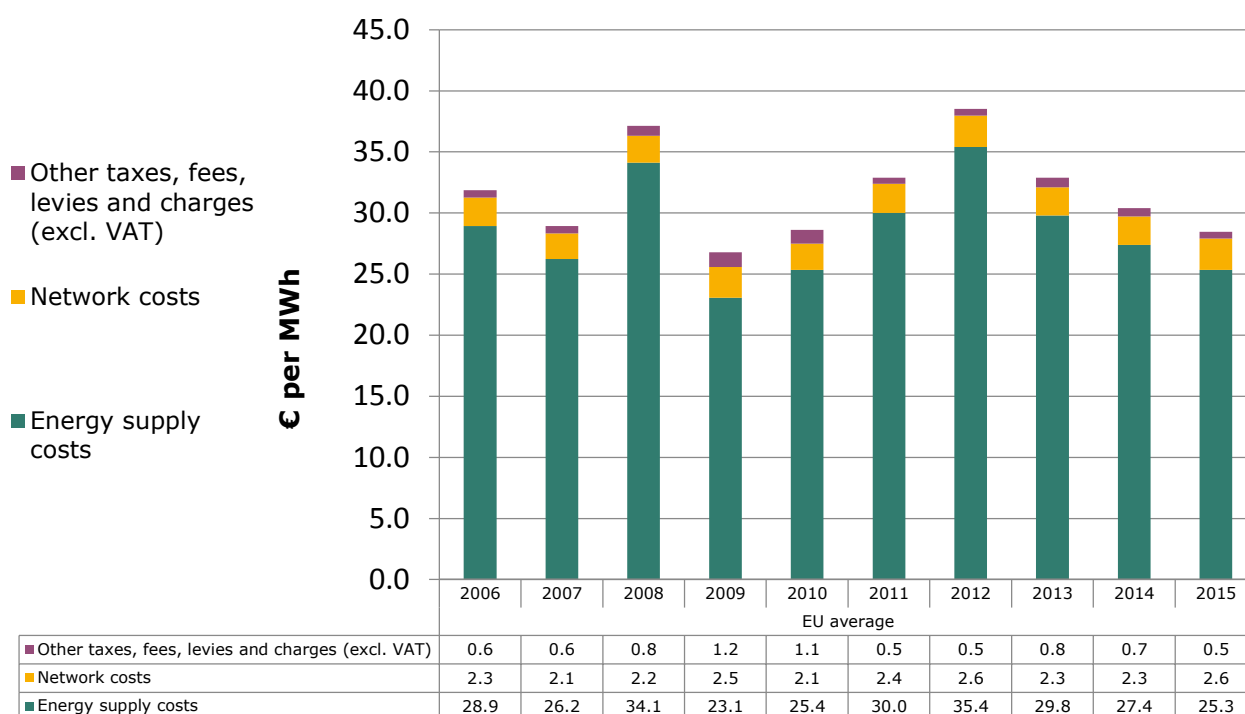
Data received from respondents on their natural gas cost components shows that unlike in the case of electricity cost components, the energy component is the driver of the natural gas costs. Part of the network costs as well as taxes generated by the Energy Taxation Directive are a result of EU legislation.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

**Figure 72. Unfired shaped refractories: Components of the natural gas bills paid by respondents (% , weighted averages, 2006-15)**



Source: Authors' own elaboration.

**Figure 73. Unfired shaped refractories: Components of the natural gas bills paid by respondents (€/MWh, weighted averages, 2006-15)**



Source: Authors' own elaboration.

### Direct regulatory costs

This section addresses 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 fired refractories industry. As a result, these charges may not be entirely represented 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 fired refractories sector. Following the analysis of the relevance of EU energy legislation to the fired refractories sector, this Chapter addresses indirect compliance costs generated by Internal Market legislation.

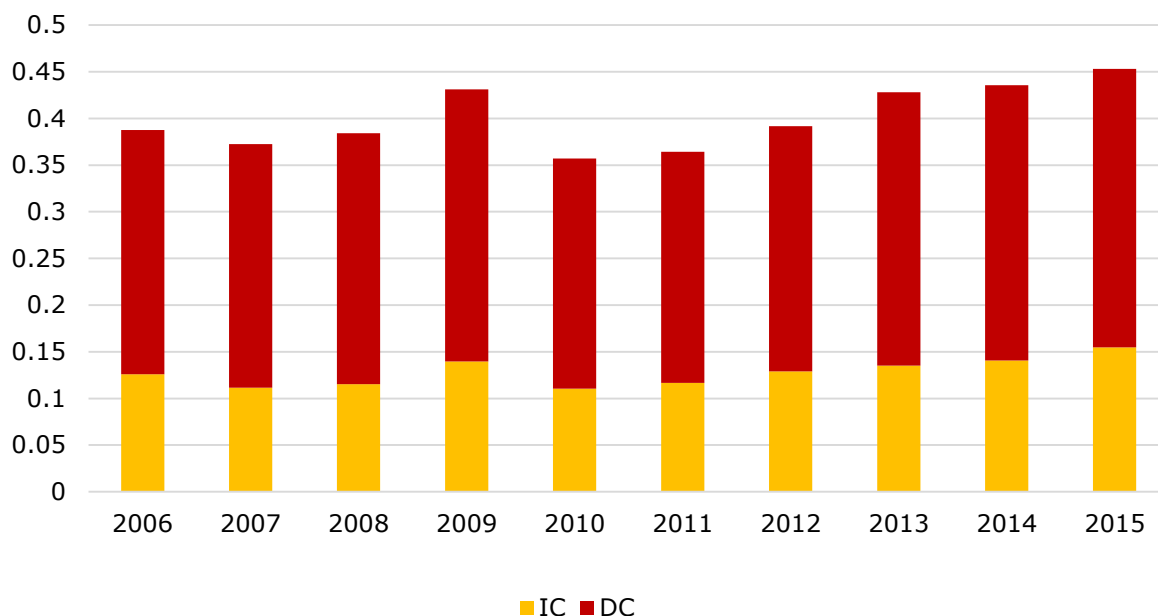


Two legislative acts and repealed acts on internal energy market have the potential to generate indirect regulatory costs for the ceramics sector:

- 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.

**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 Directives are included.

**Figure 74. Unfired shaped refractories: Cumulative regulatory costs of natural gas legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 47 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's production, as it has recovered following the economic crisis.

**Table 47. Unfired shaped refractories: Cumulative regulatory costs of natural gas legislation 2015 (€/tonne of production)**

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	0
	Direct charges	0.30
Indirect regulatory costs		0.15
<b>Total regulatory costs</b>		<b>0.45</b>

*Source: Authors' own elaboration.*

## **6.6 Energy efficiency**

### **6.6.1 Description of the Acts**

While the section on electricity and natural gas addressed the regulatory costs related to electricity and gas used by the plants in their production process, this section shows the costs generated by pursuing the EU's goal of promoting the industry's energy efficiency. Unlike in previous areas, here 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 ceramics 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 that 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 obligation of energy audit applies to large companies. After 5 June 2014, the 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 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 – Bricks and tiles**

#### *Sample*

A short overview of the number of questionnaires received can be found below in Table 48. In total the sample covers 23 respondents from the bricks and tiles sector. More than three companies from the NWE and SE geographical regions provided data enabling the Research Team to present two regional cost assessments for the bricks and tiles sector. Due to confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 48. Bricks and tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Bricks and tiles	23	12	5	6	23

*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 bricks and tiles manufacturers. Both the i) obligation to pass an energy audit and ii) the requirement for 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 bricks and tiles sector 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 bricks and tiles sector were asked about the costs of hiring external auditors and about the amount of time their employees<sup>135</sup> 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 23 bricks and tiles manufacturers, 13 reported having passed an energy audit between 2012 and 2015.** One responding plant had 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.

<sup>135</sup> These employees are assumed to be technicians and associate professionals. The hourly earnings of technicians and associate professionals are therefore applied.

**Table 49. Bricks and tiles: Number of plants that have carried out the energy efficiency audit 2012-15**

Subsector	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	13	8	3	2
Energy efficiency audit not carried out	10	4	2	4

*Source: Authors' own elaboration.*

**The weighted average of costs incurred at EU level was at €0.06/tonne of production in 2015.** In most cases when a plant carried out an energy audit, employees of the plant 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 seven 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. A respondent provided information on the breakdown of hours spent on activities necessary to complete an energy audit. It was recorded that the majority of person-hours were spent on taking and reporting measurements at the kiln. Subsequent to this, a number of hours were spent discussing results internally, with business unit and plant managers and with external auditors, as well as discussing the concept of the energy audit report and possible energy saving opportunities. A few further person-hours were spent compiling an energy saving plan.

Many companies foresaw an energy audit in 2016. As the legislation entered into force in 2012, it is possible that the indirect costs generated by the Energy Efficiency Directive are likely to increase in the future.

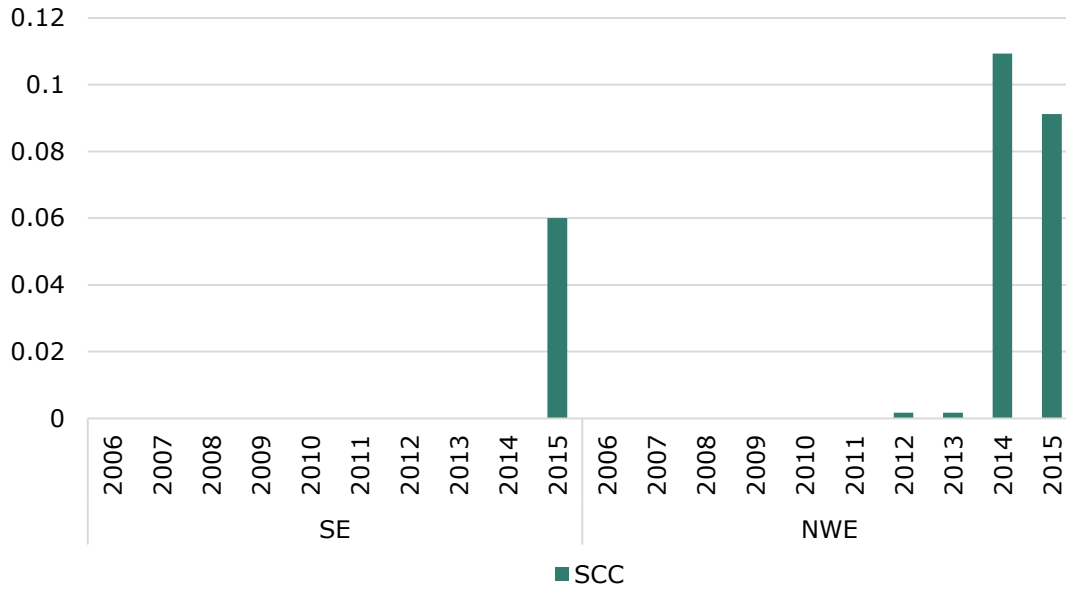
#### *Cost-benefit analysis*

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 ceramics 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.

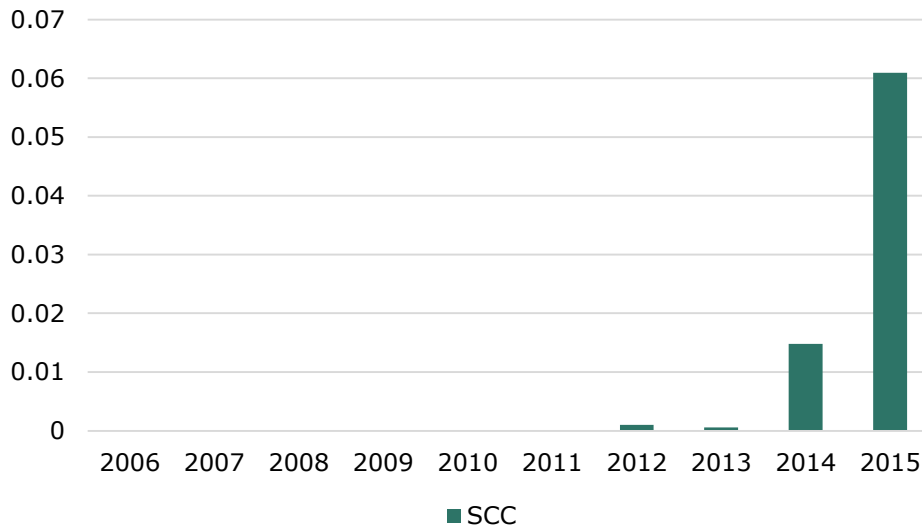
Consequently, no plant reported to have carried out a cost-benefit analysis to assess the option of introducing co-generation in heating. **Therefore, this requirement is not likely to have generated any direct costs.** As this requirement, however, entered into force only on June 2014, it is likely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

**Figure 75. Bricks and tiles: Cumulative regulatory costs of energy efficiency legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 76. Bricks and tiles: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 50 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 following the introduction of energy efficiency regulation.

**Table 50. Bricks and tiles: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	Confidential	0	0
	Substantive compliance costs	0.09	Confidential	0.06	0.06
	Direct charges	0	Confidential	0	0
Indirect regulatory costs		0	Confidential	0	0
Total regulatory costs		<b>0.09</b>	<b>Confidential</b>	<b>0.06</b>	<b>0.06</b>

Source: Authors' own elaboration.

#### 6.6.4 Cost assessment – Ceramic tiles

##### Sample

A short overview of the number of questionnaires received can be found below in Table 51. In total the sample covers 16 respondents from the ceramic tiles sector. More than three companies from the NWE and SE geographical regions provided data enabling the Research Team to present two regional cost assessments for the ceramic tiles sector. Due to confidentiality reasons, a regional cost assessment for the CEE region could not be presented.

**Table 51. Ceramic tiles: Total number of questionnaires received and used in the Chapter**

Sector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Ceramic tiles	16	4	5	7	16

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 ceramics tile manufacturers. Both the i) obligation to pass an energy audit and ii) the requirement

for 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 ceramic tiles sector 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 ceramic tiles sector were asked about the costs of hiring external auditors and about the amount of time their employees<sup>136</sup> 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 16 ceramic tiles manufacturers, eight reported having passed an energy audit between 2012 and 2015.** No responding plants carried out the energy efficiency audit prior to 2012.

**Table 52. Ceramic tiles: Number of plants that have carried out the energy efficiency audit 2012-15**

Subsector	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	8	4	1	3
Energy efficiency audit not carried out	8	0	4	4

*Source: Authors' own elaboration.*

Although the costs of the energy efficiency audit are described under 'Substantive compliance costs', they can be considered minor. **The weighted average of costs incurred at EU level was at €0.02/tonne of production in 2015.**

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 40 working days.** As labour costs vary from one Member State to another, the cost impact measured in the amount of working days varies.

Many companies foresaw energy audits in 2016. As the legislation entered into force in 2012, it is possible that the indirect costs generated by the Energy Efficiency Directive are likely to increase in the future.

<sup>136</sup> Ibid.



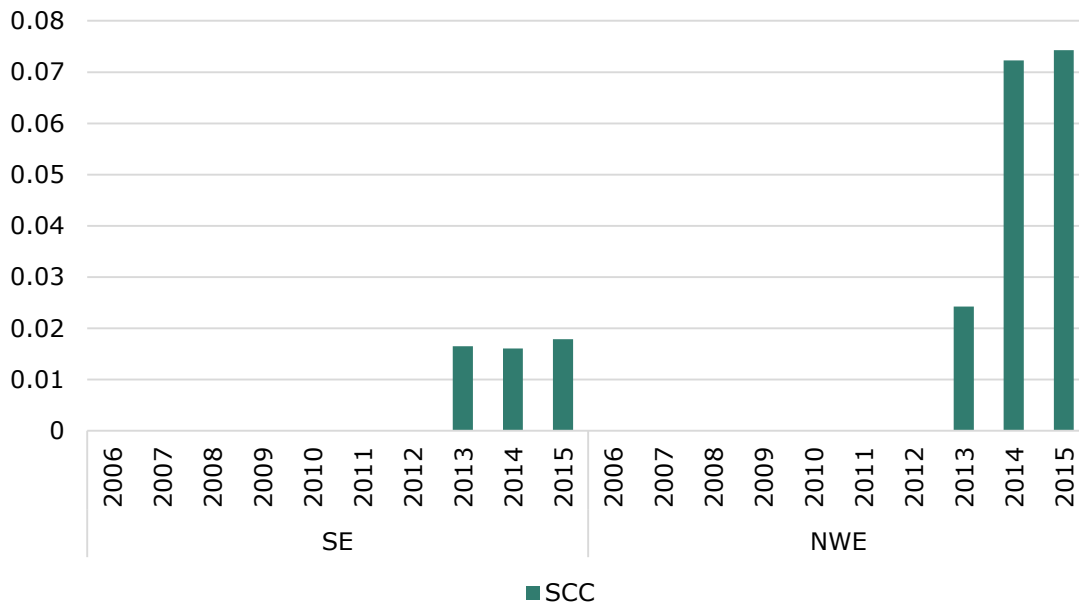
*Cost-benefit analysis*

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 ceramics 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.

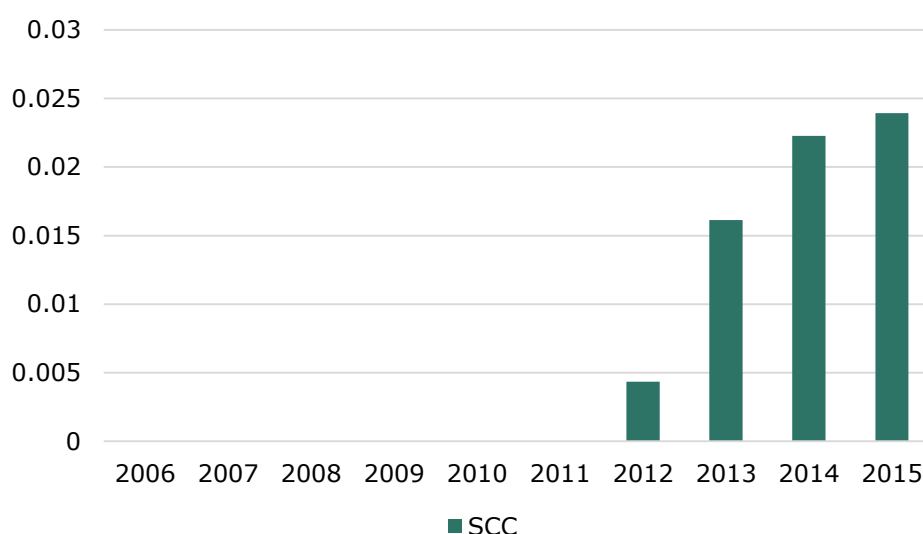
Consequently, no plant reported having carried out a cost-benefit analysis to assess the option of introducing co-generation in heating. **Therefore, this requirement is not likely to have generated any direct costs in the study period.** As this requirement, however, entered into force only on June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

**Figure 77. Ceramic tiles: Cumulative regulatory costs of energy efficiency legislation 2006-15 for the NWE and SE regions (€/tonne of production)**



Source: Authors' own elaboration.

**Figure 78. Ceramic tiles: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 53 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 following the introduction of energy efficiency regulation.

**Table 53. Ceramic tiles: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	Confidential	0	0
	Substantive compliance costs	0.07	Confidential	0.02	0.02
	Direct charges	0	Confidential	0	0
Indirect regulatory costs		0	Confidential	0	0
Total regulatory costs		<b>0.07</b>	<b>Confidential</b>	<b>0.02</b>	<b>0.02</b>

Source: Authors' own elaboration.

### 6.6.5 Cost assessment – Fired refractories

#### Sample

A short overview of the number of questionnaires received can be found below in Table 54. In total the sample covers 11 respondents from the fired refractories subsector. More than three companies from the SE geographical region provided data enabling the Research Team to present one regional cost assessment for the fired refractories subsector. Due to confidentiality reasons, a regional cost assessment for the NWE and CEE regions could not be presented.

**Table 54. Fired refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants				Number of questionnaires used
	Total EU	NWE	CEE	SE	
Fired refractories	11	5	2	4	11

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 ceramics tiles manufacturers. Both the i) obligation to pass an energy audit and ii) requirement for 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 fired refractories 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 fired refractories subsector were asked about the costs of hiring external auditors and about the amount of time their employees<sup>137</sup> 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 11 fired refractories manufacturers, only three reported having passed an energy audit between 2012 and 15. No responding plants carried out the energy efficiency audit prior to 2012.

<sup>137</sup> Ibid.

**Table 55. Fired refractories: Number of plants that have carried out the energy efficiency audit 2012-15**

Subsector	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	3	3	0	0
Energy efficiency audit not carried out	8	2	2	4

*Source: Authors' own elaboration.*

**The weighted average of costs incurred at EU level was €0.08/tonne of production in 2015.**

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 was 40 working days for all plants for the years they carried out an audit. As labour costs vary from one Member State to another, the cost impact measured in the amount of working days varies.

Many companies, however, foresaw energy audits in or after 2016 as a result of EU legislation. As the legislation entered into force in 2012, it is possible that indirect costs generated by the Energy Efficiency Directive are likely to increase in the future.

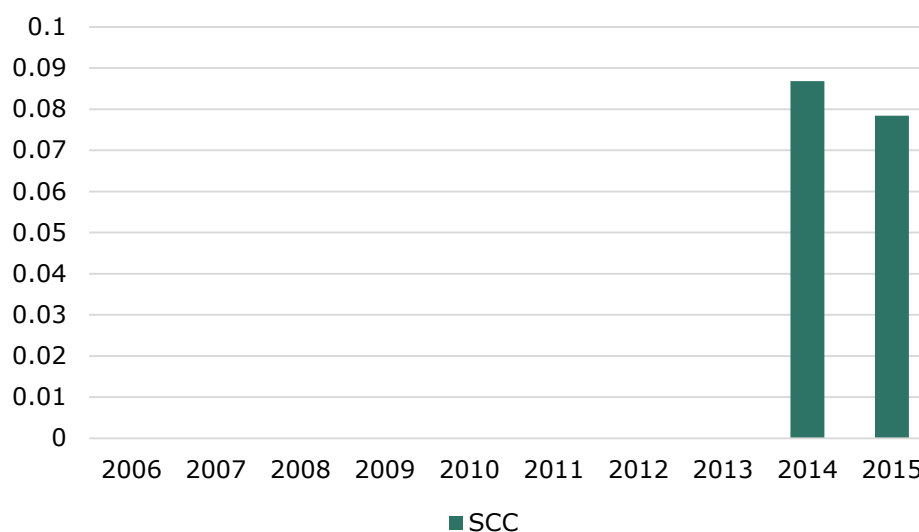
#### *Cost-benefit analysis*

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 ceramics 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 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 not likely to have generated any direct costs.** As this requirement, however, entered into force only in June 2014, it is likely that costs will be incurred in the future.

**Figure 79. Fired refractories: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 56 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 following the introduction of energy efficiency regulation.

**Table 56. Fired refractories: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0	0
	Substantive compliance costs	Confidential	Confidential	0	0.08
	Direct charges	Confidential	Confidential	0	0
Indirect regulatory costs		Confidential	Confidential	0	0
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0</b>	<b>0.08</b>

Source: Authors' own elaboration.

### 6.6.6 Cost assessment – Unfired shaped refractories

#### Sample

A short overview of the number of questionnaires received can be found below in Table 57. In total the sample covers four respondents from the unfired shaped refractories subsector. The Research Team are unable to present a regional cost assessment for the unfired shaped refractories sector for any of the three regions, because fewer than three companies provided data.

**Table 57. Unfired shaped refractories: Total number of questionnaires received and used in the Chapter**

Subsector	Number of responding plants	Number of questionnaires used
	Total EU	
Unfired shaped refractories	4	4

*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 unfired shaped refractories manufacturers. Both the i) obligation to pass an energy audit and ii) requirement for 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 unfired shaped refractories 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 unfired shaped refractories subsector were asked about the costs of hiring external auditors and about the amount of time their employees<sup>138</sup> 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.

All of the four unfired shaped refractories manufacturers reported having passed an energy audit in 2012-15. No responding plants carried out the energy efficiency audit prior to 2012.

<sup>138</sup> Ibid.

**Table 58. Unfired shaped refractories: Number of plants that have carried out the energy efficiency audit 2012-15**

Subsector	Number of responding plants			
	Total EU	NWE	CEE	SE
Energy efficiency audit carried out	4	-	-	-
Energy efficiency audit not carried out	0	-	-	-

*Source: Authors' own elaboration.*

**In 2015, the weighted average of costs incurred at EU level was at €0.11/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 ranged between six and 50 working days for all plants for the years they carried out an audit. As labour costs vary from one Member State to another, the cost impact measured in the amount of working days varies.

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 ceramics 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 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 not likely to have generated any direct costs.** As this requirement, however, entered into force only in June 2014, it is likely that costs will be incurred occur in the future.

**Figure 80. Unfired shaped refractories: Cumulative regulatory costs of energy efficiency legislation 2006-15, EU average (€/tonne of production)**



Source: Authors' own elaboration.

Table 59 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 following the introduction of energy efficiency regulation.

**Table 59. Unfired shaped refractories: Cumulative regulatory costs of energy efficiency legislation 2015 (€/tonne of production)**

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	0.11
	Direct charges	0
Indirect regulatory costs		0
<b>Total regulatory costs</b>		<b>0.11</b>

Source: Authors' own elaboration.



## 7 Climate legislation

The present Chapter focuses on **the impacts on the ceramics 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 ceramics 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 sectors 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 great majority is carbon dioxide (CO<sub>2</sub>), and therefore all gasses are converted into CO<sub>2</sub> equivalent units according to their warming potential (known as CO<sub>2</sub>e). 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.<sup>139</sup> 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 installation 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

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<sup>139</sup> 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 ceramics 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 in 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: substantive compliance costs, administrative burdens and indirect costs. 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 ceramic 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.<sup>140</sup> 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.

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<sup>140</sup> 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 ceramics sectors indicate that instead of buying equipment for MRV, they rent it yearly from external verification companies. Therefore, the one-off start-up costs have not been 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 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 ceramic 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

$$\begin{aligned} \text{Substantive compliance costs (€)} &= \text{Emissions (tonnes of CO}_2\text{)} \\ &\quad - \text{Allocations (tonnes of CO}_2\text{)} \\ &\quad * \text{CO}_2\text{Price (€/tonne of CO}_2\text{)} \end{aligned}$$

Where:

- Emissions are the verified emissions of the installation.
- Allocations are the EUAs freely allocated to the installation.
- CO<sub>2</sub>Price is the average yearly market price of CO<sub>2</sub>.

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.
- CO<sub>2</sub>Price:
  - 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.<sup>141</sup>

**Table 60. Average yearly prices per tonne of CO<sub>2</sub> (euros)**

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CO <sub>2</sub> 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): these data are 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

$$\begin{aligned} \text{Indirect cost (€/Tonne of product)} &= \text{Purchased electricity (kWh/Tonne of product)} \\ &\quad * \text{Carbon intensity of electricity (CO}_2\text{/kWh)} \\ &\quad * \text{CO}_2\text{Price (€/Tonne of CO}_2\text{)} \\ &\quad * \text{Pass-on rate} \end{aligned}$$

Where:

- Purchased electricity: the amount of electricity to produce one tonne of product. This amount is plant and technology specific.
- Carbon intensity of electricity generation indicates the number of tonnes of CO<sub>2</sub> emitted by utilities to generate one kWh.
- CO<sub>2</sub>Price is the average yearly market price of CO<sub>2</sub>.

<sup>141</sup> This CO<sub>2</sub> 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.

- *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.<sup>142</sup> 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.
- *CO<sub>2</sub>Price*: the same data is utilised as in the previous section to create a yearly average price.

#### **7.6.5 Administrative burdens**

*Administrative burden (€/tonne of product) = Start-up costs (€/tonne of product)  
+ 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.

Additionally, it proved difficult for plants to provide numbers on start-up costs: many use equipment from external reviewers to monitor emissions and, therefore, costs that would be seen as start-up costs became 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

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<sup>142</sup> 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).

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). 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.

### **7.6.6 Data issues**

Three plants in the ceramics sectors (two in the ceramic tiles sector, one in the refractories sector) indicated difficulties in completing the full questionnaire with regards to purchased electricity. These three plants reported incomplete purchased electricity data. The missing years were filled in with extrapolations and interpolations. The methodology for these estimations are discussed in detail in the energy section of this Study.

## **7.7 *Cost assessment – Bricks and tiles***

### **7.7.1 Sample**

The sample in this section is the same as in other areas of legislation, and is discussed in depth in earlier Chapters (see Part A). Relevant to this Chapter is that 14 plants were not covered by the EU ETS for one or more years. Three of those plants were not covered during the entire period under analysis, one plant was only covered for Phases 2 and Phase 3 (2008-15), four plants were covered for Phases 1 and Phase 2 (2006-12), two plants entered the EU ETS in Phase 3 (2012-15), three plants were not covered during Phase 2 (2006-07 and 2012-15), and the last plant was not covered in 2006.

All these plants are included for the entire analysis, as the aim of this Study is to quantify average regulatory costs for sampled plants, irrespective of which areas of legislation are directly impacting them. These 14 plants do not face substantive compliance costs or administrative burdens in the years that they were not covered by the EU ETS, but do face indirect costs throughout the period studied.

### **7.7.2 Direct regulatory costs**

Two types of direct regulatory costs are relevant for bricks and tiles 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 almost 50% 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 –€7.44/tonne in one specific year. Overallocation was mostly an issue pre-2013, and in the latter years substantive compliance costs per tonne vary between –€1.40/tonne and –€0.70/tonne. The observations with very negative potential 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.

**Average substantive compliance costs are very different across regions, and show different trends.** In SE substantive compliance costs started low (–€0.36/tonne) but increased steadily (€0.09/tonne in 2009) till dropping significantly in 2010 (€0.24/tonne). Between 2011 and 2013 substantive compliance costs remained relatively stable around –€0.15/tonne, but in 2014 it once again dropped significantly to –€0.46/tonne. By 2015 substantive compliance costs in SE had recovered somewhat but was still negative at –€0.27/tonne.

The trend in NWE is much clearer: starting negatively at –€0.10/tonne in 2006, decreasing sharply to –€1.51/tonne by 2010. Since 2010 substantive compliance costs in NWE increased year on year, with the impact of the Phase 3 allocation rules being felt from 2013 onwards with a drop in (negative) substantive compliance costs of over 60% between 2012 and 2013. By 2015 it stood at –€0.04/tonne.

On the regional level, we can therefore conclude that **substantive compliance costs were relatively low in all three regions**, and were usually even negative. There is no clear convergence in regional averages, but substantive compliance costs observed in the latter years are significantly higher than the rest of the period for NWE. That trend cannot be observed yet in SE.

### *Administrative burdens*

As indicated above, administrative burdens are consistent across years and plants as most installations reported MRV costs only for 2015. However, there are large variations between plants. One plant reported MRV costs of less than €0.01/ tonne, while another plant reported MRV costs of over €0.30/ tonne. One plant was dropped, however, as its verification costs were considered outliers.<sup>143</sup>

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.

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<sup>143</sup> 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.



### 7.7.3 Indirect regulatory costs

Indirect costs are the most relevant costs for the bricks and tiles plants in this sample over the period under observation. 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.

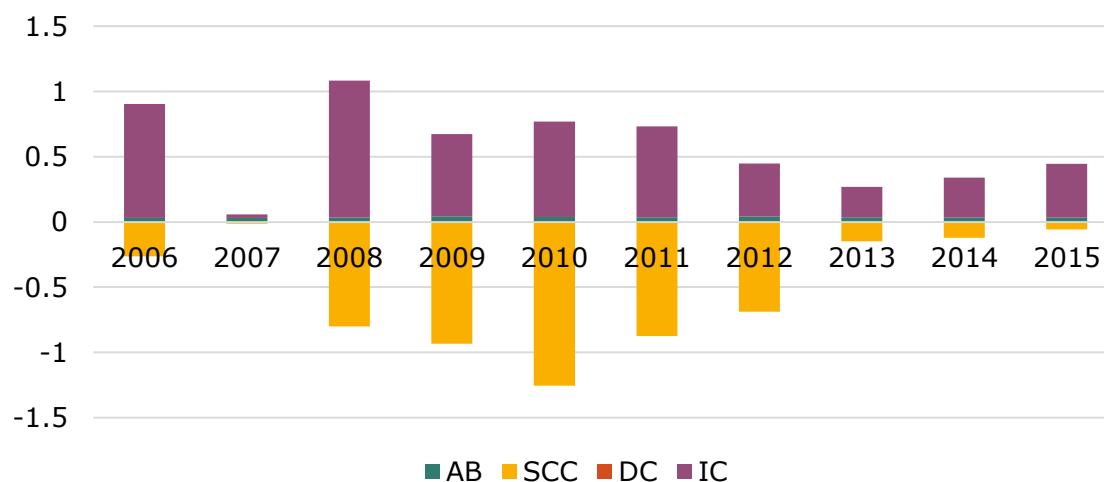
Two pass-on rates for indirect costs passed through by electricity providers to consumers were used in the analysis: 0.6 and 1. Of course, this had a direct impact on the results. When using a pass-on rate of 0.6, indirect costs vary between €0.01/tonne and €2.23/tonne, with an EU average of €0.40/tonne across the entire period. When using a pass-on rate of 1, indirect costs vary between €0.01/tonne and €3.72/tonne, **with an EU average of €0.67/tonne of bricks and tiles for the entire period**. One plant indicated very large energy intensity for one year when compared with other years, thus this plant was dropped for that specific year.

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 bricks and tiles producers, there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production: the bricks and tiles sector is characterised by relatively low electricity purchases: the average of the sample is 0.08 MWh/tonne of product. However, there are large differences between installations: the most electricity efficient consume 0.003 MWh/tonne and the least electricity efficient consume 0.15 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 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 81. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, EU weighted average (€/tonne – indirect cost pass-on rate 1), bricks and tiles sector**



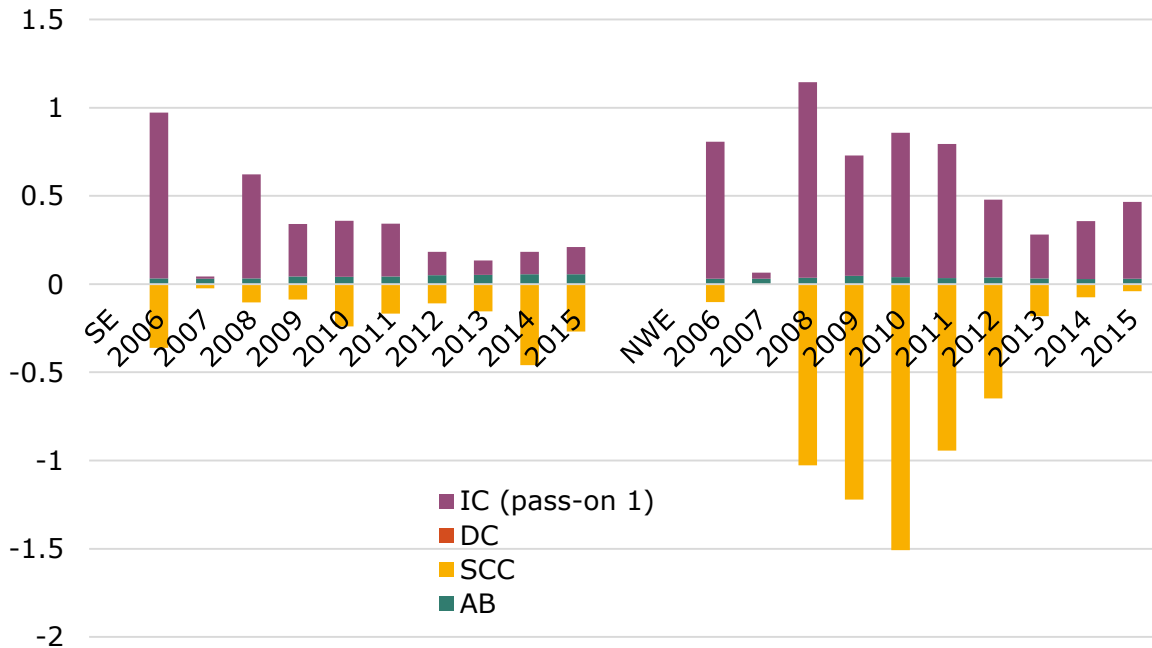
Source: Authors' own elaboration.

Figure 81 clearly indicates that administrative burdens are not significant. By contrast, substantive compliance costs and indirect costs are very relevant for bricks and tiles producers.

Substantive compliance costs were negative over the entire period, meaning that the sample was overallocated free allowances and could have sold those extra allowances leading to potential revenues from overallocation. Starting in 2013, however, the overallocation decreased significantly. 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 cost was –€0.26/tonne, which decreased to –€1.25/tonne by 2010, and increased year after year and in 2015 stood at –€0.06/tonne.

Indirect costs are significant for bricks and tiles 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 €1.05/tonne in the EU in 2008 to around €0.23/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 €0.41/tonne** (pass-on rate 0.6: €0.32/tonne).

**Figure 82. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, regional weighted averages for SE and NWE (€/tonne – indirect cost pass-on rate 1), bricks and tiles sector**



Source: Authors' own elaboration.

There were significant differences between regions, as can be observed in Figure 82 above. Indirect costs in NWE were substantively higher than in SE.

Substantive compliance costs were also substantially different between the two regions. In SE and NWE they remain negative (though relatively low; SE: –€0.27/tonne and NWE: –€0.04/tonne). The impact of the Phase 3 allocation rules is most clearly observed in NWE where windfall profits plummeted between 2012 and 2013.

Administrative burdens were stable in NWE: around €0.03/tonne. In SE, however, decreasing production volumes influenced administrative burdens during the period. Administrative burdens in 2006 were also €0.03/tonne, but this increased to €0.06 €/tonne in 2015. Though still relatively low, it nearly doubled over this period.

Table 61 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 might evolve in the future.

**At the EU level, administrative burdens were equal to €0.03/tonne, while substantive compliance costs (–€0.06/tonne) are negative. Indirect costs (€0.25 or €0.41/tonne depending on the pass-on rate) are more relevant for EU installations, but are still relatively low.**

On the regional level, some clear differences emerge. As discussed above, administrative burdens in SE were significantly higher than in NWE due to decreases in production levels in SE. Substantive compliance costs were negative in SE and NWE as installations in the sample remain on average oversupplied with free allocation, especially in SE, where this was also related to significant production decreases. Indirect costs remain significant in all regions, but were lowest in SE due to low carbon intensity of electricity generation.

**Table 61. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, bricks and tiles sector**

		Regions		EU
		NWE	SE	
Direct regulatory costs	Administrative burdens	0.03	0.06	0.03
	Substantive compliance costs	-0.04	-0.27	-0.06
	Direct charges	0	0	0
Indirect regulatory costs	Pass-on: 0.6	0.26	0.09	0.25
	Pass-on: 1	0.44	0.15	0.41
Total regulatory costs (pass-on rate 1)		<b>0.43</b>	<b>-0.06</b>	<b>0.39</b>

Source: Authors' own elaboration.

## **7.8 Cost assessment – Ceramic Tiles**

### **7.8.1 Sample**

The sample in this section is the same as in other areas of legislation, and is discussed in depth in earlier Chapters (see Part A). Relevant to this Chapter is that nine plants were not covered by the EU ETS for one or more years. Seven of those plants were not covered during Phase 1 and Phase 2 (2006-12), one plant entered the EU ETS in 2007, and one plant was not covered over the 2011-12 period.

All these plants are included for the entire analysis, as the aim of this Study is to quantify average regulatory costs for sampled plants, irrespective of which areas of legislation are directly impacting them. These nine 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 in order to be able to show that their emissions levels were low enough to stay under minimum thresholds to be included in the EU ETS.

### **7.8.2 Direct regulatory costs**

Two types of direct regulatory costs are relevant for ceramic tiles 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 about 40% 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 revenues were –€10.02/tonne for one specific year. Overallocation was mostly an issue pre-2013, and in the latter years substantive compliance costs per tonne varies between –€1.09/tonne and –€1.79/tonne. 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 were part of an increasing trend. The SE average of the sample reflect low and even negative substantive compliance costs in the beginning (–€0.57/tonne in 2006), followed by the lowest averages in 2009 (SE: –€1.07/tonne in 2009), then slowly increased and turned positive in 2013. The highest average substantive compliance costs were in 2015 (€0.32/tonne). The NWE region had a very different trend as none of the plants in the sample were covered by the EU ETS prior to 2013. Since then substantive compliance costs have increased as well: from €0.12/tonne in 2013 to €0.33/tonne in 2015.

On the regional level, we can therefore conclude that substantive compliance costs were frequently even negative in both areas. Regional averages did converge significantly towards the end of the period.

### *Administrative burdens*

As indicated above, administrative burdens were consistent across years and plants as most installations reported MRV costs only for 2015. However, there were large variations between plants. Two plants reported MRV costs of less than €0.01/tonne, while another plant reported MRV costs of over €0.25/tonne. **The EU average over all plants was €0.07/tonne for the entire period.** Two plants were dropped, however, as their outsourcing costs were several times higher than those reported by other comparable plants and they were therefore considered outliers.

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.

### **7.8.3 Indirect regulatory costs**

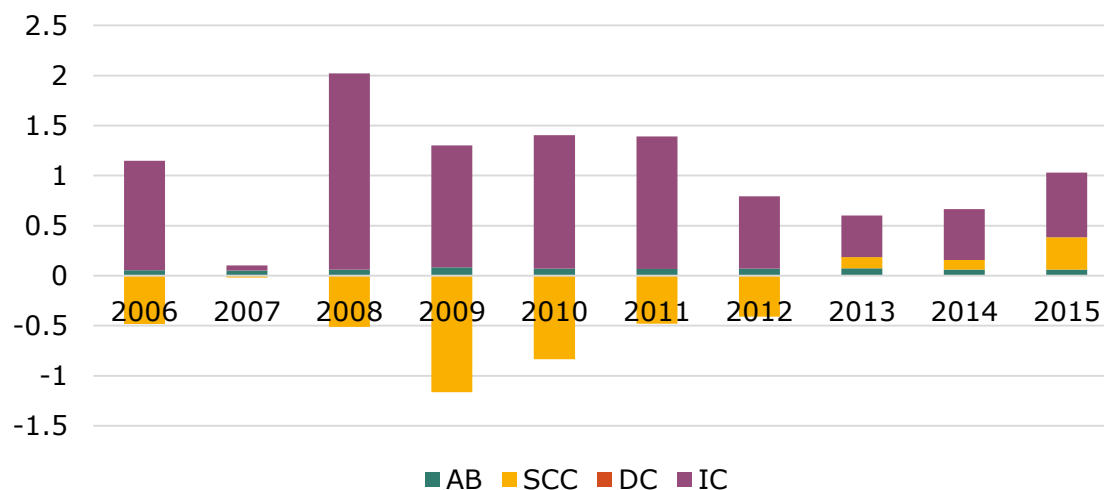
Indirect costs are the most relevant costs for the ceramic tiles plants in this sample over this period. As noted before, the methodology used here will likely lead to an overestimation of indirect costs as the carbon intensities of electricity generation could potentially be overstated in several Member 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 €0.08/tonne and €1.48/tonne, with an EU average of €0.40/tonne for the entire period. When using a pass-on rate of 1, indirect costs vary between €0.01/tonne and €3.72/tonne, **with an EU average of €0.67/tonne of ceramic tiles for the entire period.** One plant indicated very large energy intensity for one year when compared with other years; this plant was dropped for that one year. 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 ceramic tiles producers there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production: the ceramic tiles sector is characterised by a relatively low electricity purchases: the average of the sample was 0.22 MWh/tonne of product. However, there were large differences between installations, with the most electricity efficient consuming 0.02 MWh/tonne and the least electricity efficient consuming more than 0.35 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 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.

#### 7.8.4 Cumulative regulatory costs

**Figure 83. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, EU weighted average (€/tonne – indirect cost pass-on rate 1), ceramic tiles sector**



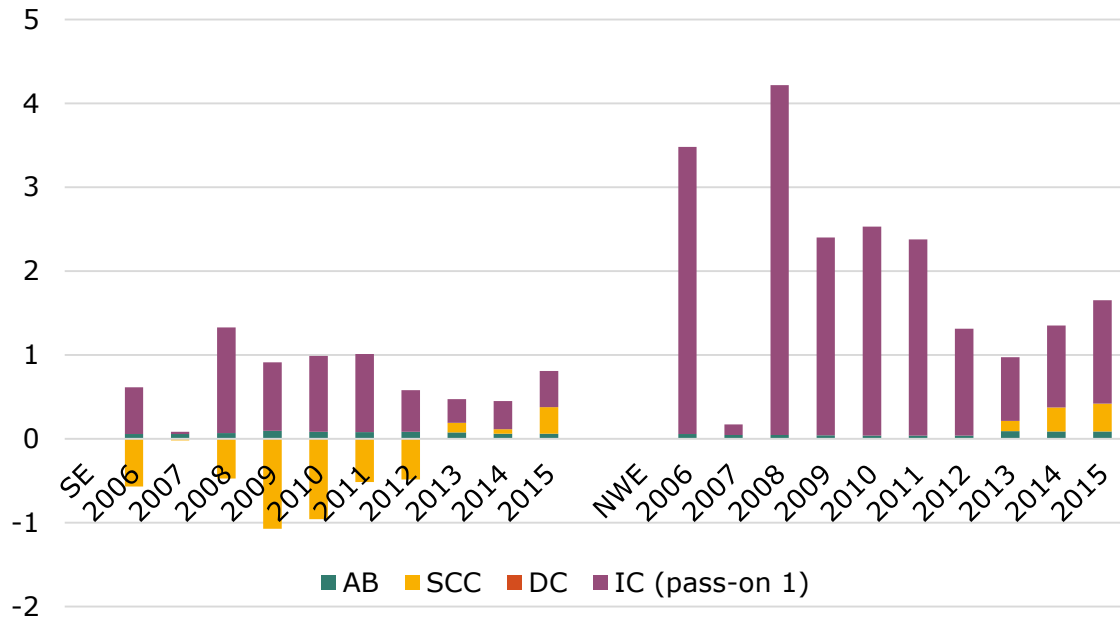
Source: Authors' own elaboration.

Figure 83 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 bricks and tiles producers.

Substantive compliance costs were negative till 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. However, starting in 2013 the overallocation decreased significantly and substantive compliance costs turned positive. This evolution is 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 –€0.48/tonne, which decreased to –€1.16/tonne by 2009, and then increased significantly and in 2015 stood at €0.32/tonne.

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 put downwards 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 €1.10/tonne in the EU in 2006 to €1.96/tonne in 2008. Between 2009 and 2011 indirect costs were relatively stable between €1.22 and €1.33/tonne. 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 €0.64/tonne** (pass-on rate 0.6: €0.39/tonne).

**Figure 84. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, regional weighted averages for SE and NWE (€/tonne – indirect cost pass-on rate 1), ceramic tiles sector**



Source: Authors' own elaboration.

There were significant differences between regions, as can be observed in Figure 84 above. Indirect costs in NWE were significantly higher than in SE, mostly due to higher carbon intensities of electricity production in NWE countries. Additionally, the least electricity intensive plants were all located in SE.

Substantive compliance costs were also substantially different in the two regions. While substantive compliance costs were negative in SE up till 2012, they turned positive between 2013 and 2015 (while remaining relatively low, however). In NWE, no plants in the sample were covered by the EU ETS until 2012: for this region substantive compliance costs was therefore 0 until 2013, when it followed the trend in SE: positive, but low. The impact of the Phase 3 allocation rules is most clearly observed in SE where windfall profits plummeted between 2012 and 2013.

In SE, decreasing production volumes influenced administrative burdens during the period. Administrative burdens in 2006 was also €0.05/tonne, but this increased to €0.09/tonne in 2009. By 2015 it decreased to €0.06/tonne. In NWE it was stable at around €0.04/tonne for those plants that stated they had to monitor emissions even if they were not covered by the EU ETS. In 2013, as plants entered the scheme, administrative burdens increased to just under €0.09/tonne, where it remained for the rest of the period.

Table 62 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.

**Table 62. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, ceramic tiles sector**

		Regions		EU
		NWE	SE	
Direct regulatory costs	Administrative burdens	0.09	0.06	0.06
	Substantive compliance costs	0.33	0.32	0.32
	Direct charges	0	0	0
Indirect regulatory costs	Pass-on: 0.6	0.74	0.26	0.39
	Pass-on: 1	1.23	0.43	0.64
<b>Total regulatory costs (pass-on rate 1)</b>		<b>1.65</b>	<b>0.81</b>	<b>1.03</b>

Source: Authors' own elaboration.

On the EU level, administrative burdens were indeed not high (€0.06/tonne), while substantive compliance obligations (€0.32/tonne) were more significant for producers. Indirect costs (€0.39 or €0.64/tonne, depending on the pass-on rate) were even more relevant for EU installations but still relatively low.

On the regional level some clear differences emerge. As discussed above, administrative burdens in NWE were significantly higher than in SE. Indirect costs were substantially higher in NWE than in SE, due to higher carbon intensity of electricity generation in the region.

Substantive compliance costs, on the other hand, were comparable across regions: positive in 2015 but low at around €0.33/tonne.

**Total EU ETS costs were substantial (€1.03/tonne on average in EU) but relatively low when compared to other sectors**

In this sample four plants are considered SMEs. When only analysing those plants we can observe that administrative burdens were significantly higher (€0.11/tonne) due to lower production levels. Substantive compliance costs were significantly lower than the EU average, which includes SMEs and non-SMEs: €0/tonne in 2015. However, indirect costs were over twice as high, as electricity intensity was far higher for the SMEs in the sample (pass-on rate 0.6: €0.85/tonne pass-on rate 1: €1.41/tonne). Overall EU ETS costs for SMEs in the ceramic tiles sample for 2015 were therefore €1.53/tonne (not regionally weighted).



## **7.9 Cost assessment – Fired Refractories**

### **7.9.1 Sample**

The sample in this section is the same as in other areas of legislation, and is discussed in depth in earlier Chapters. Relevant for this Chapter on climate change is that three plants were not covered by the EU ETS at all over the period. The other fired refractories plants were included for the entire period.

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 or administrative burdens in the years that they were not covered but did face indirect costs throughout the period studied.

### **7.9.2 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 and years, and were negative for just over 50% of all observations in this subsector. This means that plants were overallocated EUAs, and therefore could have sold surplus EUAs on the market. The substantive compliance costs simple average of all plants and all years was –€0.26/tonne. The plant with the largest overallocation had negative substantive compliance costs of –€3.10/tonne for one specific year.

In this sample, substantive compliance costs were positive up to 2008 for SE but fell significantly after that. SE substantive compliance costs decreased from €0.53 to –€0.98/tonne over the same period. This trend was partially caused by a limited number of plants that changed their production output significantly and repeatedly over the period, with several plants changing production by around 40% over the period. By decreasing production, more allowances per tonne of product were received, while overall emissions went down. This led to lower substantive compliance costs.

#### *Administrative burdens*

As indicated above, administrative burdens were consistent across years and plants as most installations reported MRV costs only for 2015. However, there were large variations between plants. Administrative burdens costs were between €0.06/tonne and €0.30/tonne. The large difference between plants was largely due to differences in production levels. Costs for external verification and outsourcing of monitoring and reporting were very similar across plants.

### **7.9.3 Indirect regulatory costs**

Indirect costs were the most relevant costs for the fired refractories 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.

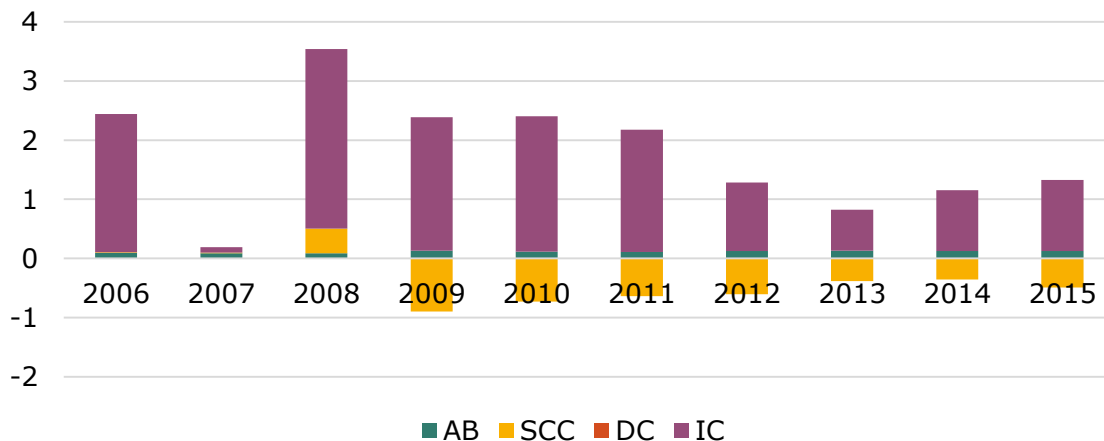
Two pass-on rates for indirect costs passed through by electricity providers to consumers were used in the analysis: 0.6 and 1. Of course, this had a direct impact on the results. When using a pass-on rate of 0.6, indirect costs vary between €0.02/tonne and €6.85/tonne, with a simple EU average of €1.39/tonne over the entire period. When using a pass-on rate of 1, indirect costs vary between €0.04/tonne and €11.41/tonne, **with an EU average of €2.31 €/tonne for fired refractories over the entire period**. The large variation in the sample is explained by the differences in products; some plants indicated that they produce isostatic pieces, which are lighter but more valuable, and these plants have far lower levels of production in terms of tons. Costs per tonne were therefore substantially higher for these plants.

There are three main determinants for indirect costs (beyond pass-on rates):

- Carbon intensity of electricity generation: in the case of this sample of fired refractories producers there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production; the fired refractories sector is characterised by a wide variety in electricity consumption: the average of the sample was 0.29 MWh/tonne of product, with the most electricity efficient consuming 0.09 MWh/tonne and the least electricity efficient consuming 1.08 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 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.

#### 7.9.4 Cumulative regulatory costs

**Figure 85. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, EU weighted average (€/tonne – indirect cost pass-on rate 1), fired refractories subsector**



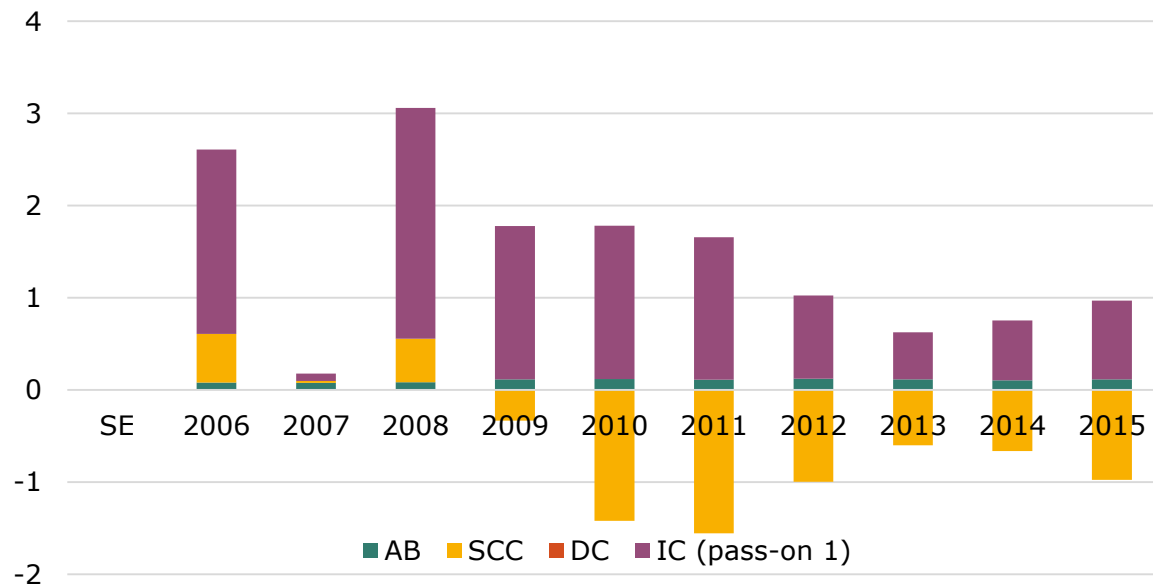
Source: Authors' own elaboration.

Figure 85 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 fired refractory producers.

Substantive compliance costs were small but positive up to 2008, but turned negative in 2009 and remained that way till the end of the entire period, meaning that the sample was overallocated free allowances and could have sold those extra allowances. In 2006 substantive compliance costs was €0.01/tonne, but this decreased to –€0.90/tonne by 2009. In 2015 it was –€0.49/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 saw indirect costs decrease from €3.03/tonne in the EU in 2008 to €0.69/tonne in 2013. Since then, slowly rising EUA prices resulted in increases in indirect costs. **In 2015 indirect costs with pass-on rate 1 were an estimated €1.20/tonne (pass-on rate 0.6: €0.72/tonne).**

**Figure 86. Yearly overview of regulatory costs generated by the EU ETS and linked implementing legislation, regional weighted averages for SE (€/tonne – indirect cost pass-on rate 1), fired refractories subsector**



Source: Authors' own elaboration.

Table 63 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.

**Table 63. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, fired refractories**

		Regions	EU
		SE	
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.11	0.13
	<b>Substantive compliance costs</b>	-0.98	-0.49
	<b>Direct charges</b>	0	0
<b>Indirect regulatory costs</b>	<b>Pass-on: 0.6</b>	0.51	0.72
	<b>Pass-on: 1</b>	0.86	1.20
<b>Total regulatory costs (pass-on rate 1)</b>		<b>-0.01</b>	<b>0.83</b>

Source: Authors' own elaboration.

On the EU level, administrative burdens were higher than for other ceramic subsectors due to lower output levels in the fired refractories sector (€0.13/tonne), while substantive compliance obligations (-€0.49/tonne) were negative. Indirect costs (€0.72 or €1.20/tonne, depending on the pass-on rate) were more relevant for EU installations.

## **7.10 Cost assessment – Unfired shaped refractories**

### **7.10.1 Sample**

The sample in this section is the same as in other areas of legislation, and is discussed in depth in earlier Chapters. Relevant for this Chapter on climate change is that some of the plants in this sample were not covered by the EU ETS for the entire period under study.

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 directly impact them. Plants not covered by the EU ETS did not face substantive compliance costs or administrative burdens but did face indirect costs throughout the period studied.

One plant indicated that their contract with their electricity provider does include a clear carbon cost. However, the company was unwilling to share that data as they deemed it highly confidential. Therefore, the methodology to estimate indirect costs is also used for this plant.

### **7.10.2 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 at the EU level were negative since 2008, meaning that plants were overallocated EUAs, and therefore could have sold surplus EUAs on the market.

### *Administrative burdens*

EU weighted averages were around 0.05 €/tonne between 2006 and 2015.

### **7.10.3 Indirect regulatory costs**

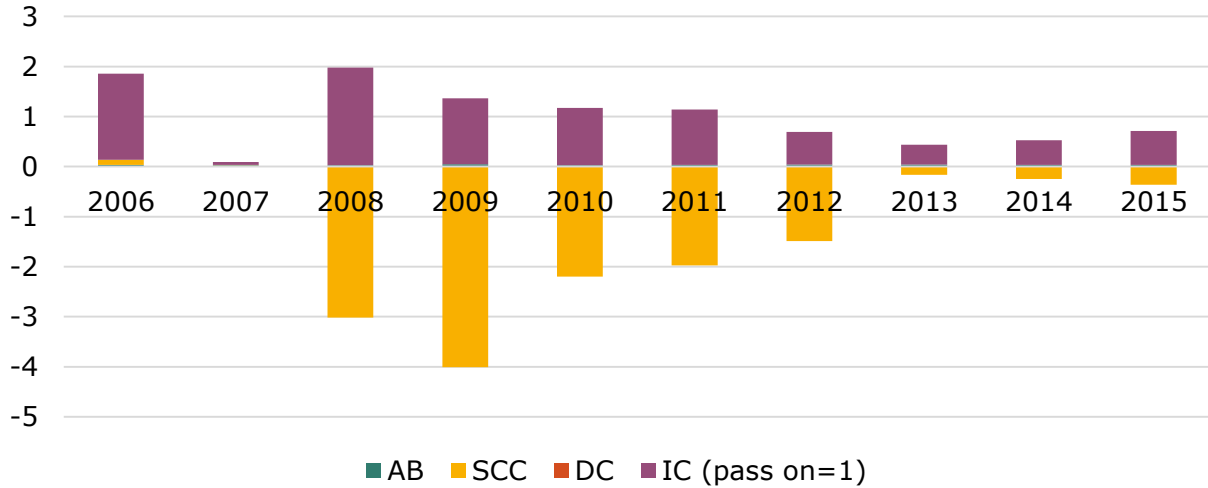
Indirect costs were the most relevant costs for the unfired shaped refractories plants in this sample over this period. As noted before, the methodology used here will likely lead to an overestimation of indirect costs as the carbon intensities of electricity generation could potentially be overstated 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 €0.02/tonne and €1.86/tonne, with an EU average of €0.54/tonne over the entire period. When using a pass-on rate of 1, indirect costs vary between €0.04/tonne and €3.10/tonne, **with an EU average of €0.91/tonne of unfired shaped refractories**. 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 unfired shaped refractories producers there was a large difference in carbon intensity of electricity generation.
- Purchased electricity intensity of production: the unfired shaped refractories sector is characterised by relatively low electricity purchases: the average of the sample was 0.13 MWh/tonne of product. However, there were large differences between installations, with the most electricity efficient consuming 0.08 MWh/tonne and the least electricity efficient consuming 0.20 MWh/tonne.
- 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.

**7.10.4 Cumulative regulatory costs**

**Figure 87. Yearly overview of regulatory costs generated by the EU ETS, EU weighted average (€/tonne – indirect cost pass-on rate 1), unfired shaped refractories subsector**



Source: Authors' own elaboration.

Figure 87 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 unfired shaped refractories producers.

Substantive compliance costs were negative between 2008 and 2015, 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.

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 €1.95/tonne in 2008 to €0.40/tonne in 2013. Since then the slowly rising EUA prices resulted in moderate increases in indirect costs. In 2015 indirect costs with pass-on rate 1 were an estimated €0.68/tonne (pass-on rate 0.6: €0.41/tonne).

Table 64 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, 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 limited (€0.04/tonne), while substantive compliance obligations (-€0.36/tonne) are negative. Indirect costs (€0.41/tonne or €0.68/tonne depending on the pass-on rate) were the most relevant cost for sampled EU installations. **Total EU ETS related costs for sampled unfired shaped refractories were relatively low: €0.35/tonne of product.**

**Table 64. Regulatory costs generated by the EU ETS and linked implementing legislation in the EU (€/tonne – average costs), 2015, unfired shaped refractories subsector**

		<b>EU</b>
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.04
	<b>Substantive compliance costs</b>	-0.36
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>	<b>Pass-on: 0.6</b>	0.41
	<b>Pass-on: 1</b>	0.68
<b>Total regulatory costs (pass-on rate 1)</b>		<b>0.35</b>

*Source: Authors' own elaboration.*

## 8 Environmental legislation for the ceramics sector

### 8.1 Description of the Act

The **Industrial Emission Directive (IED)**<sup>144</sup> 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”.<sup>145</sup>

The IED entered into force in subsequent steps between 2014 and 2016,<sup>146</sup> replacing the Integrated Pollution and Prevention Control (IPPC) Directive,<sup>147</sup> 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.<sup>148</sup>

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.<sup>149</sup> In the permit, Emission Limit Values (ELV) are set based on the so-called Best Available Techniques (BAT). The BAT and the associate 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 IED<sup>150</sup> 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 depending upon the level of risk. The competent authorities shall regularly visit each site, the frequency being decided upon a systematic appraisal of the environmental risks of the installations concerned; in any case, the period shall not exceed one year for installations posing the highest risks and three years for installations posing the lowest risks.<sup>151</sup>

**Legislation on industrial emissions is relevant for all ceramics sectors, with the partial exception of the unfired refractory producers.** Indeed, the IED and the BREFs<sup>152</sup> specifically apply to the **manufacturers of ceramics products by firing**, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, **with a production capacity exceeding 75 tonnes per day** and/or with a kiln capacity

<sup>144</sup> Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (Industrial Emissions Directive, IED).

<sup>145</sup> Art. 1 IED.

<sup>146</sup> 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.

<sup>147</sup> Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC).

<sup>148</sup> 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).

<sup>149</sup> Art. 4 and Art. 5 IED.

<sup>150</sup> Art. 13 IED.

<sup>151</sup> Art. 16 and 23 IED.

<sup>152</sup> European Commission (2007), Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry.



exceeding 4 m<sup>3</sup> and with a setting density per kiln exceeding 300 kg/m<sup>3</sup>.<sup>153</sup> Thus, EU environmental legislation applies to the vast majority of installations in the ceramics industry, which are included among industries listed in Annex I of IED and have their own approved BREF document.<sup>154</sup>

The **BREF** for ceramics regulates emissions to air, water and waste, as well as noise and odours. The most important emissions produced by the ceramics industry are those to air, in particular, dust from the raw material preparation, drying, firing, and finishing phases and gaseous emissions, such as carbon oxides, nitrogen oxides, sulphur oxides, inorganic fluorine and chlorine compounds, organic compounds and heavy metals, especially from fossil fuels and the calcination of raw materials during the firing phase and the breakdown and formation of compounds during the firing process. Water, though being a very important raw material, eventually evaporates during the drying and firing stages. Hence, process wastewater is only produced in small quantities, e.g. while mixing raw materials, cooling or cleaning finished products. Finally, waste consists in the sludge originating from wastewater, broken material/ware, dust, plaster moulds, sorption agents and other solid residues. Waste is partly recycled into the plant and for the rest supplied as raw material to other industries or disposed of.<sup>155</sup>

The BREF identifies a series of **BATs** for the prevention or minimisation of pollution applicable to the various stages of the ceramics 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 of energy consumption and the prevention and control of air emissions, with special emphasis on the emissions of dust (particulate matter), hydrogen fluorides (HF), and nitrogen and sulphur oxides (NO<sub>x</sub> and SO<sub>x</sub>, respectively). 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.<sup>156</sup> 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**:

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<sup>153</sup> Annex I to the IED, § 3.5.

<sup>154</sup> European Commission (2007), Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry.

<sup>155</sup> BREF for ceramics, pp. 89-92.

<sup>156</sup> 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<sup>157</sup>; 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 ceramics sector, as illustrated in Box 12); 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 12. The Role of Environmental Subsidies in the Ceramics 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, 43 out of 50 ceramics plants replied to this additional questionnaire,<sup>158</sup> indicating that the impact of these subsidies in the ceramics industry was almost negligible. Indeed, more than half of the interviewees (25) reported a total absence of environmental subsidies in the sector, a fifth (8) assessed their role as marginal and only one as moderate. The remainder was 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). Additionally, the internal expert panel and two national associations confirmed the negligible to marginal role of environmental subsidies in the ceramics sector. Coherently, as few as three plants claimed to have received an environmental subsidy between 2006 and 2015. When compared with the total estimate of environmental investment made by the 43 plants, **the incidence of the environmental subsidies was estimated at 1.5% 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 ceramics sector was found. However, this is not surprising considering that in the case of ceramics 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 aid 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 ceramics industry. Still, assuming that the sector

<sup>157</sup> 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.

<sup>158</sup> Note that the four plants producing unfired shaped refractories are not covered by the IED; therefore, they were not asked to provide information on environmental subsidies.

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 for as low as 1% of these expenditures** (a value fully 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 ceramics 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 13. 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 treatment 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 was 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 2014; and iii) the financial costs incurred for the financing of all investments made since 2006.

To measure the regulatory costs associated with 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, kiln improvement, 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 ceramics 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 applied minimum BAU, even when companies reported that an investment was 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 14),<sup>159</sup> 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,<sup>160</sup> the **average shares of CAPEX attributable to EU legislation**

<sup>159</sup> 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.

<sup>160</sup> 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

**were set at 50%, 74% and 76% for the plants surveyed in the ceramic tiles, bricks and tiles, and fired refractories sectors, respectively.**

#### **Box 14. 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 factors for the ceramics sectors 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 annualised, considering an average life of the assets of 15 years, a fairly typical value for capital expenditure in the ceramics industry (as indicated by interviewees as well as secondary sources, such as the general depreciation rates adopted by national revenue authorities<sup>161</sup>).
- 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 sources.
- 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.

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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.

<sup>161</sup> The retained value is also broadly in line with the assumptions made in a recent European Commission 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).

- 3) Out-of-pocket expenses that may have 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 – Bricks and Tiles**

##### **8.4.1 Sample**

The analysis is based on data from all the 23 bricks and tiles plants that responded to the questionnaire. About half the questionnaires (12) concern plants from the NWE region, but an adequate number of plants was surveyed also in other regions, i.e. five in CCE and six in SE. Nonetheless, results for the CEE region cannot be shown due to confidentiality issues; in fact, the minimum requirement of having three different companies is not satisfied.

##### **8.4.2 Substantive compliance costs**

For the substantive costs incurred in connection with emission limits, estimated cost parameters are briefly illustrated here below.

- A minority of the operators surveyed (10) reported to have made **environment-related investments** over the 2006-15 period, for a total of about €10.1 million, giving an average value of some €450,000 per plant (commonly falling between €100,000 and €1 million per plant). Most of the surveyed operators had reportedly incurred similar environmental protection expenditures before year 2006. When the role played by local and national factors as well as of other determinants of plants' investments (such as company strategies and/or energy efficiency considerations) is taken into consideration, the value of environment-related investments attributable to the EU legalisation declines to €7.5 million (and the average value per plant to €330,000). Dust/fluoride filters and wastewater treatment systems are the most commonly reported types of investment (a much larger investment on a desulphurisation system was reported by only a single plant).
- According to the information gathered from the operators surveyed, the value of the additional operating costs associated with these environment-related investments is rather small. OPEX/CAPEX ratios provided by the producers surveyed were broadly consistent in the case of filters (in the 2%-5% range), while more significant variations characterised ratios for wastewater treatment systems, going from 4% up to 25%. Overall, the **annual average value of OPEX** during the 2006-15 period has been set at €20,000 per plant, i.e. about 5% of CAPEX, on average.
- When the financial costs incurred in connection with environmental protection investment are also taken into account, **in 2015, the cumulated substantive compliance costs for the bricks and tiles producers were an estimated €0.58/tonne at EU (weighted average) level. This value was largely driven by plants in NWE region, where costs were an estimated €0.79/tonne. Significantly smaller values were found in the other two regions, e.g. €0.12/tonne in SE.**

### 8.4.3 Administrative Costs

For administrative costs associated with the environmental legislation, estimated cost parameters are briefly illustrated here below.

- Only about half of the facilities (11) surveyed were issued a new IEP between 2006 and 2015 (as in the other cases, permits were obtained in previous years). A tiny majority of the operators (12) had to update the IEP, due to changes in operating conditions, typically in connection with an expansion or modernisation of the plant's capacity. Only in three cases did plants have to update the IEP more than once. Besides internal staff costs, all the plants that got/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 €15,000. 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 €2,500, on average.
- Bricks and tiles producers are regularly subject to inspections to verify the fulfilment of conditions specified in the IEP, commonly on an annual basis. About one-third of the plants reported a lower frequency of inspections, typically every two years. The annual administrative burden due to this information obligation, essentially consisting of the staff time devoted to accompany inspectors and, in case, prepare/follow-up on inspections, is about €1,000 per plant. Only slightly more significant are costs incurred by plants to monitor emissions levels. In this case, besides internal staff costs, the vast majority of the plants (19) also incurred expenditures to pay external contractors for monitoring (and auditing) emission limits, paying an annual amount of €2,700, on average. Virtually none of the interviewees reported incurring investment and related-operating costs to the same purpose. Overall, **annual costs linked to compliance inspections and monitoring of emissions** typically range from €2,000 to some €20,000 per plant.
- Based on the above, in 2015, the **annual value of administrative costs** incurred by bricks and tiles producers expressed in terms of unit of output has been estimated at **€0.14/tonne at EU (weighted average) level. Differences across regions are not marked, going from €0.15/tonne in NWE up to €0.23/tonne in SE.**

### 8.4.4 Cumulative regulatory costs

Table 65 shows the regulatory costs per tonne generated by the environmental legislation over the 10-year period of the analysis on the bricks and tiles sector, for the EU and the three regions. **The EU weighted average of the cumulated regulatory costs in this sector in 2015 has been estimated at €0.73/tonne, largely driven by substantive compliance costs, which account for almost 80% of the total.** As indicated above, cumulated regulatory costs are more comparatively significant in the NWE region (€0.93/tonne), due to the larger size of environmental protection investment made during the period under review. The cumulated regulatory costs per tonne generated by the environmental legislation in 2015 represents about 3.7% of the average value of EBITDA registered by sampled plants during the period under review. Considering that EBITDA is an underestimated proxy of the value added (which is closely approximated by EBITDA plus compensation of employees), the estimated costs are broadly in line with the findings of the Commission report on the costs of environmental legislation for selected industries over time,<sup>162</sup> which, in 2012, set the environmental protection expenditure at about 2% of value added of the manufacturing sector.

<sup>162</sup> EC, Environmental Expenditures in EU industries, November 2015.

**Table 65. Regulatory costs generated by the environmental legislation on the bricks and tiles sector (€/tonne, 2015)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.15	<i>Confidential</i>	0.23	0.14
	Substantive compliance costs	0.79	<i>Confidential</i>	0.12	0.58
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
<b>Total regulatory costs</b>		<b>0.93</b>	<i>Confidential</i>	<b>0.35</b>	<b>0.73</b>

Source: Authors' own elaboration.

## 8.5 Cost assessment – Ceramic tiles

### 8.5.1 Sample

The analysis is based on data from all 16 ceramic tiles plants that responded to the questionnaire and could be used. No less than four questionnaires for each region were collected, hence regional estimates can be presented. Nonetheless, results for the CEE region cannot be shown due to confidentiality issues; in fact, the minimum requirement of having three independent companies is not satisfied.

### 8.5.2 Substantive compliance costs

For the substantive costs incurred in connection with emission limits, estimated cost parameters are briefly illustrated here below.

- The majority of the operators surveyed (13) reported to have made **environment-related investments** over the 2006-15 period worth a total of €12.3 million (values per plant largely fall between €300,000 and €1.1 million with average value of €770,000 per plant). When only the share of these investments attributable to the EU legislation is taken into account, this value halves, down to €6.1 million and €380,000 per plant, on average. As in the case of bricks and tiles producers, dust/HF filters and wastewater treatment systems are the most common environment-related investments made (only one plant reported a more significant investment, concerning the substitution of a kiln).
- Operators surveyed reported additional costs associated to these environment-related investments of limited size. On average, the OPEX/CAPEX ratios are an estimated 4-7%, leading to an **annual average value of OPEX** during the 2006-15 period of some €20,000 per plant.
- When the financial costs incurred in connection with environmental protection investment are added to the above cost components, **in 2015, the cumulated substantive compliance costs for the ceramic tiles producers are an**



**estimated €1/tonne at EU (weighted average) level. Comparatively somewhat higher values were found in the SE and NWE regions, i.e. €1.13/tonne and €0.81/tonne, respectively, than in the CEE region.**

### **8.5.3 Administrative Costs**

For administrative costs associated with the environmental legislation, estimated cost parameters are briefly illustrated here below.

- The majority of the facilities (10) surveyed were issued a new IEP between 2006 and 2015, while the remainder of the operators surveyed obtained permits in previous years (in some cases back to the 1990s). The vast majority of the operators (13) had to update/renew the IEP at least once during the period of analysis due to a modernisation of the plant's equipment or the expiration of the permit validity. In most of the cases (eight), the permit had to be updated more than once, typically two or three times. More than half of the plants (10) made recourse to external experts to assist them in the preparation of the technical documentation. The average amount of these out-of-pocket expenditures was about €8,000 per IEP issuance/update. 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 €3,500.
- About half of the ceramic tiles producers reported to be subject to inspections to verify the fulfilment of conditions specified in the IEP on an annual basis. The remainder of the plants reported a lower frequency of inspections, i.e. every two to four years. Associated annual administrative costs for the plants were reported to be about €1,200, on average. All the operators surveyed invariably resorted to external service providers for monitoring and/or auditing emission limits. Information gathered from producers surveyed on the annual fee paid to these external experts were largely consistent, with an average value of about €7,500 per plant. Overall, the **annual costs linked to compliance inspections and monitoring of emissions** typically range from €4,000 to some €35,000 per plant, with an average value of some €17,000.
- Summing up the above annual administrative costs and dividing them by the average output production, in 2015, the **administrative costs incurred by ceramic tiles producers** were estimated **€0.22/tonne at EU (weighted average) level. Differences across regions were small, for instance €0.18/tonne in the NWE compared to €0.24/tonne in SE.**

### **8.5.4 Cumulative regulatory costs**

Table 66 shows the regulatory costs per tonne generated by the environmental legislation over the 10-year period of the analysis on the ceramic tiles sector, for the EU and the two regions. The costs for the ceramic tiles sector are only slightly higher than the estimates previously illustrated for the bricks and tiles producers. **Indeed, the EU weighted average of the cumulated regulatory costs in this sector in 2015 has been estimated at €1.25/tonne (compared to €0.73/tonne for the bricks and tiles sector)**, with a similar incidence of substantive compliance costs, accounting for more than 80% of total regulatory costs. The estimated cumulated regulatory costs generated by the environmental legislation accounts for as low as 1.1% of the average value of EBITDA registered by sampled plants during period under review, below the average value for the manufacturing sector estimated in the recent Commission report on the costs of environmental legislation,<sup>163</sup> i.e. 2% in 2012.

<sup>163</sup> EC, Environmental Expenditures in EU industries, November 2015.

**Table 66. Regulatory costs generated by the environmental legislation on the ceramic tiles sector (€/tonne, 2015)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.18	<i>Confidential</i>	0.24	0.22
	Substantive compliance costs	0.81	<i>Confidential</i>	1.13	1.03
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		0	<i>Confidential</i>	0	0
Total regulatory costs		<b>0.99</b>	<b><i>Confidential</i></b>	<b>1.37</b>	<b>1.25</b>

Source: Authors' own elaboration.

## 8.6 Cost assessment – Refractories

### 8.6.1 Sample

The analysis is based on the review of 11 questionnaires from fired refractory producing plants. Environmental legislation only tangentially applies to unfired refractory producers as indicated above, thus they were excluded from the analysis. Furthermore, it is important to underline upfront that two operators surveyed do not fall within IED parameters and administrative procedures due to their small production capacity. Given the narrow size of the sample, estimates can be presented only at EU level.

### 8.6.2 Substantive compliance costs

For the substantive costs incurred in connection with emission limits, estimated cost parameters are briefly illustrated here below.

- With the obvious exclusion of the two plants falling outside the scope of the IED (IPPC), all fired refractories producers surveyed (nine) reported to have made **environment-related investments** over the 2006-15 period, for a total of a €15.1 million (with average value of €1.4 million per plant and most of the values falling between €230,000 and €2.5 million). When the share of these investments attributable to the EU legislation is taken into account, this value only partially decreases to €11.5 million (and to €1 million per plant), further confirming the significant role played by normative prescriptions. The range of environment-related investments reported by fired refractories producers is more diversified than the one of other ceramics sectors, encompassing regenerative afterburning systems, regenerative thermal oxidizer, and kiln refurbishment/realignment, among others.
- Consistent with the above, the additional costs associated with these environment-related investments (which typically include consumables that are more expensive) were reported to be more significant than other ceramics sectors. On average, the OPEX/CAPEX ratios have been estimated in the 15-20% range, leading to an

**annual average value of OPEX** during the 2006-15 period of some €70,000 per plant.

- When the financial costs incurred by fired refractories producers in connection with environmental protection investment are added to the above cost components, **the EU weighted average value of the cumulated substantive compliance costs in 2015 has been estimated at €10.31/tonne.**

### **8.6.3 Administrative Costs**

For administrative costs associated with the environmental legislation, estimated cost parameters are briefly illustrated here below.

- About half of the fired refractories producers (six) surveyed were issued a new IEP between 2006 and 2015. The remainder includes operators that obtained permits in previous years and/or not subject to expiration as well as, noticeably, the two plants falling outside the scope of the IED. Only a minority of the operators (four) had to update the IEP, typically once, during the period of analysis. All plants required to obtain/update the IEP needed the assistance of external services providers to prepare technical documents to be submitted to competent authorities. The value of these services go from as low as €1,000 up to €20,000 per IEP issuance/update. Overall, and including plants not required to get the IEP, the **annual administrative costs linked to the issuance/renewal/updating of the IEP** incurred by fired refractories plants over the 2006-15 period have been estimated at €3,300.
- Fired refractory producers reported to be subject to inspections to verify the fulfilment of conditions specified in the IEP typically every two or three years, generating administrative costs to surveyed plants of about €1,400 per year, on average. Almost all the operators surveyed made recourse to external service providers for monitoring and/or auditing emission limits. The annual fee reportedly paid to these providers ranges between €5,000 and €30,000, with an average annual value of €9,000 per plant. Overall, **annual costs linked to compliance inspections and monitoring of emissions** have been estimated at some €22,000 (€27,000) per plant, on average (in brackets, the value without operators falling outside the scope of the IED).
- Summing up the above annual, administrative costs and dividing them by the average output production, the **administrative costs** incurred fired refractories producers in 2015 has been estimated at **€0.86/tonne at the EU (weighted average) level.**

### **8.6.4 Cumulative regulatory costs**

Table 67 shows the regulatory costs per tonne generated by the environmental legislation over the 10-year period of the analysis on the fired refractories subsector at the EU level. **EU regulatory costs per tonne has been estimated at €11.17 per tonne**, i.e. a multiple of the costs estimated in the other two ceramics sectors. **These significantly greater costs are essentially driven by higher values of the CAPEX and OPEX associated to the environmental protection expenditures.** Such a result is essentially due to the peculiarities and profound differences in the refractories production process, which, on the one hand, requires higher temperatures, entailing more expensive technology to abate emissions, and, on the other hand, is characterised by extremely high manufacturing costs as almost every production run is a one-off batch of different mix components, sizes, shapes and firing temperature as well as the number required.

**Table 67. Regulatory costs generated by the environmental legislation on the fired refractories subsector (€/tonne, 2015)**

		<b>EU</b>
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.86
	<b>Substantive compliance costs</b>	10.31
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>		0
<b>Total regulatory costs</b>		<b>11.17</b>

*Source: Authors' own elaboration.*

However, it is worth noticing that, when compared to performance indicators, the estimated value of the environmental protection expenditures for fired refractories sector looks more homogenous with other ceramics sectors. Indeed, the estimated cumulated regulatory costs generated by the environmental legislation accounts for 6.1% of average value of EBITDA registered by sampled plants during period under review. Furthermore, according to Eurostat PRODCOM data, in 2013, the volume of refractories sold was equal to about 5.36 million tonnes. Thus, total environmental protection expenditure can be assessed in the order of €30 million, i.e. 1.8% of sector gross value added at factor costs.

## 9 Waste legislation

This section presents the identified costs generated by and the relevance for the EU ceramics industry of the following acts belonging to the waste legislation area:

- 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.

### 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 definitions of 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 stipulates (Article 6) the criteria for when waste ceases to be a 'waste' product – which also means that after those conditions are met, the handling of the product is much less cost-intensive and easier. However, to date, end-of-waste criteria have been developed and adopted only for a few waste streams. The Waste Framework Directive also requires that the **costs of waste disposal 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 of industries involved.

Based on the survey responses, in most of the ceramics plants the 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). **Many types of waste are recycled**, thus keeping the costs for waste disposal and landfilling low in comparison to other industries. For example, tiles and clay pipes can be easily recycled into new products. Further waste streams include: packaging waste (paper, wood, and plastics), municipal waste, hazardous waste (oils, fluorescent lamps, laboratory waste etc.). For some ceramics plants, the packaging waste is picked up by a company that carried out the initial delivery (without charging any fees).

**Box 15. Example of tiles' recycling<sup>164</sup>**

Broken tiles that were not yet burned in the oven, so-called 'green tiles', can be easily recycled into new tiles, as their properties stay the same. It is more difficult to recycle already burned tiles. These can be broken into small pieces and used (to some extent) to produce new tiles. Some big tile companies recycle their broken tiles themselves. Others buy broken tiles and recycle them into a material that can be used in the production process of new tiles. The amount of recycled material used in new products is rather small (less than 5%), in order not to undermine the quality of new tiles.

*Source: Interview with a ceramics plant.*

The industry hence incurs **substantive compliance costs** (for waste collection, segregation, reuse, recycling and disposal and landfilling) that in some cases also include investment costs (special machines, warehouses for waste storage). According to the majority of interviewed plants, waste management would take place even in the absence of any specific legal obligation (BAU). Nevertheless, some of the companies stated that waste management would be cheaper if the legislation would be less strict.<sup>165</sup>

Based on our survey responses, no major increase or decrease of regulatory costs due to the update of the **Waste Framework Directive in 2008** occurred in most plants. Some plants mentioned, however, an increase of substantive compliance costs due to additional obligations. It was stated that the new Directive obliges the companies to: 1) recycle their waste and 2) promote waste prevention (through for example educational activities). Many of the interviewed manufacturers have the ISO14001 Environmental Management System in place, which includes waste management and provides incentives for continuous development in this area.

The **Directive on Landfilling Waste** distinguishes three separate classes of landfill: inert waste, non-hazardous waste and hazardous waste. In the Directive, bricks, tiles and ceramics are on the "list of wastes acceptable at landfills for **inert waste without testing**".<sup>166</sup> In case of suspicion of contamination testing should be applied or the waste refused.<sup>167</sup> 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.<sup>168</sup> This Directive is more relevant for downstream users of ceramics products, e.g. construction companies involved in building demolition, than for the industry itself. Based on the questionnaire findings, the ceramics industry is landfilling a relatively small amount of its waste and the landfilling costs relate to direct charges on the waste being landfilled, which is seen as BAU. Thus, this Directive can be considered of **low relevance for the ceramics industry**.

**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 the areas, the data collection

<sup>164</sup> The example applies also for misshaped unfired bricks, where normally recycling is conducted simultaneously with production.

<sup>165</sup> An example of calcium carbonate (substance used in form of granulate removing oven fumes) was mentioned: the substance was classified as dangerous and thus requires costlier disposal (yet the industry is not convinced that the substance could be harmful).

<sup>166</sup> Directive 1999/31/EC on the Landfill of Waste.

<sup>167</sup> Ibid.

<sup>168</sup> Ibid.

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 variety in formats 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. 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 developed: if a company declares to involve one worker, it is assumed to be of managerial category (corresponding to level 1 of ISCO classification<sup>169</sup>); if 15 or fewer workers are involved, it is reasonable to consider the higher categories to be involved (ISCO 1 and ISCO 3 worker 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 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 consumption, cost of consumables, etc. Investments made in years preceding 2006 were excluded.

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<sup>169</sup> *International Standard Classification of Occupation*, International Labour Organization, UN.

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 to be **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 applies to all sectors, as the legislation similarly applies to firms operating in the industries of bricks and tiles, ceramic tiles, fired and unfired shaped refractories.

#### **9.1.4 Cost assessment – Bricks and tiles**

##### *Sample*

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

**Table 68. Bricks and tiles: Sample size by geographic region**

Bricks and tiles: Waste Framework Directive, Landfill of Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	12	5	6	23

*Source: Authors' own elaboration.*

The target sample of at least five plants and at least three independent companies per sector/segment and geographical area was reached. Only data for CEE cannot be shown due to confidentiality reasons, as the plants are not owned by at least three different companies.

##### *Direct regulatory costs*

Direct regulatory costs of the Waste Framework Directive and the Landfill of Waste Directive for bricks and tiles are estimated at **€0.26/tonne of production in a typical year at the EU level**. The costs include only substantive compliance costs.

The main costs observed based on our sample contain mainly investments and operational costs linked to waste disposal and recycling systems. Costs related to the person-days



spent are relatively limited. Differences in terms of costs occur between geographic areas: in NWE the costs are estimated to be €0.31/tonne and in SE €0.29/tonne. Considering the data from a plant-by-plant perspective, the variance across Europe is rather limited. Greater differences can be seen within the NWE region. The BAU goes from about 50% in SE to 74% in the NWE region.

The regulatory costs in NWE might be higher than in SE, partially because of the higher landfill taxes for inert waste (including construction and demolition waste). According to a study by Bio,<sup>170</sup> the highest taxes are in the Netherlands and Denmark. These two Member States also demonstrate the highest levels of recycling of inert waste. Such pre-existing national legislation imposing regulatory costs on the sector consequently can be seen in the interpretation of the BAU factor (being higher in NWE).

#### Cumulative regulatory costs

**Table 69. Bricks and tiles: Regulatory costs generated by the Waste Framework Directive and the Landfill of Waste Directive (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0	Confidential	0	0
	Substantive compliance costs	0.31	Confidential	0.29	0.26
	Direct charges	0	Confidential	0	0
Indirect regulatory costs		NA	Confidential	NA	NA
Total regulatory costs		<b>0.31</b>	Confidential	<b>0.29</b>	<b>0.26</b>

Source: Authors' own elaboration.

#### 9.1.5 Cost assessment – Ceramic tiles

##### Sample

The sample used to estimate costs for this area of legislation consists of the following number of plants divided into the three defined regions.

<sup>170</sup> BIO (2012), Use of economic instruments and waste management performances ([http://ec.europa.eu/environment/waste/pdf/final\\_report\\_10042012.pdf](http://ec.europa.eu/environment/waste/pdf/final_report_10042012.pdf)).

**Table 70. Ceramic tiles: Sample size by geographic region**

Ceramic tiles: Waste Framework Directive, Landfill of Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	5	7	16

*Source: Authors' own elaboration.*

While data for CEE cannot be shown for confidentiality reasons, data for NWE should be treated with additional care, given the limited number of plant responses.

#### *Direct regulatory costs*

In a typical year, direct regulatory costs of the Waste Framework Directive and the Landfill of Waste Directive for EU ceramic tile producers are estimated at **€1.4/tonne of production output**. Differences occur between geographic areas: whereas in NWE the costs are estimated at €1.2/tonne, in SE the costs are €1.55/tonne. The amount for the NWE region needs to be treated with care because the number of observations is fewer than the target.

The main substantive compliance costs observed based on our sample contain mainly investments and operational expenses linked to waste disposal and recycling systems. The person-days spent are rather limited in scale. There is some variance between companies across the EU. The greatest differences are within the NWE region. The higher BAU factor in NWE (75%) partially explains lower costs due to EU legislation in NWE in comparison to SE (64%).

SE plants show additional differences along national lines. Plants in one nation tend to uniformly display higher costs specifically relative to general waste management. This spread is due to an allocation of workers for a considerable share of their working time (roughly 75%) to tasks such as recovery, reuse, recycling and disposal of waste. Costs are increased also by operational costs related to landfilling (and including waste disposal). Cleaning of septic tanks also increases costs, as well as investment in machinery such as rainwater tanks or in upgrading recycling points. Plants from another of the countries within SE have higher costs in managing hazardous waste.

Cumulative regulatory costs

**Table 71. Ceramic tiles: Regulatory costs generated by the Waste Framework Directive and the Landfill of Waste Directive (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0*	Confidential	0	0
	Substantive compliance costs	1.2*	Confidential	1.55	1.4
	Direct charges	0*	Confidential	0	0
Indirect regulatory costs		NA	Confidential	NA	NA
Total regulatory costs		<b>1.2*</b>	Confidential	<b>1.55</b>	<b>1.4</b>

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

Source: Authors' own elaboration.

**9.1.6 Cost assessment – Fired refractories**

Sample

The sample used for cost estimates for this area of legislation includes the following plants split across the three defined regions.

**Table 72. Fired refractories: Sample size by geographic region**

Fired Refractories: Waste Framework Directive, Landfill of Waste Directive	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	2	4	11

Source: Authors' own elaboration.

The target sample of at least five plants was reached for the EU and for the NWE region. Nonetheless, with regard to geographical regions, the confidentiality threshold of at least three independent companies was reached only in SE. This number, however, needs to be treated with care, as it is fewer than the target of five plants.

Direct regulatory costs

Direct regulatory costs of the Waste Framework Directive and the Landfill of Waste Directive for fired refractories are estimated at **€1.92/tonne of production output for a typical year at the EU level** and €2.48/tonne in SE.

The main substantive compliance costs observed based on our sample includes CAPEX and OPEX linked to waste disposal and recycling systems. The person-days spent are rather limited in size.

Strong differences between products manufactured in each sampled plant also lead to some variance in cost per tonne estimates. This is not surprising given that the sector contains factories producing high-value products and low-value products. The BAU factor only partially explains differences, being overall at about 50%.

*Cumulative regulatory costs*

**Table 73. Fired refractories: Regulatory costs generated by Waste Framework Directive, Landfill of Waste Directive (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0	0
	Substantive compliance costs	Confidential	Confidential	2.48	1.92
	Direct charges	Confidential	Confidential	0	0
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>2.48</b>	<b>1.92</b>

Source: Authors' own elaboration.

**9.1.7 Cost assessment – Unfired shaped refractories**

*Sample*

The sample adopted to estimate regulatory costs for this area of legislation consists of the following plants. Given the low number of plants in the sample, only EU estimates can be shown. Results need to be treated with care given that they are fewer than the target of five plants.

**Table 74. Unfired shaped refractories: Sample size**

Unfired shaped refractories: Waste Framework Directive, Landfill of Waste Directive	EU
Number of plants in the sample	4

Source: Authors' own elaboration.

*Direct regulatory costs*

Direct regulatory costs generated by the Waste Framework Directive and the Landfill of Waste Directive on EU unfired shaped refractory producers are estimated to be **€2.26/tonne of production output in a typical year**. From a regulatory standpoint, such costs include only substantive compliance costs; more specifically, they comprise CAPEX and OPEX linked to waste disposal and recycling systems. The person-days spent are limited in number. The BAU factor is slightly below 60%. Regional differences cannot be assessed due to the low response rate. Variance between company responses is high. This is not surprising given the rather heterogeneous nature of unfired shaped refractories.

*Cumulative regulatory costs*

**Table 75. Unfired shaped refractories: Regulatory costs generated by Waste Framework Directive, Landfill of Waste Directive (€/tonne, typical year, averages)**

		EU
Direct regulatory costs	Administrative burdens	0
	Substantive compliance costs	2.26
	Direct charges	0
Indirect regulatory costs		NA
Total regulatory costs		<b>2.26</b>

*Source: Authors' own elaboration.*

## **10 Consumer and health legislation**

This section presents the costs generated on the EU ceramics industry by the following acts belonging to the consumer and health area of legislation:

1. Framework Regulation EC 1935/2004<sup>171</sup> on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC;
2. Commission Regulation 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food;
3. 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, 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. With regard to ceramics, Directive 84/500/EEC on the approximation of the laws of the Member States relating to ceramic articles in contact with foodstuffs was amended by Directive 2005/31/EC of April 2005.

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.

### **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 are based upon three articles. The general requirements stipulate that the business operators have the obligation to comply with good manufacturing practice and to ensure that labelling, advertising and presentation of a material or an article shall not mislead 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.

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<sup>171</sup> Annex I to the Framework Regulation lists 17 groups of materials and articles, including ceramics, 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 under Directive 84/500/EC on the approximation of the laws of the Member States relating to ceramic articles intended to come into contact with foodstuffs.

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 a documentation requirement (Article 7) which obliges them to establish and maintain an appropriate documentation.

Concerning **general product safety**, the overall objective of the legislation is to make sure that business 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).

Based on the survey, it can be observed that a small number of employees are dedicating more than 5% of their time in ensuring product safety requirements, i.e. providing relevant information to enable consumers to assess the risks inherent, acting with due care, informing the competent authorities in case of risk to the consumer, cooperating with them. Some activities falling under product safety requirements are sometimes outsourced. In addition, when asked whether these activities (and costs) would occur in the absence of any specific legal obligation, the answers ranged from "to some extent" to "to the full extent". It is important to stress that for some refractory companies, this legislation is not relevant, as they were not working with consumer goods. Overall, the costs related to consumer and health legislation are rather limited.

Finally, according to a study conducted by the European Parliament,<sup>172</sup> 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.

### **10.3 Methodological aspects**

The part of the survey related to general product safety requirements was structured in the same way for all considered ceramic sectors. Questions attained to two broad areas: namely **(a) producers' and distributors' obligations regarding safety requirements** and **(b) rapid intervention situations** (as those falling under the scope of RAPEX<sup>173</sup>). Firms were requested to quantify costs in terms of staff involved, outsourced activities or other operational costs. Estimates were discounted based on the BAU factor indicated by each plant. Interestingly, while plants provided costs for general obligations linked to this area of legislation, responses regarding rapid intervention situations were fairly limited, as they appear to be not really relevant to the ceramics sector.

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<sup>172</sup> European Parliament (2016), "Food Contact Materials Regulation (EC) 1935/2004 European Implementation Assessment Study".

<sup>173</sup> RAPEX is a Rapid Alert System which enables the rapid exchange of information between national authorities and the EU on dangerous products found on the market.

### 10.4 Cost assessment – Bricks and tiles

#### Sample

Complete responses in this area of legislation were collected from 17 plants operating in the bricks and tiles sector.

**Table 76. Bricks and tiles: Sample by geographic region**

Bricks and Tiles: Consumer and health legislation	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	8	5	4	17

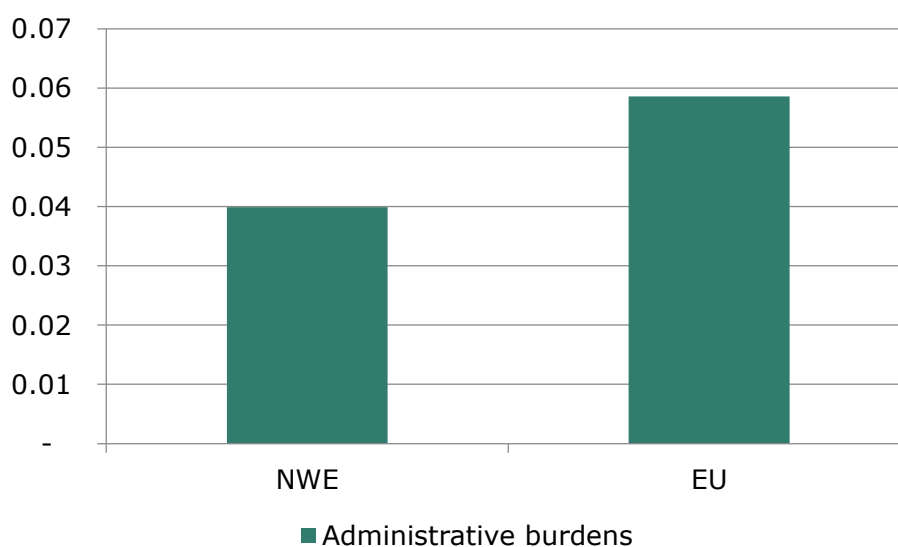
Source: Authors' own elaboration.

The target sample of at least five plants was not achieved for all geographic regions. In addition, data for CEE and SE cannot be shown as they do not fulfil the necessary criteria for confidentiality; the plants analysed do not belong to a sufficient number of independent companies.

#### Direct regulatory costs

Direct regulatory costs of consumer and health legislation for bricks and tiles, which include both substantive compliance costs and administrative burdens, are estimated to be €0.04/tonne in a typical year at the EU level. At regional level, they are estimated at €0.06/tonne in NWE.

**Figure 88. Bricks and tiles: Regulatory costs generated by consumer and health legislation per region (typical year, breakdown per cost category)**



Source: Authors' own elaboration.



At the plant level, there is some but limited variance in the cost estimates. Regional differences are mainly due to different BAU factors ranging between 50% and 75% across regions.

#### Administrative burdens

Administrative burdens of consumer and health legislation for bricks and tiles are estimated to be **€0.06/tonne of production output for a typical year in the EU** and hence capture about 40% of the total regulatory costs in this area of legislation. At regional level, substantive compliance costs are estimated to be €0.04/tonne in NWE.

#### Substantive compliance costs

Substantive compliance costs generated by consumer and health legislation on the EU bricks and tiles sector are estimated to be close to zero across the EU. This is because 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, which is not the case for bricks and tiles.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs borne by bricks and tiles producers in the area of consumer and health legislation.

**Table 77. Bricks and tiles: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.04	Confidential	Confidential	0.06
	Substantive compliance costs	0	Confidential	Confidential	0
	Direct charges	0	Confidential	Confidential	0
Indirect regulatory costs		NA	Confidential	Confidential	NA
Total regulatory costs		<b>0.04</b>	<b>Confidential</b>	<b>Confidential</b>	<b>0.06</b>

Source: Authors' own elaboration.

### 10.5 Cost assessment – Ceramic tiles

#### Sample

Fourteen complete responses were collected from ceramic tiles producers with regard to consumer and health legislation.

**Table 78. Ceramic tiles: Sample size by geographic region**

Ceramic Tiles: Consumer and health legislation	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	3	5	6	14

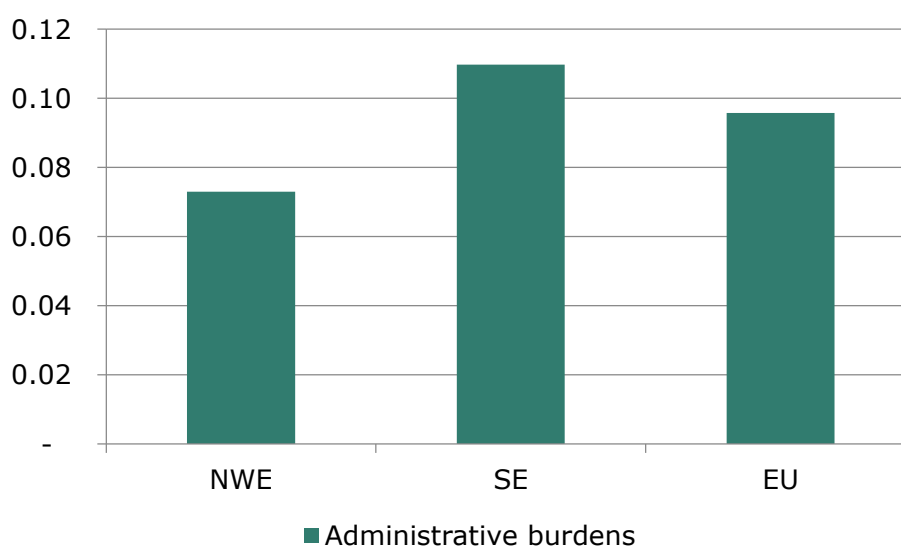
Source: Authors' own elaboration.

The target sample of at least five plants per geographic area was reached for all areas apart from NWE. The NWE region does, however, fulfil the confidentiality threshold, hence relevant data can be presented but should be interpreted with additional care. Unfortunately, since the five CEE plants do not belong to at least three independent companies, data cannot be presented for this region.

#### Direct regulatory costs

In a typical year, direct regulatory costs of consumer and health legislation for ceramic tiles, which comprise both substantive compliance costs and administrative burdens, are estimated to be **€0.10/tonne at the EU level**. At regional level, direct regulatory costs are estimated at €0.07/tonne in NWE and €0.12/tonne in SE.

**Figure 89. Regulatory costs generated by consumer and health legislation per region (typical year, breakdown per cost category)**



Source: Authors' own elaboration.

Variance between the costs reported by individual plants is limited. The strongest differences are observed in SE due to more specialised production lines. Another factor influencing the different cost estimates is the diverging BAU factor which is estimated by respondents to be lower in SE (about 55%) compared to NWE (above 70%).

#### Administrative burdens

Administrative burdens generated by consumer and health legislation on EU ceramic tile producers **are estimated at €0.09/tonne in a typical year**; therefore, they represent about 90% of the total regulatory cost in this area of legislation. At regional level, administrative burdens are estimated at €0.07/tonne in new and €0.11/tonne in the SE.

#### Substantive compliance costs

Substantive compliance costs of consumer and health legislation for ceramic tiles are estimated at €0.01/tonne of production output for a typical year at the EU level and therefore represent about 10% of the total regulatory cost in this area of legislation. At regional level, substantive compliance costs direct regulatory costs are estimated to be very low as well: €0/tonne of in the NWE region and €0.01/tonne in the SE region.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs borne by EU ceramic tile producers when complying with EU consumer and health legislation.

**Table 79. Ceramic tiles: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.07*	<i>Confidential</i>	0.11	0.09
	Substantive compliance costs	0*	<i>Confidential</i>	0.01	0.01
	Direct charges	0*	<i>Confidential</i>	0	0
Indirect regulatory costs		NA	<i>Confidential</i>	NA	NA
Total regulatory costs		<b>0.07*</b>	<b><i>Confidential</i></b>	<b>0.12</b>	<b>0.10</b>

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

Source: Authors' own elaboration.

**10.6 Cost assessment – Fired refractories**

*Sample*

The sample of fired refractories producers providing cost data with regard to the consumer and health legislation includes 10 plants across the EU.

**Table 80. Sample size by geographic region**

Fired Refractories: Consumer and health legislation	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	2	4	10

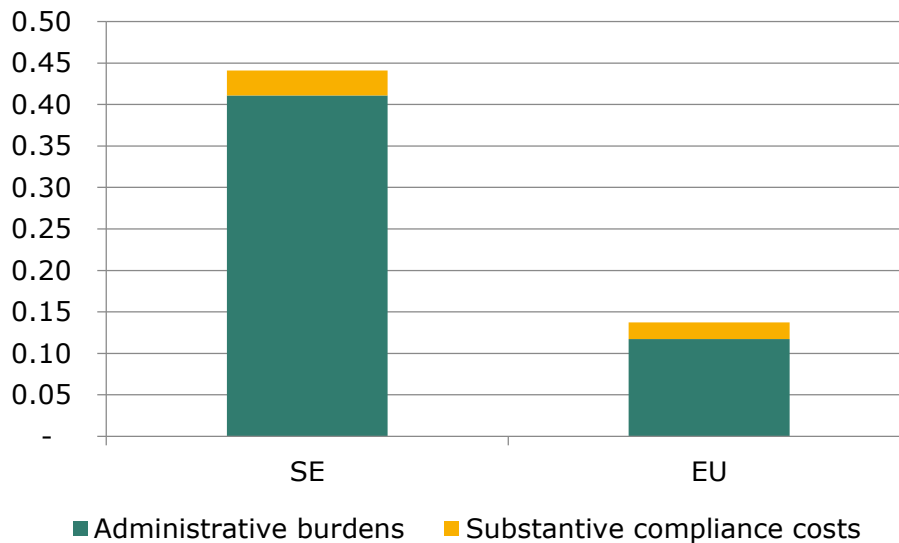
*Source: Authors' own elaboration.*

The target sample of at least five plants was only reached at EU level. However, regional numbers can also be presented for SE, as the four plants fulfil the confidentiality threshold. But numbers presented at the regional level need to be treated with extra care.

*Direct regulatory costs*

Direct regulatory costs generated by the consumer and health legislation on EU producers of fired refractories, including substantive compliance costs and administrative burdens, **are estimated at €0.14/tonne of production in a typical year**. At regional level, direct regulatory costs can be estimated at €0.44/tonne in SE.

**Figure 90. Fired refractories: Regulatory costs generated by consumer and health legislation per region (typical year, breakdown per cost category)**



*Source: Authors' own elaboration.*

Variance between plants in this segment is very high when measured in costs per tonne of output. This is due to the heterogeneity of products included in this cost segment, which

is quite large even if production processes are rather comparable. This is the main factor causing different cost estimates between regions and plants. In fact, the BAU factor remains similar across regions between 50% and 60%.

#### Administrative burdens

Administrative burdens generated by consumer and health safety legislation on EU producers of fired refractories are estimated at €0.12/tonne and are hence responsible for the largest share of costs in this area of legislation. At regional level, they can be estimated at €0.41/tonne in SE.

#### Substantive compliance costs

Substantive compliance costs of consumer and health legislation for fired refractories are estimated at €0.02/tonne in a typical year at the EU level. At regional level, direct regulatory costs can be estimated at €0.03/tonne in SE.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs incurred by EU producers of fired refractories when dealing with EU consumer and health legislation.

**Table 81. Fired refractories: Regulatory costs generated by consumer and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0.41*	0.12
	Substantive compliance costs	Confidential	Confidential	0.03*	0.02
	Direct charges	Confidential	Confidential	0*	0
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0.44*</b>	<b>0.14</b>

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

Source: Authors' own elaboration.

### **10.7 Cost assessment – Unfired shaped refractories**

#### *Sample*

When it comes to production of unfired shaped refractories, data on consumer and health legislation were provided by only two plants across the EU; hence no data can be presented in this Study.

**Table 82. Sample size**

<b>Unfired shaped refractories: Consumer and health legislation</b>	<b>EU</b>
<b>Number of plants in the sample</b>	2

*Source: Authors' own elaboration.*

## **11 Workers' safety and health legislation**

This section discusses the costs generated by the European Union's legislative acts and the relevance for the EU ceramics 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 ceramic 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 Worker's 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** 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**, including that 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 has to be carried out as quickly as possible; the workplace and the equipment and devices are 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 that the employer shall 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).

Most of the costs engendered by the **Workplace Directive** are related to requirements stated in Article 1, such as technical maintenance of the workplace and of the equipment and devices. For instance, it states that 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 the recent study "Evaluation of the Practical Implementation of the EU Occupational Safety and Health (OSH) Directives in EU Member States" for DG Employment,<sup>174</sup> 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

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<sup>174</sup> COWI, Milieu and IOM (2015), "Evaluation of the Practical Implementation of the EU Occupational Safety and Health (OSH) Directives in EU Member States".



approaches. Yet another regulatory regime comes from Bulgaria, where risk assessment is regulated by a specific ordinance which is effective for all individual Directives. In addition, general requirements can be found in the national framework law while specific requirements are in the laws transposing the individual Directive. This specificity may, according to the study, introduce inconsistencies across the national implementation of the legislation.

### ***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, it 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, we 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 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 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 classification<sup>175</sup>); 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

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<sup>175</sup> *International Standard Classification of Occupation*, International Labour Organization, UN.

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 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, so to better identify regulatory costs generated by specific sets of obligations. Replies show an average equal to four, i.e. companies claim that the costs would have occurred in any case to a high extent, also in the case that the legislation would not be in place. This implies that companies consider the H&S of workers to be a compelling issue. Consequently, we deduct the BAU share of the costs to assess the actual additional costs of EU legislation.

This part of the questionnaire was the same across the sectors considered, as the legislation similarly applies to firms operating in the industries of bricks and tiles, ceramic tiles, fired and unfired shaped refractories. All cost items identified are **substantive compliance costs**, incurred while ensuring the implementation of the legislative prescriptions.

Plants operating in the sectors of ceramic tiles and refractories displayed a certain degree of heterogeneity within their sector, and in some cases, outliers were detected. For some of these outliers, costs in absolute terms were in line with other observations, but they appeared fairly high when computed in terms of tonne of output. This can be partially due to the existence of plants dedicated to high-value and low-tonnage production.

We opted for the inclusion of these outliers, for two reasons. Firstly, production with high value and low tonnage usually account for a small share of the total production. This implies that overall sector averages are affected only to a limited extent by the inclusion of such observations. Hence, there seems to be no strong reason to arbitrarily remove individual observations. The second reason is inherent to the nature of the sector. Types of products tend to be quite heterogeneous, a fact which potentially explains the differences in volumes of costs and of tonnage, e.g. advanced refractories and high-performance refractory materials as compared to standard refractories, or porcelain ceramic tiles as compared to wall tiles. The dispersion of observations cannot be simply neglected – it is a pattern inherent to the sector.

### 11.1.4 Cost assessment – Bricks and tiles

#### Sample

Nineteen brick and tile producers provided information on costs generated by general workers' and workplace safety legislation.

**Table 83. Bricks and tiles: Sample size used by geographic region**

Bricks and tiles: General workers' safety and health and general workplace safety	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	8	5	6	19

Source: Authors' own elaboration.

The target sample of at least five plants was achieved for each geographic region. However, plants for CEE do not fulfil the confidentiality criterion and can hence not be presented.

#### Direct regulatory costs

Direct regulatory costs generated by general workers' safety and health and general workplace safety legislation on the **EU bricks and tiles sector are estimated at €0.54/tonne in a typical year**; they include only substantive compliance costs. At regional level, direct regulatory costs are estimated at €0.66/tonne of production output for a typical year in NWE and €0.36/tonne in SE. The variance of plant responses within each region is low. The BAU factor is the highest in NWE (70%) and followed by SE (60%). While plants in the NWE region are used to higher standards and therefore also report a higher BAU factor, they also face stricter requirements.

The higher average of the NWE sample is influenced by the larger costs reported by individual plants from two Member States in all areas of general workers H&S, as in the costs associated with the organisation of training activities or the investment costs related to H&S equipment. All plants from one other Member State reported fairly high costs regarding workplace safety, such as maintenance of safety devices or clearance of emergency exits routes. These differences underline the finding that the different transpositions into national law have an impact on the cost estimates of plants per Member State.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for bricks and tiles producers generated by general workers' safety and health and general workplace safety legislation.

**Table 84. Bricks and tiles: 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	Confidential	0	0
	Substantive compliance costs	0.66	Confidential	0.36	0.54
	Direct charges	0	Confidential	0	0
Indirect regulatory costs		NA	Confidential	NA	NA
Total regulatory costs		<b>0.66</b>	<b>Confidential</b>	<b>0.36</b>	<b>0.54</b>

Source: Authors' own elaboration.

### 11.1.5 Cost assessment – Ceramic tiles

#### Sample

Across the EU, 16 ceramic tile producers have provided cost data on general workers' and workplace safety.

**Table 85. Ceramic tiles: Sample size by geographic region**

Ceramic tiles: General workers' safety and health and general workplace safety	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	5	7	16

Source: Authors' own elaboration.

The target sample of at least five plants per geographic area was reached for all areas apart from NWE. The NWE region, however, fulfils the confidentiality threshold and can be presented (but results need to be interpreted with additional care). Data for CEE cannot be presented due to confidentiality issues.

#### Direct regulatory costs

Direct regulatory costs of general workers' safety and health and general workplace safety legislation for ceramic tiles, which only include substantive compliance costs, **are estimated at €1.24/tonne in a typical year at the EU level**. At regional level, direct

regulatory costs are estimated to be €1.99/tonne in NWE and €1.22/tonne in SE. Variance between individual companies is relatively high, particularly in NWE and SE. This is due to the inclusion of some more specialised companies which produce high-cost, high-value products. The BAU factor is within a range of 60-70% across regions.

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for ceramic tiles in the area of general workers' safety and health and general workplace safety.

**Table 86. Ceramic tiles: 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*	Confidential	0	0
	Substantive compliance costs	1.99*	Confidential	1.22	1.24
	Direct charges	0*	Confidential	0	0
Indirect regulatory costs		NA	Confidential	NA	NA
Total regulatory costs		<b>1.99*</b>	<b>Confidential</b>	<b>1.22</b>	<b>1.24</b>

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

Source: Authors' own elaboration.

**11.1.6 Cost assessment – Fired refractories**

*Sample*

Cost estimate for general workers' and workplace safety legislation in the fired refractories sector relies on a sample of 10 plants.

**Table 87. Fired refractories: Sample size by geographic region**

Fired refractories: General workers' safety and health and general workplace safety	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	2	4	11

Source: Authors' own elaboration.

The target sample of at least five plants was only reached at EU level and at NWE. Data for NWE can however due to the confidentiality threshold not be shown. On the other hand, despite being below the target number of 5 plants, SE data can still be shown.

#### Direct regulatory costs

Direct regulatory costs of general workers' safety and health and general workplace safety legislation for fired refractories are estimated at **€3.17/tonne in a typical year at the EU level**; they comprise only substantive compliance costs. Interestingly, at the regional level, such costs are equal to €5.05/tonne in SE. Due to product heterogeneity, per tonne estimates vary strongly between companies. Measured in other ratios, e.g. *vis-à-vis* key performance indicators), they are more similar to each other. The BAU factors play a minor role, as they are all in the range of 50-60%.

#### Cumulative regulatory costs

The following table summarises the cumulative regulatory costs for fired refractories in the field of general workers' safety and health and general workplace safety.

**Table 88 Fired refractories: 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	Confidential	Confidential	0*	0
	Substantive compliance costs	Confidential	Confidential	5.05*	3.17
	Direct charges	Confidential	Confidential	0*	0
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>5.05*</b>	<b>3.17</b>

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

Source: Authors' own elaboration.

#### **11.1.7 Cost assessment – Unfired shaped refractories**

##### Sample

Finally, when it comes to unfired shaped refractories, four plants have provided relevant data to measure regulatory costs in this area of legislation. The target sample of at least five plants was not reached at EU level, which is why these estimates need to be interpreted with care.

**Table 89. Unfired shaped refractories: Sample size**

<b>Unfired shaped refractories: General workers' safety and health and general workplace safety</b>	<b>EU</b>
<b>Number of plants in the sample</b>	4

*Source: Authors' own elaboration.*

*Direct regulatory costs*

Direct regulatory costs of general workers' safety and health and general workplace safety legislation for EU producers of unfired shaped refractories are estimated at €1.81/tonne in a typical year.

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for unfired shaped refractories in the area of general workers' safety and health and general workplace safety.

**Table 90. Unfired shaped refractories: Regulatory costs generated by general workers' safety and health and general workplace safety legislation (€/tonne, typical year, averages)**

		<b>EU</b>
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0
	<b>Substantive compliance costs</b>	1.81
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>		NA
<b>Total regulatory costs</b>		<b>1.81</b>

*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 the ceramics sector 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 89/391/EEC. 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, with regard to the Directive 2003/10/EC for instance, 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, noise and chemical agents are the main risks identified by all ceramics companies (bricks and tiles, ceramic and tiles, and refractories). Overall, plants measure and assess on an annual basis the level of exposure regarding noise and hazardous chemical agents. As for general workers' safety and health, medical surveillance



and check-ups are most of the time outsourced and so are specific measurements sometimes as well. Operational costs are also important elements especially regarding noise and chemical risks since companies have to purchase earplugs, dust masks, etc. In comparison to substantive compliance costs generated by activities such as measuring the level of exposure or providing training, administrative burdens appear to be limited as they are sometimes taken care of at company level, rather than at plant level. Activities classified as administrative burdens are nonetheless important as risk assessment and documentation obligations are part of a more general task. Therefore, regulatory costs are mainly included in two categories: i) **substantive compliance costs** (measuring the level of exposure and ensuring health surveillance related to identified risks in general); and ii) **administrative burden**, e.g. providing information and training regarding the risks and updating of the risk assessment. Finally, activities falling under special workers' safety and health are largely considered good business practices and this is reflected in a quite high BAU factor.

### ***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 legislation primarily requires the involvement of employees, hence generating labour costs, which we aim to quantify. We 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. We similarly 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 for questions on 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 cost 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 measure the 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 classification<sup>176</sup>); 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 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 triggered by 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 great 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 in 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 industries of bricks and tiles, ceramic tiles, fired and unfired shaped refractories.

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<sup>176</sup> Ibid.

**11.2.4 Cost assessment – Bricks and tiles**

*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.

**Table 91. Bricks and tiles: Sample size by geographic region**

Bricks and tiles: Special workers' safety and health	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	6	5	6	17

*Source: Authors' own elaboration.*

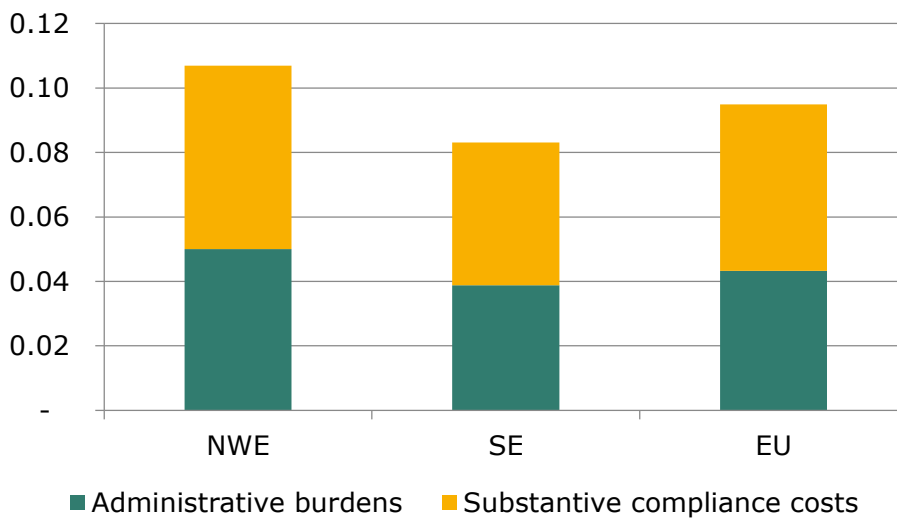
The target sample of at least five plants was reached in each region. However, due to confidentiality reasons data for CEE cannot be shown.

*Direct regulatory costs*

Direct regulatory costs generated by EU special workers' health and safety legislation on brick and tile producers **are estimated at €0.09/tonne in a typical year**. For the regions, direct regulatory costs are estimated at €0.11/tonne of production output for a typical year in NWE and €0.08/tonne in SE.

The direct regulatory costs can be broken down at almost equal shares into substantive compliance costs and administrative burdens. The following figures show divisions between NWE, SE and the EU as a whole.

**Figure 91. Bricks and tiles: Regulatory costs generated by special workers' safety and health legislation per region (typical year, breakdown per cost category)**



*Source: Authors' own elaboration.*

The variance between individual company answers within the geographic segments is rather low. The estimated BAU factor varies lightly from 66% in SE to 77% in NWE.

#### *Substantive compliance costs*

Substantive compliance costs of special workers' health and safety legislation for bricks and tiles are estimated to be €0.05/tonne of production output in a typical year at the EU level. At regional level, substantive compliance costs are estimated to be €0.06/tonne in NWE and €0.04/tonne in SE.

#### *Administrative burdens*

Administrative burdens generated by special workers' health and safety legislation for bricks and tiles are estimated at €0.04/tonne at the EU level. Concerning the regions, administrative burdens are estimated to be €0.05/tonne in NWE and €0.04/tonne in SE.

#### *Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for bricks and tiles in the area of special workers' safety and health.

**Table 92. Bricks and tiles: Regulatory costs generated by special workers' safety and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.05	<i>Confidential</i>	0.04	0.04
	Substantive compliance costs	0.06	<i>Confidential</i>	0.04	0.05
	Direct charges	0	<i>Confidential</i>	0	0
Indirect regulatory costs		NA	<i>Confidential</i>	NA	NA
<b>Total regulatory costs</b>		<b>0.11</b>	<b><i>Confidential</i></b>	<b>0.08</b>	<b>0.09</b>

*Source: Authors' own elaboration.*

#### **11.2.5 Cost assessment – Ceramic tiles**

##### *Sample*

The sample used for cost estimates for this area of legislation consists of the following number of plants across the EU

**Table 93. Ceramic tiles: Sample size by geographic region**

Ceramic tiles: Special workers' safety and health	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	4	5	7	16

Source: Authors' own elaboration.

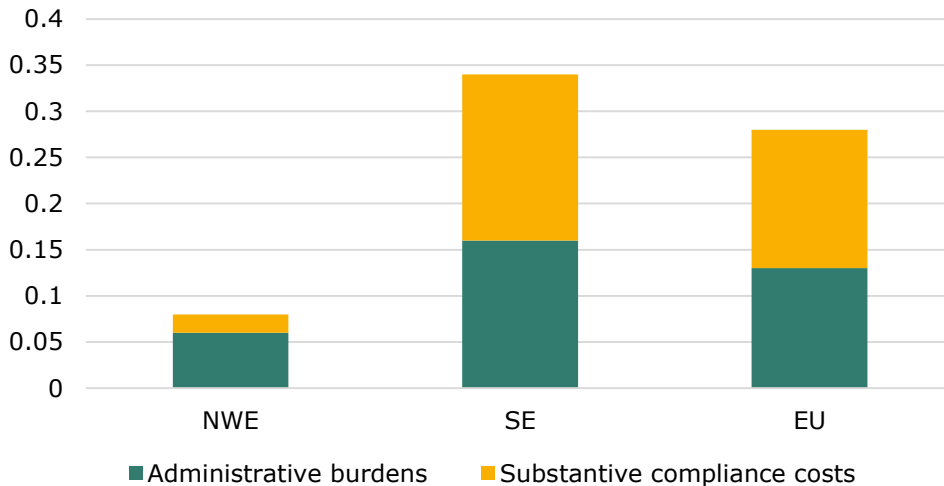
The target sample of at least five plants was reached for CEE and SE and consequently for the EU as a whole. Data for CEE cannot be shown, as the five plants are not part of at least three different companies. Data for NWE can be shown, despite being below the target, but need to be treated with additional care.

*Direct regulatory costs*

Direct regulatory costs linked to special workers' health and safety legislation for the ceramic tiles sector **are estimated at €0.28/tonne of production output in a typical year at the EU level**. At regional level, costs are estimated at €0.34/tonne in SE and €0.08/tonne in NWE.

The direct regulatory costs can be broken down into a high share of substantive compliance costs and a more limited share of administrative burdens. The following figures show a split for all regions and the EU.

**Figure 92. Ceramic tiles: Regulatory costs generated by special workers' safety and health legislation per region (typical year, breakdown per cost category)**



Source: Authors' own elaboration.

The variance between plant responses is particularly high in SE, where more heterogeneous plants (and products) are located. For the other regions, responses are of a similar order of magnitude. Differences in the BAU factor lead only to limited variation: the BAU is the highest in NWE (75%), the lowest in SE (66%).

*Substantive compliance costs*

Substantive compliance costs of special workers' health and safety legislation for ceramic tiles are estimated at €0.76/tonne of production output in a typical year in the EU and therefore represent the less relevant category in this area of legislation. For NWE, costs are estimated at €0.02/tonne and for SE at €0.97/tonne.

*Administrative burdens*

Administrative burdens generated by special workers' health and safety legislation for ceramic tiles are estimated to be €0.14/tonne in a typical year at the EU level and represent the most important category of regulatory costs in this area of legislation. In NWE the costs are estimated at €0.02/tonne of production output for a typical year, in SE at €0.17/tonne.

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for ceramic tile producers generated by special workers' safety and health legislation.

**Table 94. Ceramic tiles: Regulatory costs generated by special workers' safety and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	0.06*	Confidential	0.16	0.13
	Substantive compliance costs	0.02*	Confidential	0.18	0.15
	Direct charges	0*	Confidential	0	0
Indirect regulatory costs		NA	Confidential	NA	NA
<b>Total regulatory costs</b>		<b>0.08*</b>	<b>Confidential</b>	<b>0.34</b>	<b>0.28</b>

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

Source: Authors' own elaboration.

**11.2.6 Cost assessment – Fired refractories**

*Sample*

The sample adopted to estimate regulatory costs generated by this area of legislation on fired refractories producers consists of the following number of plants split across the three defined regions.

**Table 95. Fired refractories: Sample size by geographic region**

Fired refractories: Special workers' safety and health	Regions			EU
	NWE	CEE	SE	
Number of plants in the sample	5	2	4	10

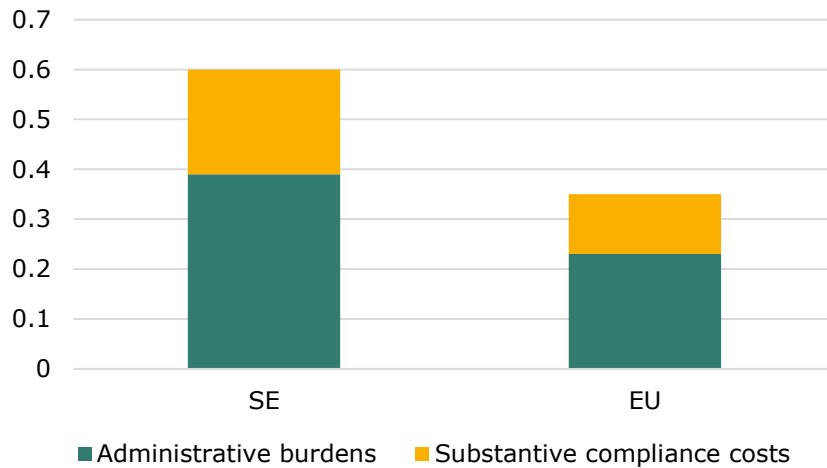
Source: Authors' own elaboration.

The target sample of at least five plants was reached at an EU level and for the NWE region. Data for NWE cannot be shown as the five plants are not part of at least three independent companies. However, data for SE can be presented as it fulfils the confidentiality threshold.

*Direct regulatory costs*

Direct regulatory costs generated by special workers' safety and health legislation for fired refractories **are estimated at €0.35/tonne of production output in a typical year at the EU level.** For the SE region, costs are estimated to be €0.60/tonne. Cost estimates consist of administrative burdens and substantive compliance cost which are distributed as shown in the following figure.

**Figure 93. Fired refractories: Regulatory costs generated by special workers' safety and health legislation per region (typical year, breakdown per cost category)**



Source: Authors' own elaboration.

The variance between individual plant responses is high, due to the deployment of more specialised production processes. Geographical differences are also due to different BAU factors across regions. Overall BAU is at about 55%.

*Substantive compliance costs*

Substantive compliance costs generated by special workers' health and safety legislation on EU producers of fired refractories are estimated at €0.12/tonne in a typical year and

are hence the smaller share of costs in this area of legislation. At regional level, same costs are estimated to be €0.21/tonne in SE.

#### *Administrative burdens*

Administrative burdens of special workers' health and safety legislation for fired refractories are estimated to be €0.23/tonne of production output in a typical year at the EU level and hence represent the bulk of costs in this area of legislation. At regional level, administrative burdens are estimated to be €0.39/tonne in SE.

#### *Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for fired refractories in the area of special workers' safety and health.

**Table 96. Fired refractories: Regulatory costs generated by special workers' safety and health legislation (€/tonne, typical year, averages)**

		Regions			EU
		NWE	CEE	SE	
Direct regulatory costs	Administrative burdens	Confidential	Confidential	0.39*	0.23
	Substantive compliance costs	Confidential	Confidential	0.21*	0.12
	Direct charges	Confidential	Confidential	0*	0
Indirect regulatory costs		Confidential	Confidential	NA	NA
Total regulatory costs		<b>Confidential</b>	<b>Confidential</b>	<b>0.60*</b>	<b>0.35</b>

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

Source: Authors' own elaboration.

#### **11.2.7 Cost assessment – Unfired shaped refractories**

##### *Sample*

Four plants have provided information on regulatory costs generated by special workers' safety and health legislation.



**Table 97. Unfired shaped refractories: Sample size**

<b>Unfired shaped refractories: General workers' safety and health and general workplace safety</b>	<b>EU</b>
<b>Number of plants in the sample</b>	4

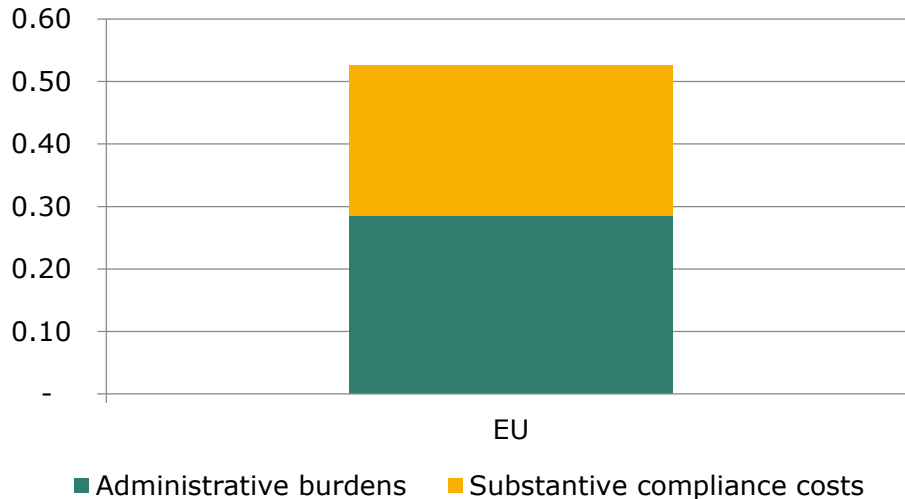
Source: Authors' own elaboration.

The target sample of at least five plants was not reached at EU level, thus we can only provide the following estimates, which need to be interpreted with care.

*Direct regulatory costs*

Direct regulatory costs generated by the EU special workers' safety and health legislation on manufacturers of unfired shaped refractories include substantive compliance costs and administrative burdens. **These costs are estimated at €0.51/tonne in a typical year.** Substantive compliance costs can be estimated at €0.23/tonne of production, whereas administrative burdens are equal to €0.28/tonne of production output.

**Figure 94. Unfired shaped refractories: Regulatory costs generated by special workers' safety and health legislation per region (typical year, breakdown per cost category)**



Source: Authors' own elaboration.

*Cumulative regulatory costs*

The following table summarises the cumulative regulatory costs for unfired shaped refractories in the area of special workers' safety and health legislation.

**Table 98. Unfired shaped refractories: Regulatory costs generated by special workers' safety and health legislation (€/tonne, typical year, averages)**

		EU
<b>Direct regulatory costs</b>	<b>Administrative burdens</b>	0.28
	<b>Substantive compliance costs</b>	0.23
	<b>Direct charges</b>	0
<b>Indirect regulatory costs</b>		NA
<b>Total regulatory costs</b>		<b>0.51</b>

*Source: Authors' own elaboration.*

## 12 Other areas of legislation

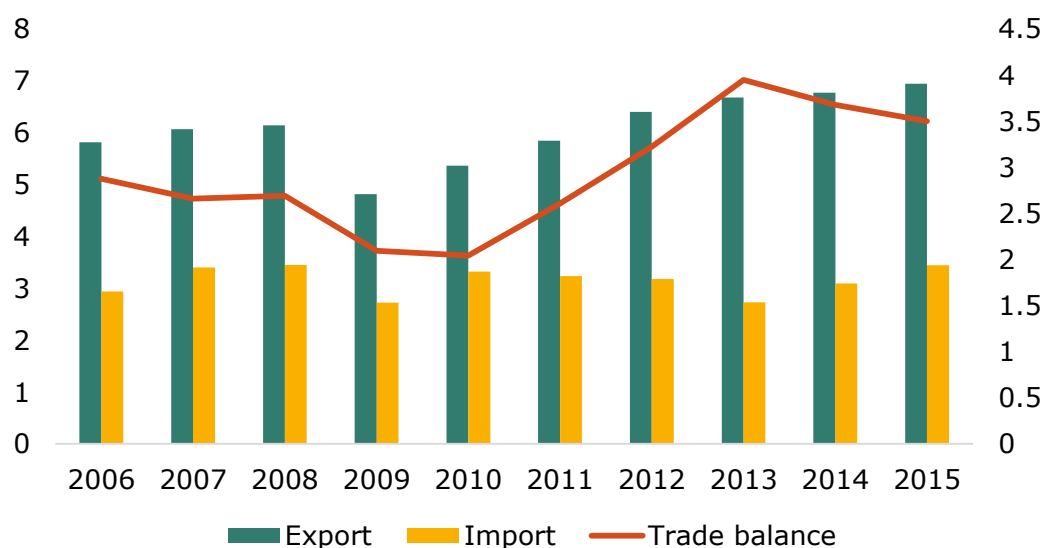
### 12.1 Trade legislation

#### 12.1.1 Trade analysis

##### Overview

The EU ceramics industry, although severely hit by the crisis, remains quite competitive at international level, registering a positive trade balance between 2006 and 2015. The 2015 trade balance was at around €3.5 billion. After the slowdown in 2009 caused by the economic and financial crisis, the industry has been recovering quite quickly, mainly due to highly competitive products sold in the international markets.

**Figure 95. Extra-EU trade of the ceramic industry (left axis: exports and imports; right axis: trade balance; € billions)**

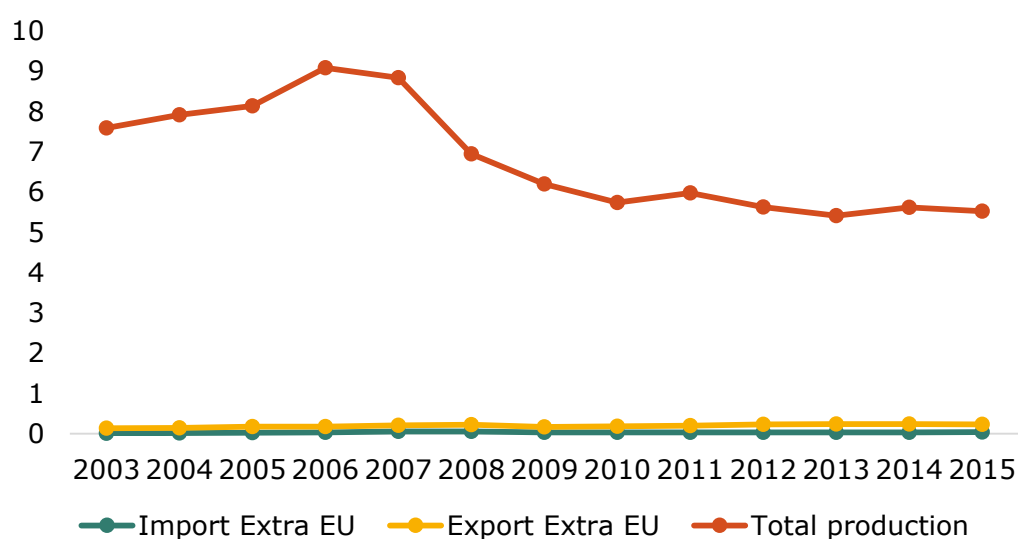


Source: Authors' own elaboration on COMEXT (2016).

Except for a few sectors, such as bricks and tiles, which have a low value-to-weight ratio, ceramic products are easily tradable. Amongst them, ceramic tiles and tableware are the most exposed to international competition. The analysis below shows trade flows for those sectors covered by this CCA (bricks and tiles, ceramic tiles, refractories); sectoral statistics for other ceramics sector are presented in Annex I.

##### Bricks and tiles

Figure 96 shows the limited share of extra-EU trade of bricks and tiles compared to the overall value of the EU production in the sector (about 5% in 2015). International trade flows in this sector have a very limited role.

**Figure 96. Extra-EU-28 trade and total production of bricks and tiles (€ billions)**


Note: The category "Manufactures of bricks, tiles and construction products, in baked clay" (C2332 NACE Rev.2) corresponds to HS 69.04, 69.05 and 69.06.  
Source: Authors' own elaboration on COMEXT (2016).

Table 99 shows bilateral trends. As explained, due to high transport costs and low value-to-weight ratio, geographic proximity seems to play a major role in determining both destination markets as well as countries exporting to the EU. The only exception is represented by **China, which accounts for 10.2% of exports to the EU.**

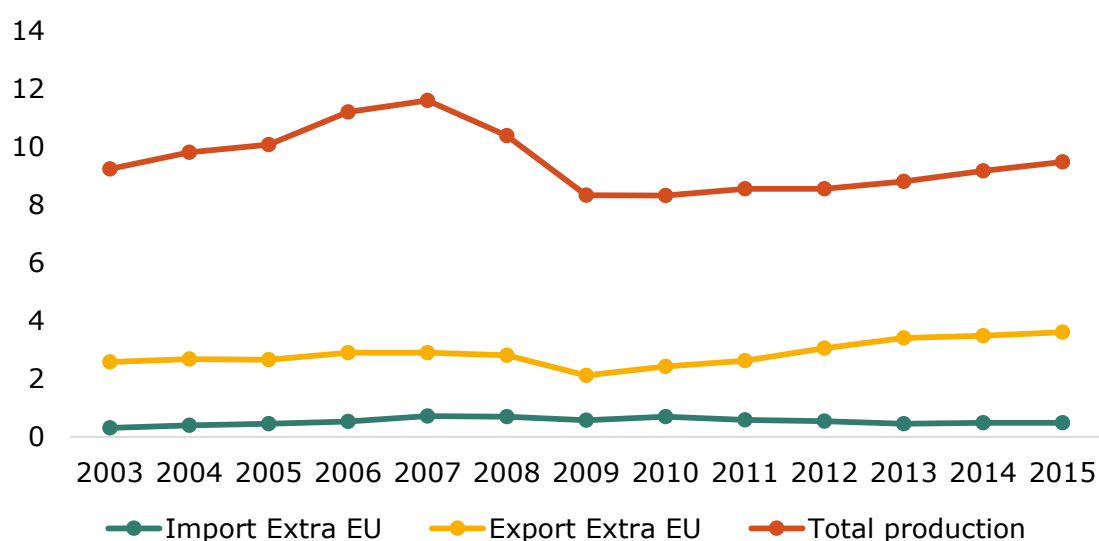
**Table 99. Top 10 trading partners for bricks and tiles in 2015 (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to EU	
Russia	12.7%	Serbia	46.3%
Switzerland	12.1%	China	10.2%
Saudi Arabia	8.7%	Turkey	9.6%
Lebanon	5.7%	Macedonia	9.1%
Bosnia And Herzegovina	5.0%	Pakistan	5.9%
Algeria	4.9%	Egypt	5.0%
Norway	4.9%	Switzerland	2.9%
United States	4.5%	United States	2.4%
South Korea	3.4%	Moldova	1.7%
United Arab Emirates	3.2%	Sri Lanka	1.1%

Note: The category "Manufacture of bricks, tiles and construction products, in baked clay" (C2332 NACE Rev.2) corresponds to HS 69.04, 69.05 and 69.06.  
Source: Authors' own elaboration on COMEXT (2016).

### Ceramic tiles

Figure 97 illustrates trade values for the ceramic tiles sector. After 2009, extra EU trade increased its weight compared to overall production, which is still below pre-crisis levels. At any rate, the EU was a **net exporter** in all the years under observation. Moreover, the positive trade balance widened after 2012, reaching €3.1 billion in 2015.

**Figure 97. Extra-EU-28 Trade and total production of ceramic tiles (€ billion)**


Note: The category "Manufacture of ceramic tiles and flags" (C2331 NACE Rev.2) corresponds to HS 69.07 and 69.08.

Source: Authors' own elaboration on COMEXT (2016).

Table 100 below shows that the **United States was the main destination country**, attracting more than 20% of all EU exports of ceramic tiles in 2015. Saudi Arabia, Russia and Switzerland followed and accounted for around 6% each. **The top exporter to the EU was Turkey** with 46% of all EU imports, followed by China (23%)<sup>177</sup> and United Arab Emirates (11.7%).

**Table 100. Top 10 trading partners for ceramic tiles in 2015 (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	20.2%	Turkey	46.0%
Saudi Arabia	6.5%	China	23.0%
Russia	6.3%	United Arab Emirates	11.7%
Switzerland	5.8%	India	3.9%
Israel	4.2%	Brazil	2.4%
Algeria	3.8%	Vietnam	2.1%
Canada	3.5%	Russia	1.5%
Australia	2.5%	Serbia	1.3%
Lebanon	2.5%	Ukraine	1.1%
Morocco	2.4%	Malaysia	1.1%

Note: The category "Manufacture of ceramic tiles and flags" (C2331 NACE Rev.2) corresponds to HS 69.07 and 69.08.

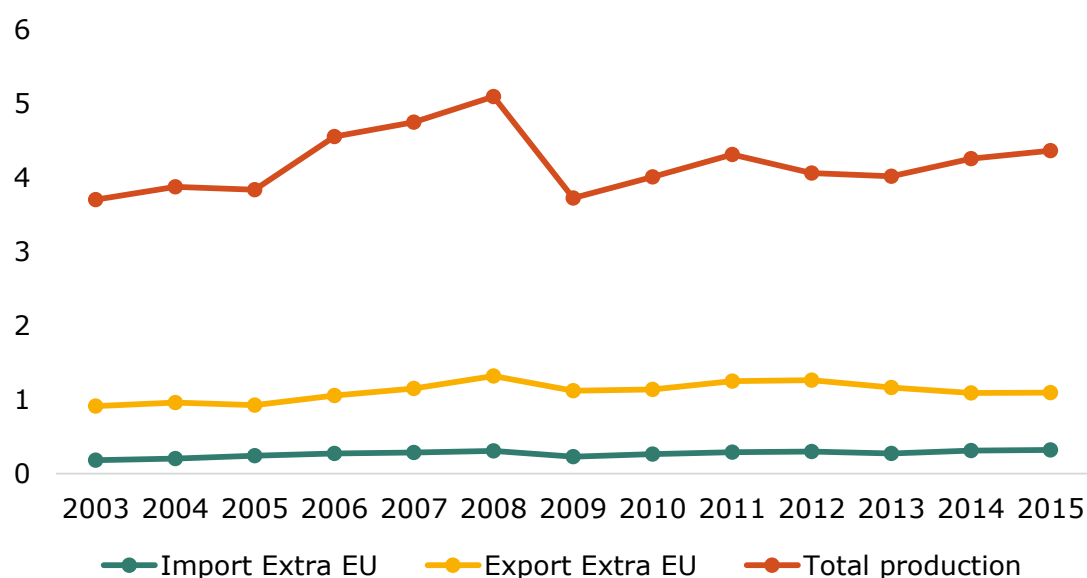
Source: Authors' own elaboration on COMEXT (2016).

<sup>177</sup> Reportedly, overcapacity along with an often subsidised industrial system allows China to place its products in international markets at artificially low prices.

## Refractories

Figure 98 shows that the EU was a **net exporter** of refractory products: extra-EU exchange was relatively stable and represents around one-third of overall EU production. More specifically, in 2015 EU imports accounted approximately for 7% of the EU production value.

**Figure 98. Extra-EU-28 trade and total production of manufacture of refractory products (€ billions)**



Note: The category "Manufacture of refractory products" (C2320 NACE Rev.2) corresponds to HS 69.01, 69.02 and 69.03.

Source: Authors' own elaboration on COMEXT (2016).

As presented in Table 101, **China was the main exporter to the EU** accounting for more than 40% of total EU imports in 2015. The United States, Russia and Turkey were the top three export destination markets, accounting respectively for 11.1%, 7% and 5.9% of overall EU exports.

**Table 101. Top 10 trading partners for manufacture of refractory products in 2015 (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	11.1%	China	43.1%
Russia	7.0%	United States	18.2%
Turkey	5.9%	Japan	14.3%
India	5.5%	India	11.9%
Iran	4.0%	Turkey	2.9%
Saudi Arabia	3.9%	Switzerland	1.4%
China	3.8%	South Korea	1.2%
Algeria	3.8%	Ukraine	0.9%
Brazil	3.4%	Russia	0.9%
United Arab Emirates	3.2%	Brazil	0.8%

Note: The category "Manufacture of refractory products" (C2320 NACE Rev.2) corresponds to HS 69.01, 69.02 and 69.03.

Source: Authors' own elaboration on COMEXT (2016).

### **12.1.2 Trade policy**

Figure 99 describes current **Custom Union tariffs** for each product under examination; with few exceptions such tariffs appear to be quite low and, to some extent, comparable to most favoured nation tariffs applied by the United States (Figure 100). By contrast, China applies significantly higher duty rates, which can go up to almost 20%.

Reportedly, however, non-tariff barriers play a more prominent role and create obstacles for the EU exporters in third countries. A telling example is **Egypt**, where a recent decree approved by the government (991/2015) obliges all exporters to Egypt to enter a registry maintained by an Egyptian ministry.<sup>178</sup> This may create a non-tariff barrier, especially if registration procedures take time and are expensive for exporters.

**Russia** represents another example of a destination market for EU exports with significant non-tariff barriers still in place. Beside the fact that labelling each box of ceramic tiles in Russian is required, EU ceramic tile exporters must also obtain a compulsory Certificate of Conformity according to the Russian norm GOST R, which is issued by the Certification State Committee (GOSSTANDARD) or authorised agents. For instance, in 2010, some British exporters of ceramic tiles reported delays up to six months to obtain such certification.<sup>179</sup> Yet, in spite of such barriers, Russia still ranked third among destination countries for EU exports of ceramic tiles in 2015, accounting for 6.3% of total EU exports (Table 100). Reportedly, even a partial decrease in waiting time to obtain the Certificate of Conformity would represent a major step toward increasing European exports of ceramic tiles to Russia.

The same argument goes for **Saudi Arabia**, which ranked second (just ahead of Russia) among destination countries for EU exports of ceramic tiles in 2015, accounting for 6.5% of total EU exports. Indeed, Saudi Arabia put in place some significant non-trade barriers to imports of ceramic tiles that are reflected in the procedure to obtain the local Certificate of Conformity. Testing represents the main component of the Certificate of Conformity. Decisions on both test methods and what types of tiles need to be tested do not follow any established principle and tend to be arbitrary. Reportedly, it can happen that two tests are performed on two tiles of the same quality, just because they are different colours. In case of large orders, moreover, there is an additional fee for each container, which can reach up to €8,000.<sup>180</sup> Yet, the most burdensome aspect of test certificate is that, after waiting up to five weeks to obtain it, it is valid for only three months. Besides the testing, ceramic tile exporters have to label "each box" in English and Arabic according to specific instructions, with specific information. This generates high costs, especially because requested information may vary for different types of tiles.<sup>181</sup> Although the Certificate of Conformity is not a legal requirement for selling ceramic tiles, as they are not included in the list of regulated products, in practice the Certificate of Conformity is occasionally demanded by customs as an obligation to import tiles. According to relevant industry associations, this uncertainty poses serious constraints on EU exports and ultimately impinges on planning and establishing more durable business relationships with clients in Saudi Arabia.

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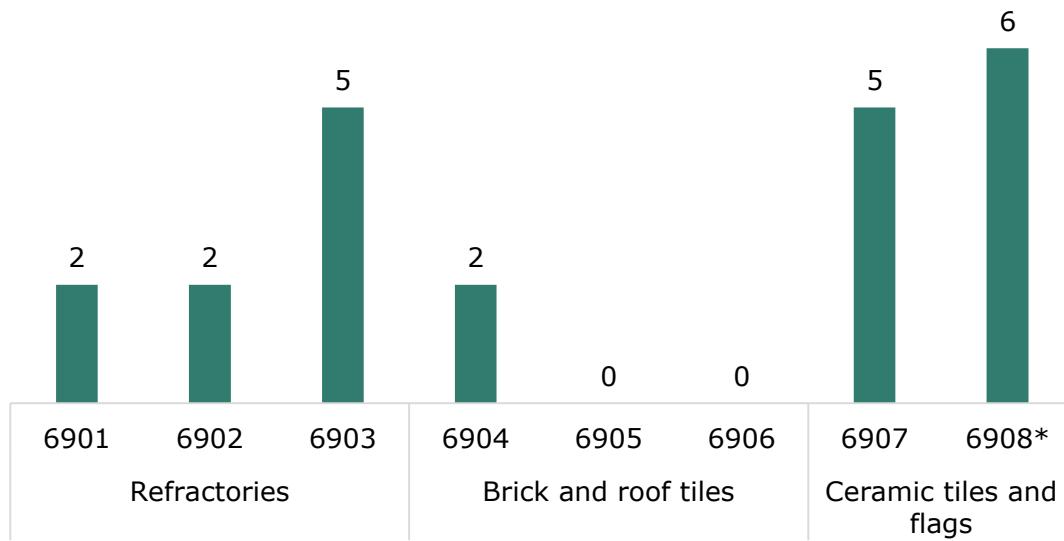
<sup>178</sup> [www.Cerameunie.eu](http://www.Cerameunie.eu).

<sup>179</sup> CU Market Access Inventory, Cerame-Unie.

<sup>180</sup> *Ibid.*

<sup>181</sup> *Ibid.*

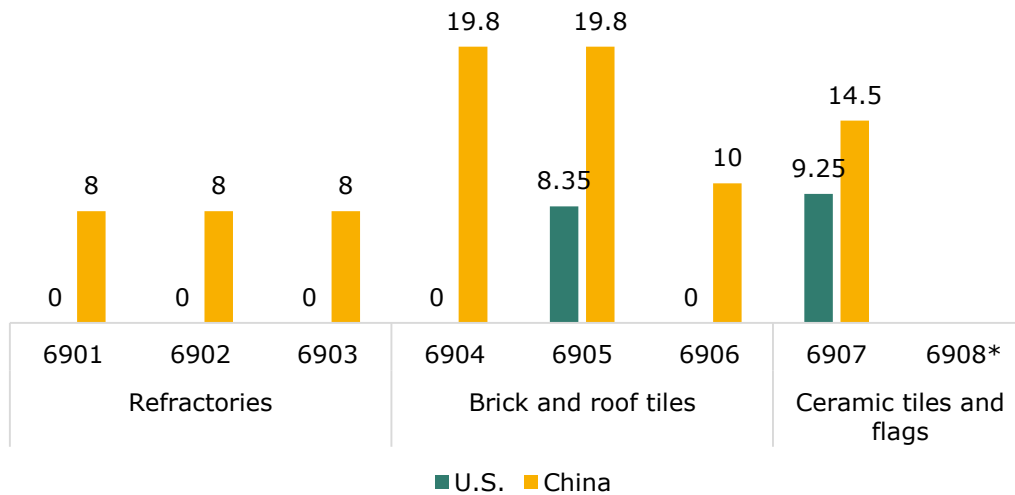
**Figure 99. EU Common Custom Tariffs in the ceramic industry by subsector, HS Code (%)**



Note: (\*) Average tariff.

Source: Authors' own elaboration on Official Journal of the EU, Volume 56, 31 October 2013.

**Figure 100. Most favoured nation tariffs applied by the US and China in the ceramics industry by subsector, HS Code (%)**



Note: Average tariffs at six-digit level.

(\*) Information not available for HS Code 6908.

Source: Authors' own elaboration on Market Access Database (MADB).

In trade policy, the removal of non-tariff barriers may well require specific actions driven by the EU's Market Access Strategy, the enforcement pillar of the EU trade policy, and trade negotiations with third countries. Nowadays, EU trade policy is especially active in negotiations of trade agreements and the removal of non-tariff measures, including



regulatory cooperation in order to reduce unnecessary barriers, such as technical barriers to trade.

In this respect the ceramics industry, mainly represented by SMEs, hopes to benefit from a dedicated Chapter on technical regulations and regulatory cooperation in trade agreements. This was under discussion in the Transatlantic Trade and Investment Partnership (TTIP). However, the TTIP negotiations ceased in late 2016. As previously shown, ceramic companies frequently export to the United States. However, besides normal tariffs, the trade cost resulting from non-tariff barriers can undermine even a sound exporting strategy. The European Commission launched a survey to make, *inter alia*, an inventory of non-tariff measures affecting SMEs when exporting to the United States.<sup>182</sup> Results show that SMEs exporting to the US in the sector of non-metallic products face technical barriers to trade (TBTs) and heavy border control procedures, followed in some cases by specific measures on competition and licenses. Compliance costs associated with the existence of TBTs, minimum standards and minimum quality, registration, testing, certification of conformity and inspection or labelling, marking and packaging tend to generate high barriers to export. Interestingly, in the non-metallic sector, 62.5% of all trade costs identified in the survey originated at federal level and 12.5% at the state level.

The ceramic sector is also involved in other bilateral trade talks, some of them concluded (such as EU-Vietnam, EU-Ukraine), others in negotiation (EU-Japan) or about to begin negotiations (EU-Mercosur, EU-Japan, EU-Philippines, EU-Indonesia, etc.) and multilateral initiatives such as the Environmental Goods Agreement.

### *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).<sup>183</sup> This Regulation, in compliance with the WTO anti-dumping agreement,<sup>184</sup> 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.<sup>185</sup> 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

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<sup>182</sup> European Commission (2015), "Small and medium enterprises in the Transatlantic Trade and Investment Partnership".

<sup>183</sup> 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.

<sup>184</sup> [www.wto.org/english/docs\\_e/legal\\_e/19-adp.pdf](http://www.wto.org/english/docs_e/legal_e/19-adp.pdf).

<sup>185</sup> [http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc\\_151016.pdf](http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_151016.pdf).

negative effect caused by dumped imports.<sup>186</sup> **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.<sup>187</sup> It sometimes happens that a market distortion may arise as a result of export subsidies, allowing the exporters to set lower 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 proved 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,<sup>188</sup> which still awaits legislation.<sup>189</sup> 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 16. 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 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

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<sup>186</sup> See note 183.

<sup>187</sup> 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).

<sup>188</sup> [http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc\\_150837.pdf](http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_150837.pdf).

<sup>189</sup> Note that 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](http://europa.eu/rapid/press-release_IP-16-3604_en.htm).

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).
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 Member 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 document<sup>190</sup> 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.<sup>191</sup> 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,<sup>192</sup> issued a July 2016 press release.<sup>193</sup> 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

<sup>190</sup> [http://trade.ec.europa.eu/doclib/docs/2009/june/tradoc\\_143599.pdf](http://trade.ec.europa.eu/doclib/docs/2009/june/tradoc_143599.pdf).

<sup>191</sup> Pelkmans, J. et al. (2016), "Tomorrow's Silk Road: Assessing the EU-China FTA", CEPS Book.

<sup>192</sup> [www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2016-0223+0+DOC+XML+V0//EN](http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2016-0223+0+DOC+XML+V0//EN)

<sup>193</sup> [http://europa.eu/rapid/press-release\\_IP-16-2567\\_en.htm](http://europa.eu/rapid/press-release_IP-16-2567_en.htm).

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 that protects 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,<sup>194</sup> 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.

On 11 December 2016, the date on which 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,<sup>195</sup> 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 Helpdesk<sup>196</sup> that provides information and advice to reduce the costs for SMEs affected by trade defence investigations abroad and in the EU. According to the European Ceramic Industry Association, a company has to invest a

<sup>194</sup> [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)

<sup>195</sup> European Commission (2012), "Evaluation of the European Union's Trade Defence Instruments" ([http://trade.ec.europa.eu/doclib/docs/2012/august/tradoc\\_149882.pdf](http://trade.ec.europa.eu/doclib/docs/2012/august/tradoc_149882.pdf)).

<sup>196</sup> [http://ec.europa.eu/trade/trade-policy-and-you/contacts/#\\_trade-defence](http://ec.europa.eu/trade/trade-policy-and-you/contacts/#_trade-defence).

minimum of 40 person-days to comply with requirements of EU anti-dumping procedure. 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 ceramics industry*

The ceramic industry can be affected by unfair trade practices, e.g. anti-dumping by third countries such as China, which is now suffering from overcapacity in some ceramics sectors. The overproduction creates a strong incentive to place a product on the international market at a price that is artificially low compared to the one set by a 'market economy' and lower abroad than at home. In the period under analysis, there was **one investigation concluded with definitive measures** on the subsectors under analysis. Precisely, **on ceramic tiles against China** (AD 560),<sup>197</sup> which is currently under review for possible extension of the anti-dumping duties for an additional five years.<sup>198</sup>

While part of the enforcement costs are included in the annual fee paid by companies to trade associations, as previously mentioned ceramics companies may incur enforcement costs to provide evidence for the investigation; such costs tend to be relatively higher for SMEs. 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 online SME TDI Helpdesk,<sup>199</sup> which provides information and advice to reduce the costs for SMEs affected by trade defence investigations (TDI).

Table 102 summarises the main characteristics of the **AD 560 case on ceramic tiles** undertaken by the Commission in 2010. The case has definitive measures still in place and, at the time of writing this Study, is still under review for another period.

The case was raised in 2011 by the European Ceramic Tile Manufacturers' Federation (CET),<sup>200</sup> referring to an injury covering the period between **April 2009 and March 2010**. The party claimed that an increase in imports of ceramic tiles from China was characterised by a dumped price in the range of 26.3-36.5%.

The Commission launched the investigation based on the information collected at plant level and the causality link between the injury suffered by the industry and the increased dumped imports. As in all the other investigations, the coordination between the national associations and the EU association was crucial to collecting the right information and proving the causality link. As China was not treated as a market economy and also did not ask for the individual treatment granted in some specific cases, the complaint proposed the United States as an 'analogue' country. According to the lesser duty rule approach, the anti-dumping duty had to be the lowest between the injury and the dumping margin. After six months of provisional measures, definitive anti-dumping duties were set between 29.3% and 36.5%. At the time of writing this Study, the Commission had accepted to proceed with a review in order to analyse whether the anti-dumping duties were still justified and could remain in place for another five years.

Based on feedback from the European Ceramic Industry Association, this case, like others for this industry, had the great challenge of grouping together a representative sample of

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<sup>197</sup> Council Implementing Regulation (EU) No 917/2011 of 12 September 2011 imposing a definitive anti-dumping duty and collecting definitively the provisional duty imposed on imports of ceramic tiles originating in the People's Republic of China.

<sup>198</sup> A second investigation concerns ceramic tableware and kitchenware (AD 586) for which AD duty between 13.9% and 32% has been applied. A last one on ceramic foam filter (AD624) expired in 2015.

<sup>199</sup> [http://ec.europa.eu/trade/trade-policy-and-you/contacts/#\\_trade-defence](http://ec.europa.eu/trade/trade-policy-and-you/contacts/#_trade-defence).

<sup>200</sup> <http://cerameunie.eu/members/sectors/>.

enterprises that are affected by the dumping practices. The coordination between the companies, the national associations and the EU associations is indeed crucial to the preparatory phase of the investigation. For instance, a national association calculated an overall amount of €120,000 spent over the first 15 months of such an investigation. More specifically, the association spent approximately €70,000 in legal fees and € 50,000 in personnel costs.

**Table 102. Anti-dumping measures in the relevant ceramic sectors since 2006**

	Product	Country	Status	Year
<b>AD560</b>	Ceramic Tiles	People's Republic of China	Measure in force until Sept 2016	2010
<b>R586</b>				

	Product	Analogue country	Dumping Margin (%)*	Injury Margin (%)	AD Duty (%)
<b>AD560</b>	Ceramic Tiles	USA	26.3-36.5	58.6-82.3	26.3-36.5
<b>R586</b>		USA	Revision of duties for some groups		13.9-32.0

*Source: Authors' own elaboration.*

Anti-dumping investigations have also been undertaken against EU Member States by third countries. Table 103 describe the investigation initiated by Morocco against Spain on exports of ceramic tiles. However, the investigation did not make a valid case to apply anti-dumping duties, so definitive measures have not been imposed.

**Table 103. Anti-dumping cases undertaken against EU countries**

Country	Product	Case status	Initiation	Definitive measures	Country investigated
Morocco	Ceramic Tiles	Investigation	16 May	Not applicable	Spain

#### *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**). 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).<sup>201</sup>

<sup>201</sup> [http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc\\_151031.pdf](http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_151031.pdf).

*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 was 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 ceramics industry*

**The European Union does not have any safeguard measures in place** in the ceramics 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 is one safeguard measure against EU Member States affecting the ceramics industry:

- Safeguard measure (investigation initiated in July 2015) on ceramic tiles exported to Tunisia.

## 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 dimension<sup>202</sup> and aims to avoid that

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<sup>202</sup> The EU dimension is met in two different cases: i) the combined worldwide turnover of the merging companies is greater 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 ceramics industry*

In the context of EU competition legislation, over the period 2006-15 **the ceramics 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 for identifying **antitrust cases and merger notifications** under scrutiny by the Commission during the period 2005-16 (Table 104).<sup>203</sup> In the selected timespan, no cartel was detected in the ceramics industry. In addition, ceramics manufacturers notified seven mergers to the Commission, all of them involving bricks and tiles producers (23.32); all the mergers were approved via a simplified procedure as per Commission Notice 2005/C 56/04.<sup>204</sup> This simplified approach is expected to streamline merger approval and reduce the administrative burden and litigation costs generated on 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 ceramics industry.

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<sup>203</sup> "Search Competition Cases" by the European Commission ([http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy\\_area\\_id=3](http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3)).

<sup>204</sup> Commission Notice on a simplified procedure for treatment of certain concentrations under Council Regulation (EC) No 139/2004 (2005/C 56/04).

**Table 104. List of antitrust cases and merger under the scrutiny of the Commission in the ceramics industry (2006-15)**

Policy area	Case Number	Title	NACE
Merger*	M.4768	CRH / CEMENTBOUW	23.32
Merger*	M.6026	CRH / BAUKING	23.32
Merger*	M.6102	WIENERBERGER / TONDACH GLEINSTATTEN	23.32
Merger*	M.6534	WIENERBERGER / PIPELIFE INTERNATIONAL	23.32
Merger*	M.6550	TOWERBROOK/ YORK / APOLLO / MONIER	23.32
Merger*	M.7500	BAIN CAPITAL / IBSTOCK GROUP	23.32
Merger*	M.7524	LONE STAR / HANSON BUILDING ENTITIES	23.32

Note: \* Simplified procedure; cases were retrieved by setting as search parameters: i) a decision date between 1 January 2006 and 31 December 2015; and ii) NACE rev.2 Code 23.2 or 23.3.

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 ceramics industry*

In the context of EU state aid control, companies operating in the EU ceramics 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 ceramics producers were able to **access 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 ceramics industry is also covered by the new 2014-20 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).<sup>205</sup>

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 ceramics subsectors of interest are mentioned** therewith. Additionally, all EU Member State notifications to DG Competition of the European Commission of their intent to provide state aid for indirect

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<sup>205</sup> 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%.

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 ceramics industry (Table 105). Interestingly, the only state aid case available on the online tool was prohibited in 2007 as not compliant with EU rules.<sup>206</sup> At any rate, as mentioned above and in light of this qualitative analysis, it appears that state aid rules did not generate substantial regulatory costs on ceramics companies over the timespan covered by the CCA.

**Table 105. List of state aid cases notified to/registered by the Commission in the ceramics industry (decision date between 2006 and 2016)**

Policy area	Case Number	Member State	Title	NACE
State Aid (R)	C21/2007	Hungary	MSF-2002-HU Ividen Hungary Ltd	23.20

*Note: R: rejected; 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 23.2 or 23.3.*

*Source: Authors’ own elaboration on European Commission.*

<sup>206</sup> This case involved IBIDEN Hungary Gyártó Kft., a Hungarian subsidiary of IBIDEN Co. Ltd., producing ceramic substrates for Diesel Particulate Filters ([http://europa.eu/rapid/press-release\\_IP-08-670\\_en.htm](http://europa.eu/rapid/press-release_IP-08-670_en.htm)).

### **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 provides **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.<sup>207</sup> The **companies are obliged to provide continuous monitoring and controls**, which are carried out on national and international level via checking tachograph records.

Through **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 **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**

According to the Directive 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. The Directive requires keeping records of the workers' working time, which causes **administrative burden** for the industry.

In general, 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. Companies might have agreements with transport providers,<sup>208</sup> thus the legislation could cause **indirect costs**.

Based on this, more strictly enforced and reduced working hours can generate **substantive compliance costs** (of direct or indirect nature depending on the business model) for the ceramics industry, which 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 companies whose upstream and/or downstream logistics are integrated, and indirect costs for those companies that outsource road transportation of raw materials or finished products.

#### **12.3.3 Relevance for the sectors**

Transport logistics constitutes an important part of costs for the ceramics industry, especially for products that are transported over long distances. Transport legislation is, however, not seen as a major cost factor for the industry. Nevertheless, in our questionnaire we included a limited number of questions to quantify direct costs generated

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<sup>207</sup> European Commission, Mobility and Transport ([http://ec.europa.eu/transport/modes/road/social\\_provisions/driving\\_time/index\\_en.htm](http://ec.europa.eu/transport/modes/road/social_provisions/driving_time/index_en.htm)).

<sup>208</sup> Ceramic Logistics Ltd., Freight for Small Businesses ([www.ceramiclogistics.com/blog/](http://www.ceramiclogistics.com/blog/)).

by transport legislation in case of integrated transport solutions. The existence of such solutions was, however, not a selection criterion for interviewees.

As all of the interviewed ceramics manufacturers outsource their transport activities, it was not possible to collect costs coming from European legislation in the transport area. The vast majority of ceramics manufacturers has **agreements with transport providers**, which supply plants with raw material and transport final products to their customers.

**Figure 101. 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. Plants producing bricks and tiles are usually located close to raw materials sources, as reflected in the short geographical distances reported in the sample. The proximity to raw materials also results in a higher fragmentation of production across plants: companies opt out to geographically spread their production lines rather than concentrating their activities. Ultimately, distance from plants and customer will tend to be shorter.

Overall feedback from industry suggests that the Directives are of low relevance for the costs of the ceramics 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, they did not pass them on to ceramics manufacturers.

According to one of the interviewed transport providers, it is not the European legislation that triggers costs but rather **differences in national legislation across the EU**. Especially burdensome are the differences in legislation regarding technical dimensions of vehicles and trailers. Due to these differences, the transport providers need various types of trailers, which generates additional costs and administrative burdens.

#### 12.4 Product legislation and life-cycle assessment: The Eco-Label Regulation

**The Eco-Label Regulation (ELR)<sup>209</sup> manages the awarding and use of the 'EU Ecolabel', a voluntary environmental performance certificate.** The EU Ecolabel is awarded to products and services distributed, consumed, or used on the Union market, on condition that products and services meet the product-specific criteria concerning the reduction of the environmental impact. While the possibility for certain products or industries to participate in the Ecolabel scheme by complying with the relevant environmental performance criteria is provided in a binding act via the Commission's secondary legislation, the participation in the Ecolabel scheme remains voluntary for companies.

This environmental performance certificate is based on multiple criteria, which set out the requirements that a product must fulfil to display the EU Ecolabel. These criteria are determined on a scientific basis considering the whole life cycle of products, taking account of, *inter alia*, (i) the impact on climate change; (ii) energy and resource consumption; and (iii) the use and release of hazardous substances. Market surveillance, aimed at verifying the correct application of the Ecolabel framework and the provision of true information to consumers, is delegated to Member States, which shall designate independent bodies for this purpose.

The impacts of the ELR on the ceramics subsectors depend on whether the products are subject to a specific Regulation. In the period covered by this Study, this is the case for: **hard coverings** (produced by the sector 'ceramic tiles and flags').<sup>210</sup> The relevance of the ELR was considered 'low' and hence only subject to a qualitative analysis. **Importantly, the Ecolabel scheme, being voluntary, cannot be considered as generating substantive costs.** The costs generated would not be regulatory costs *stricto sensu*, but costs due to market-based decisions by single companies. This would be different if Ecolabel had such a large market share of the hard coverings sector that it should be considered as a *de facto* market standard. While there is no information on market coverage of Ecolabel, only 17 licenses were granted to hard covering companies up to 2015,<sup>211</sup> which makes it very unlikely that it should be considered a market standard.

The first Regulation on the Ecolabel for hard coverings dates back to 2002,<sup>212</sup> and resulted from a decision to develop criteria for these products that was taken in the late 1990s. The input came largely from Italian stakeholders, as, under the previous framework, national competent authorities could also start the procedure to establish an ecolabel criteria for a product. Even at now, most of the producers covered by this Ecolabel are Italian companies (14 out of the 17 producers covered). The criteria were then revised in 2009, and prolonged in 2013. Costs linked to the Ecolabel framework are mostly linked with the first application and changes in the criteria. Indeed, retrieval of information to demonstrate compliance may be burdensome, especially when this information needs to be obtained by (long chains of) suppliers. Costs are due to both internal staff resources and external consultants. However, for hard coverings, the system has not been modified for eight years, hence costs to remain within the system are likely to be marginal for operators.

The management of the scheme, though voluntary, still generates administrative burdens, e.g. for submission of information, labelling, monitoring and inspection, and fees for

<sup>209</sup> Regulation (EC) No 66/2010 of the European Parliament and of the Council on the EU Ecolabel.

<sup>210</sup> Commission Decision 2009/607/EC establishing the ecological criteria for the award of the Community Ecolabel to hard coverings.

<sup>211</sup> Ecolabel licenses are granted to operators. However, an operator can then decide to Ecolabel all of its production, or only certain product lines. This is a company strategy decision.

<sup>212</sup> Commission Decision 2002/272/EC establishing the ecological criteria for the award of the Community Ecolabel to hard floor-coverings.

accessing the scheme.<sup>213</sup> Stakeholders complained that the Italian competent authorities, being responsible for the bulk of licences for hard coverings, opted to impose a high annual fee (up to €25,000), while other competent authorities, significantly less relevant for this product, require lower fees.

There are no studies on the commercial return of Ecolabel for hard coverings, and companies and trade associations considered it to be limited. The Ecolabel is not a recognised and appreciated quality market in the ceramic tiles market; as for other sectors, it may be an instrument for Green Public Procurement policies, but its use to this purpose is yet sporadic.

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<sup>213</sup> Cf. the Commission Document ([ec.europa.eu/environment/ecolabel/documents/eu-ecolabel\\_fees.pdf](https://ec.europa.eu/environment/ecolabel/documents/eu-ecolabel_fees.pdf)).



## 12.5 Natura 2000

**Natura 2000** is a European network of natural sites, selected for either their potential as breeding and resting sites for rare and threatened species, or their habitat types. The Natura 2000 network includes 'typical' nature reserves, but also privately owned or inhabited lands. In all sites, Member States have a duty to preserve or restore the natural habitat.<sup>214</sup>

The aim of the Natura 2000 network is **to protect the species and habitats covered by the Habitats and Birds Directives**.<sup>215</sup> The former, dating back to 1992, aims at protecting biodiversity in Europe through conservation, including both maintenance and restoration of natural habitats and wild flora and fauna.<sup>216</sup> The latter, dating back to 2008, aims at protecting species of certain naturally occurring birds in the wild state – as listed in Annex I – by requiring Member States to maintain their population by preserving, maintaining or re-establishing the necessary habitats.

The Habitats and Birds Directives do not target industries and economic operators. As a result, in principle they do not generate direct regulatory costs. However, they can generate **negative regulatory effects to the extent to which they interfere with the supply of raw materials**. In certain specific cases, i.e. when the supply of raw materials is vertically integrated with the manufacturing activities – as is the case for several companies in the bricks and tiles sector – regulatory effects can directly affect manufacturing companies. The impact can take the shape of increased costs, e.g. when extracting clay from a certain area is subject to more stringent constraints, or limitations to the extractive techniques or extracted quantities, or when the administrative regime is more burdensome. The impact can also be of a non-cost nature, e.g. when extracting sites can no longer be exploited and companies have to substitute their supply sources.

Preliminary evidence suggested that the Natura 2000 created problems for the ceramics industry in relation to clay extraction in the Dutch bricks industry only.<sup>217</sup> The Research Team further investigated the problem and **devised a specific questionnaire to identify Natura 2000 costs**. However, Dutch brick plants did not participate in the exercise, and plants in other parts of Europe did not report any issue with the Natura 2000 legislation. Indeed, the latter is only relevant for **plants physically located near a protected site**; otherwise, the legislation would have no impact on brick and tile plants.

Plants located near a protected site are required to evaluate the impacts of new (or existing, when the permit expires or needs updating) production activities. Public authorities may consent to the economic activity only when the environmental assessment shows that there are no significant detrimental impacts. The administrative procedure governing this process generates **administrative burdens (especially for the ecological evaluation study) and time delays**. When detrimental impacts are expected to occur, the need of the economic activities may be balanced with environmental protection measures, for justified social economic reasons, and the activities may still be authorised. The discretionary power to balance economic and environmental interests is left to the public authority in charge of the procedure, and to national legislation.

With respect to the specific **Dutch situation**, stakeholders claimed that the implementation of the Natura 2000 package creates specific risk for the brick and tile industry, whose extraction activities are in most cases close to rivers. In particular, it was

<sup>214</sup> Cf. DG ENV, Natura 2000 ([http://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/index_en.htm)).

<sup>215</sup> Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.

<sup>216</sup> Cf. Art. 2 Habitats Directive.

<sup>217</sup> Cerame-Unie, "EU policymakers address implementation of Natura 2000" (<http://cerameunie.eu/topics/cerame-unie-sectors/cerame-unie/eu-policymakers-address-implementation-of-natura-2000/>).

mentioned that **the authorisation process is very cumbersome**, and the requirements for studies and assessment extensive; also, the duration of the Natura 2000 Dutch management plan (six years) is too short for the long-term investment planning of the industry; 60 to 70% of the Dutch bricks industry would be affected by this problem. However, this claim could not be verified with other sources or with public authorities which, at EU level, reported not to be aware of any specific issue linked with the implementation of Natura 2000 in the Netherlands and/or concerning the ceramics sector. In this respect, it is also unclear, and could not be further discussed with local operators, the extent to which this problem is linked to national or local factors.

## **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 ceramics industry between 2006 and 2015. More specifically, for each sector and subsector in the scope of the assessment, i.e. bricks and tiles, ceramic tiles and refractories, including fired refractories and unfired shaped refractories, the following information over the period 2006-15 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) general worker's health and safety and workplace safety, x) special worker's health and safety and xi) consumers and health.
- **Cumulative cost versus production costs**<sup>218</sup> incurred by EU ceramics producers.
- **Cumulative cost versus EBITDA** registered by EU ceramics producers; EBITDA (earnings before interest, taxes, depreciation and amortisation) measure the profitability of a company before covering CAPEX, financial costs and national taxes.<sup>219</sup>
- **Cumulative cost versus EBIT** registered by EU ceramics producers; EBIT (Earnings Before Interest and Taxes) measure the profitability of a company before covering financial costs and national taxes.<sup>220</sup>

As mentioned in Chapter 2, margins measured in this Study are expected to be higher than average margins experienced by the EU ceramics 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).

<sup>218</sup> Production costs include all costs, both OPEX, CAPEX and other expenses, borne by the plant and directly relating to the manufacturing process.

<sup>219</sup> 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.

<sup>220</sup> The only exception is represented by unfired shaped refractories, 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,<sup>221</sup> 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 incurred 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, **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. Regional averages are presented only if based on data provided by at least three different plants belonging to three independent companies.

In what follows, **data for bricks and tiles, ceramic tiles and fired refractories are provided both at the EU and regional level.**<sup>222</sup> Conversely, **data for unfired shaped refractories are available only at the EU level.**

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<sup>221</sup> 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.

<sup>222</sup> Data for some regions cannot be shown due to confidentiality reasons, as they were collected from plants belonging to fewer than three independent companies.

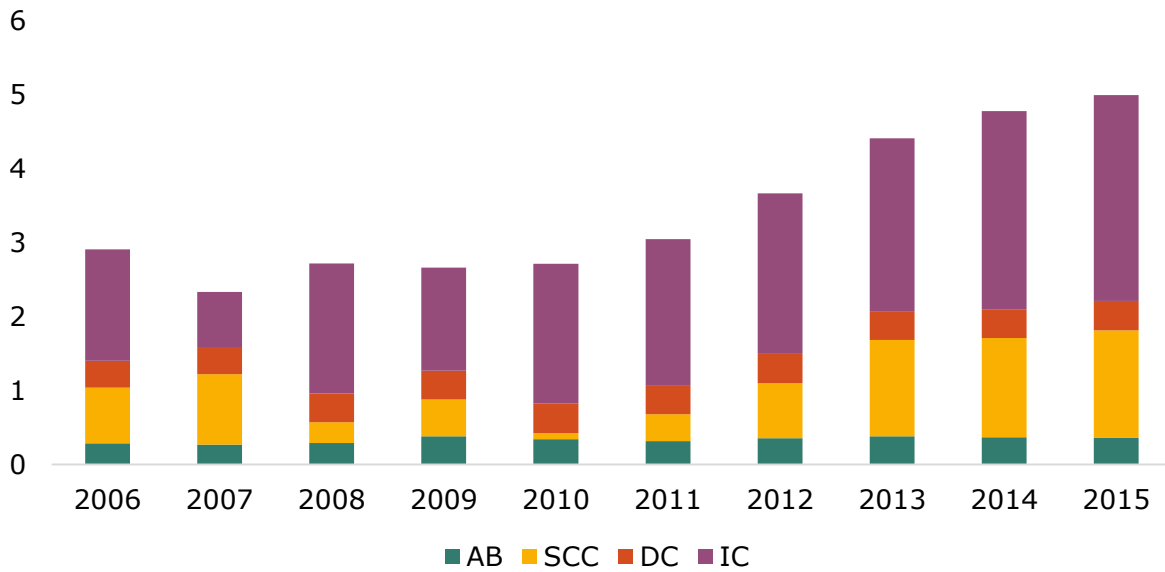
### 13.1 Bricks and tiles

#### 13.1.1 EU

EU legislation covered by this Study generated regulatory costs for the EU bricks and tiles sector ranging from **€2.30 to €5 per tonne of output** (Figure 102). Substantive compliance costs and indirect costs were the largest portions of regulatory costs in recent years; interestingly, costs registered between 2006 and 2012 were affected by potential revenues stemming from the first two phases of the EU ETS. Over the entire period, rules affecting the electricity price proved to be the most burdensome (€1.24/tonne), followed by environmental legislation (€0.64/tonne; see Figure 103).

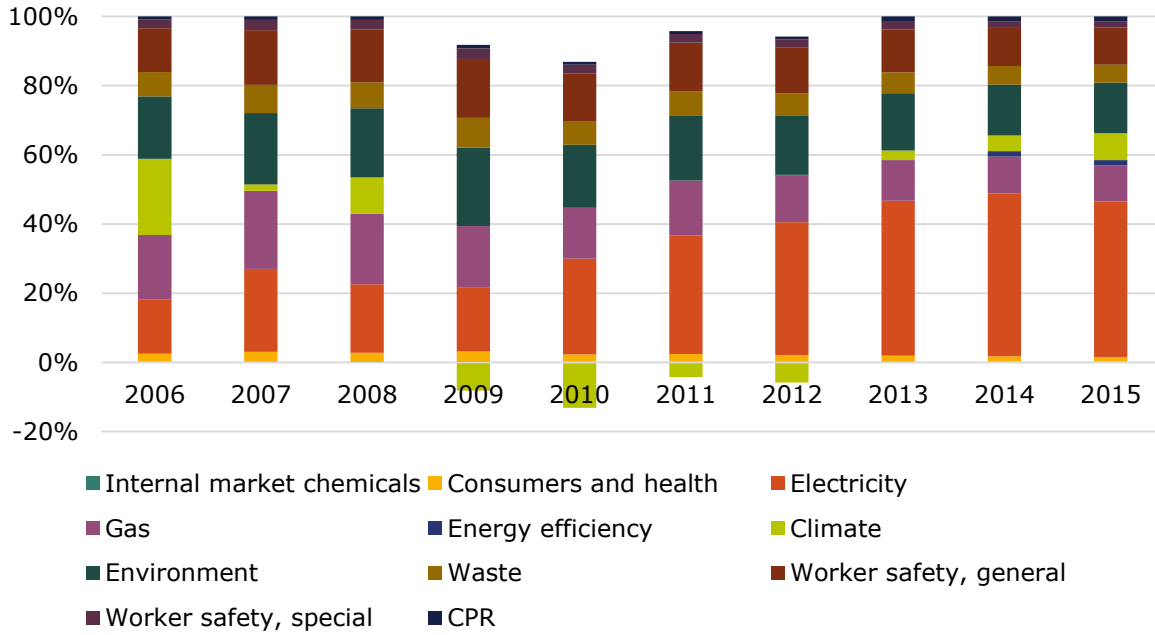
**In 2015, cumulative regulatory costs were equal to €5/tonne**, including €0.36/tonne of administrative burdens, €1.46/tonne of substantive compliance costs, €0.40/tonne of direct charges and €2.78/tonne of indirect costs (generated by energy and climate legislation). **Energy legislation in the field of electricity** generated 45% of total regulatory costs, followed by **environmental legislation** (15%), **general workers' and workplace's safety legislation** (11%) and rules affecting the gas price (10%).

**Figure 102. Bricks and tiles: Cumulative cost by category of regulatory costs (€/tonne, EU)**



Source: Authors' own elaboration.

**Figure 103. Bricks and tiles: Cumulative cost by area of legislation (% , EU)**



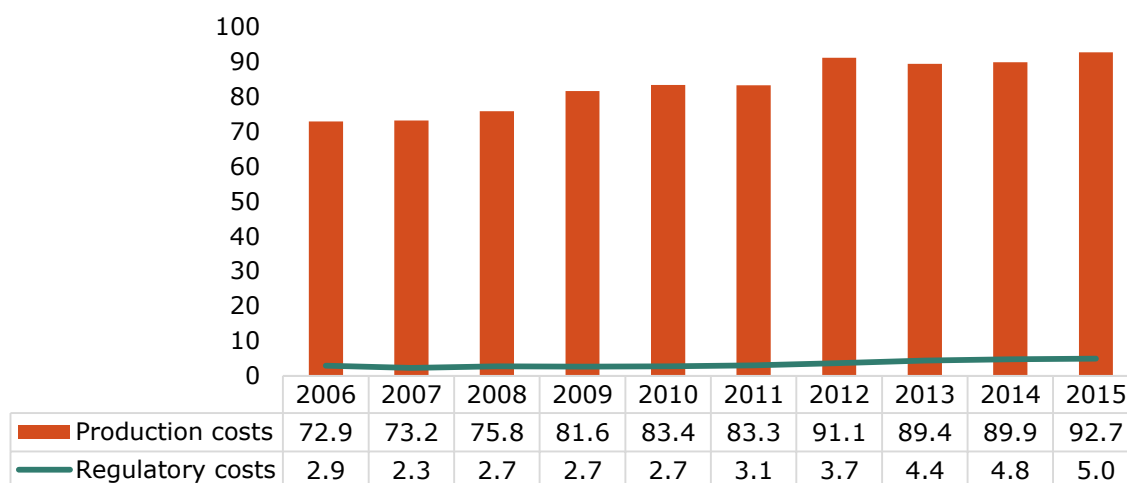
*Note: Between 2009 and 2012 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market.  
Source: Authors' own elaboration.*

Cumulative regulatory costs were between **3.2% and 5.4% of production costs** incurred by producers of bricks and tiles during the period 2006-15 (Figure 104). Importantly, in later years their share out of total production costs increased (4.9% in 2013, 5.3% in 2014 and 5.4% in 2015), mainly due to higher costs generated by the proper functioning of the EU ETS and growing regulatory costs paid in the electricity bill.<sup>223</sup>

As EBITDA of the sector were above €15/tonne for the entire period, regulatory costs represented on average **18% of this key performance indicator** (Figure 105). Finally, Figure 106 shows the EBIT trend of the sector, which followed the one registered by EBITDA. Regulatory costs were on average **42% of this key performance indicator**; ye, in 2013 they were equal to 87% of the EBIT.

<sup>223</sup> The EU sectoral turnover per tonne of output ranged between €100 (in 2006) and €127 (in 2015). Cumulative regulatory costs represented between 2.3% and 3.9% of the turnover per tonne of bricks and tiles.

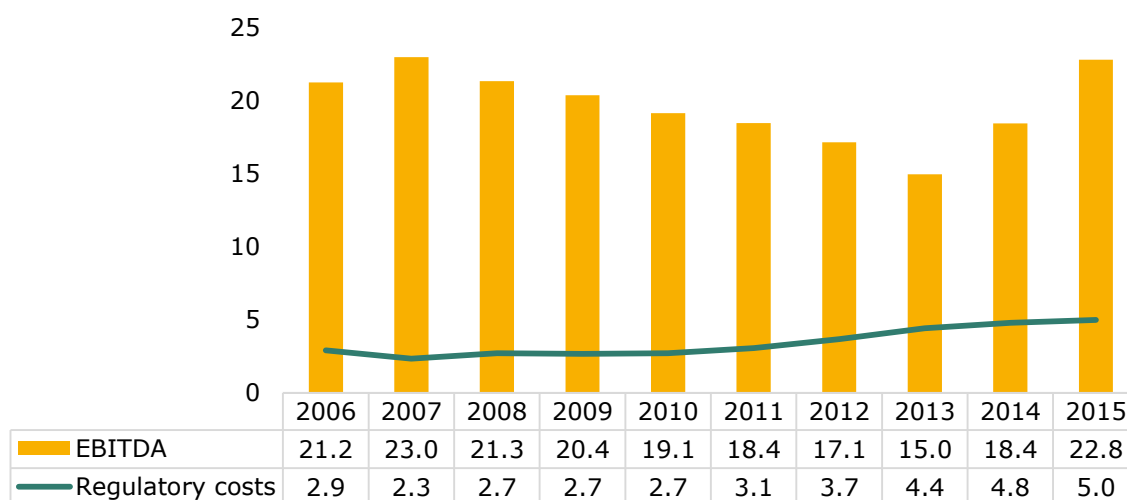
**Figure 104. Bricks and tiles: Cumulative cost versus production costs (€/tonne, EU)**



*Note: Production costs are estimated on a sample of 15 plants in 2006 and 2007 and 17 plants in other years.*

*Source: Authors' own elaboration.*

**Figure 105. Bricks and tiles: Cumulative cost versus EBITDA (€/tonne, EU)**

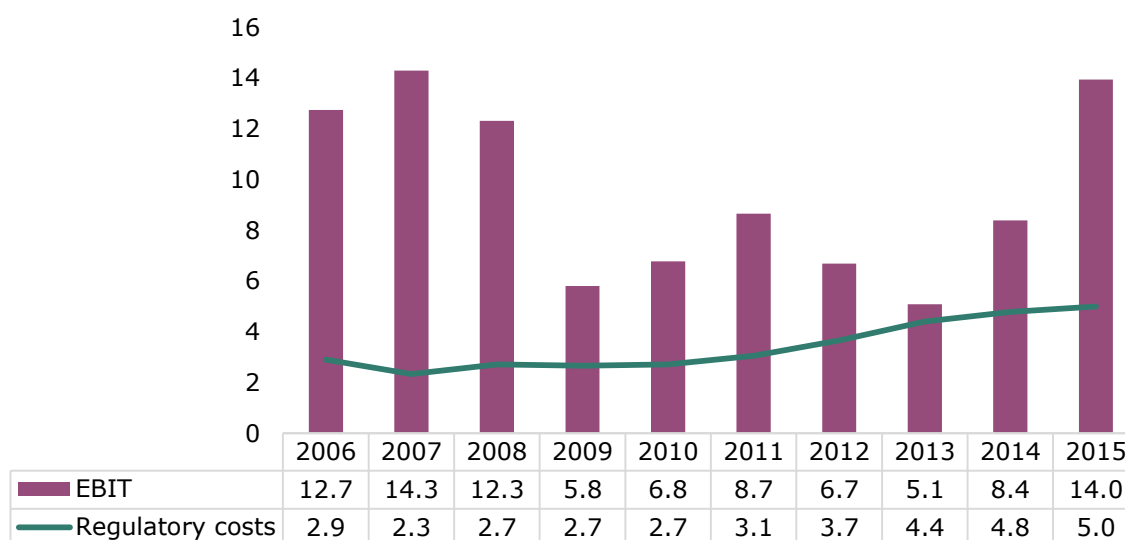


*Note: EBITDA are estimated on a sample of 15 plants in 2006 and 2007 and 17 plants in other years.*

*Source: Authors' own elaboration.*



**Figure 106. Bricks and tiles: Cumulative cost versus EBIT (€/tonne, EU)**



Note: EBITDA are estimated on a sample of 15 plants in 2006 and 2007 and 17 plants in other years.

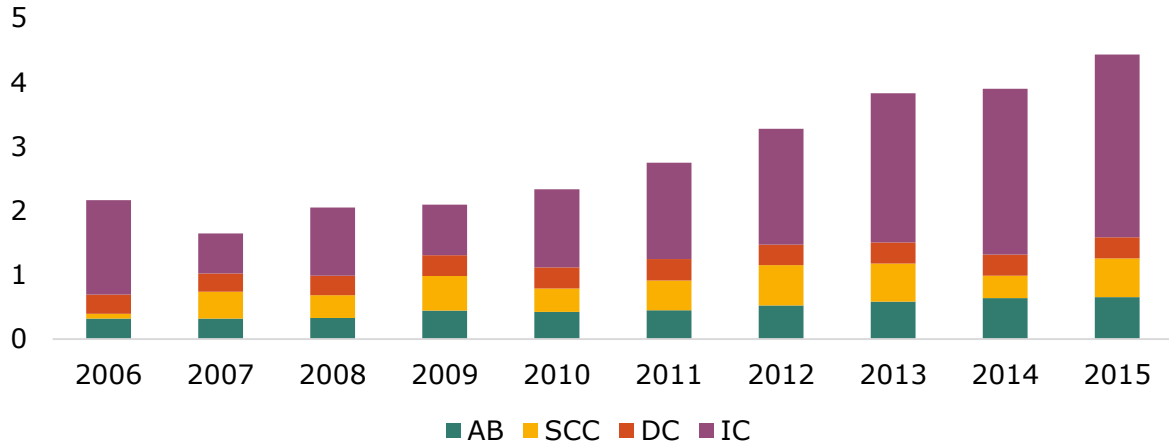
Source: Authors' own elaboration.

### 13.1.2 Southern Europe

In the SE region, **regulatory costs ranged between €1.65 and €4.43/tonne**; indirect costs represented the main component (€1.62/tonne on average). **In 2015, total regulatory costs were €4.43/tonne**, comprising €0.65/tonne of administrative burdens, €0.60/tonne of substantive compliance costs, €0.33/tonne of direct charges and €2.85/tonne of indirect costs (mainly due to electricity and climate; Figure 107).

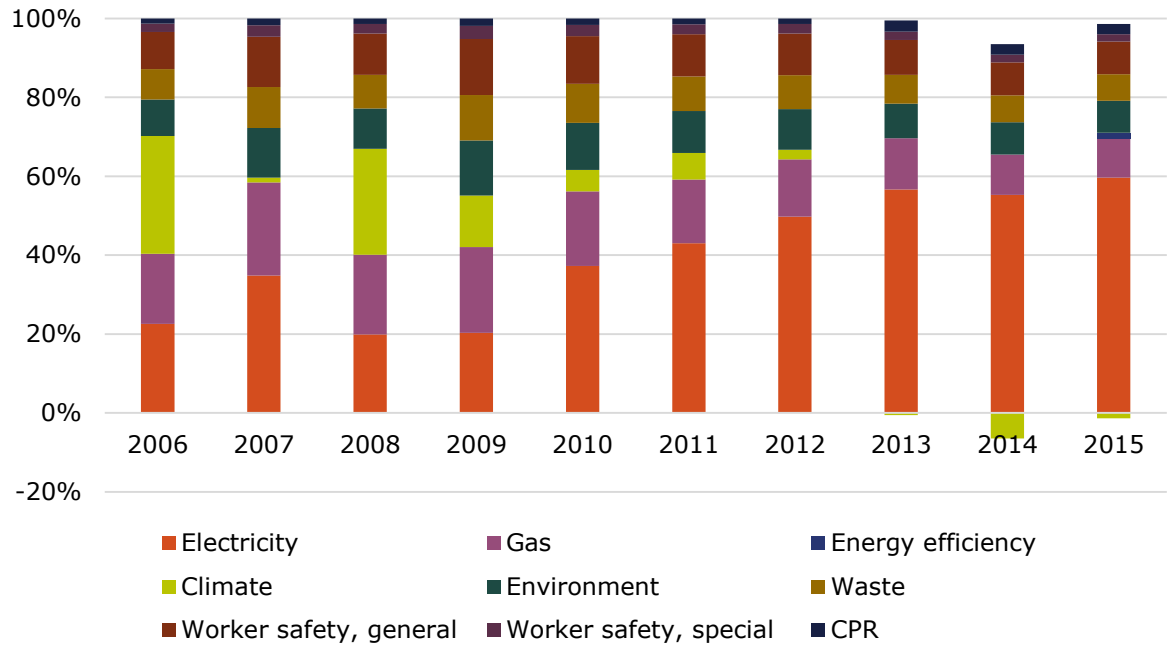
On average, the most burdensome pieces of legislation were: i) **rules affecting electricity price**, representing 39% of total regulatory costs, i.e. €1.20/tonne; ii) **rules affecting gas price**, accounting for 16% of total regulatory costs, i.e. €0.42/tonne; iii) **general workers' and workplace safety legislation**, equal to 10% of total regulatory costs, i.e. €0.28/tonne; and iv) **environmental legislation**, which accounted for 10% of total regulatory costs, i.e. 0.27 €/tonne; Figure 108.

**Figure 107. Bricks and tiles: Cumulative cost by category of regulatory costs (€/tonne, Southern Europe)**



Source: Authors' own elaboration.

**Figure 108. Bricks and tiles: Cumulative cost by area of legislation (% , Southern Europe)**



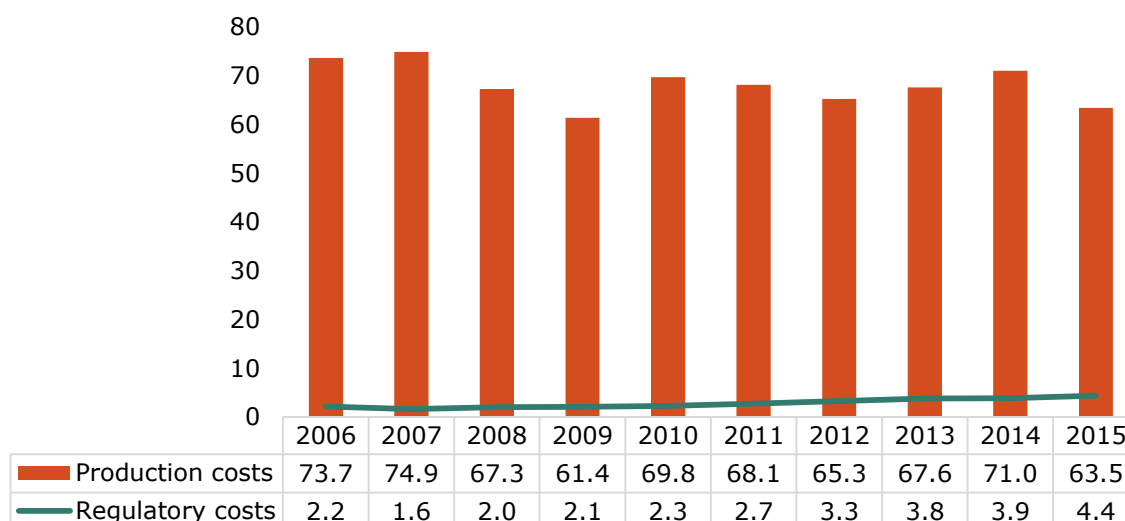
Note: Costs for "Internal Market for chemicals" and "Consumers and health" cannot be shown for this region due to confidentiality reasons; between 2013 and 2015 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market.

Source: Authors' own elaboration.

In SE, regulatory costs constituted **a share of total production costs between 2.2% and 7.0%**; the peak was registered in 2015 and was mainly due to a fall in production costs equal to €7/tonne. Interestingly, both regulatory costs and production costs were below the EU average. When it comes to key performance indicators, the share of regulatory costs out of **EBITDA** increased over the last three years, peaking at 49.5% in 2015. In fact, in these later years, EBITDA appeared to be quite low and substantially

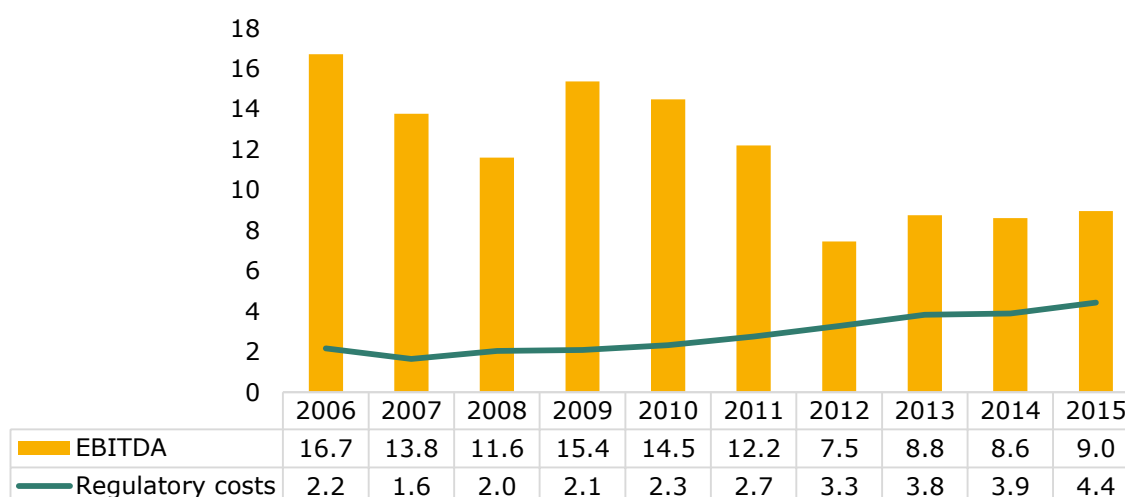
below pre-crisis levels (Figure 110). Interestingly, 2009 was the last year in which regulatory costs were lower than EBIT itself. In fact, between 2010 and 2015 **EBIT** remained on average around €1/tonne (Figure 111). Also, profitability indicators in this region were lower than those registered at the EU level.

**Figure 109. Bricks and tiles: Cumulative cost versus production costs (€/tonne, Southern Europe)**



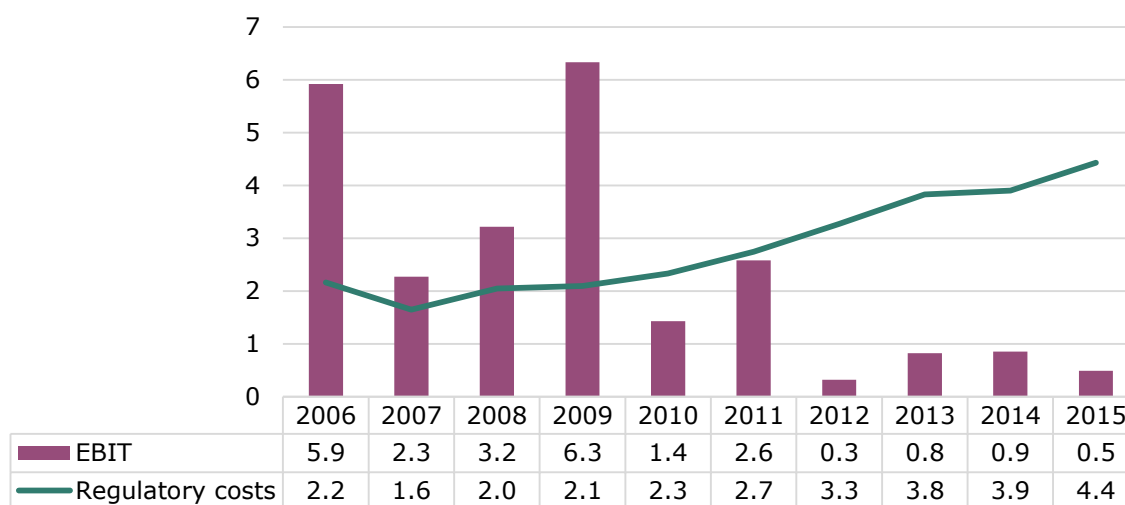
Note: Production costs are estimated on a sample of five plants.  
Source: Authors' own elaboration.

**Figure 110. Bricks and tiles: Cumulative cost versus EBITDA (€/tonne, Southern Europe)**



Note: EBITDA is estimated on a sample of five plants.  
Source: Authors' own elaboration.

**Figure 111. Bricks and tiles: Cumulative cost versus EBIT (€/tonne, Southern Europe)**

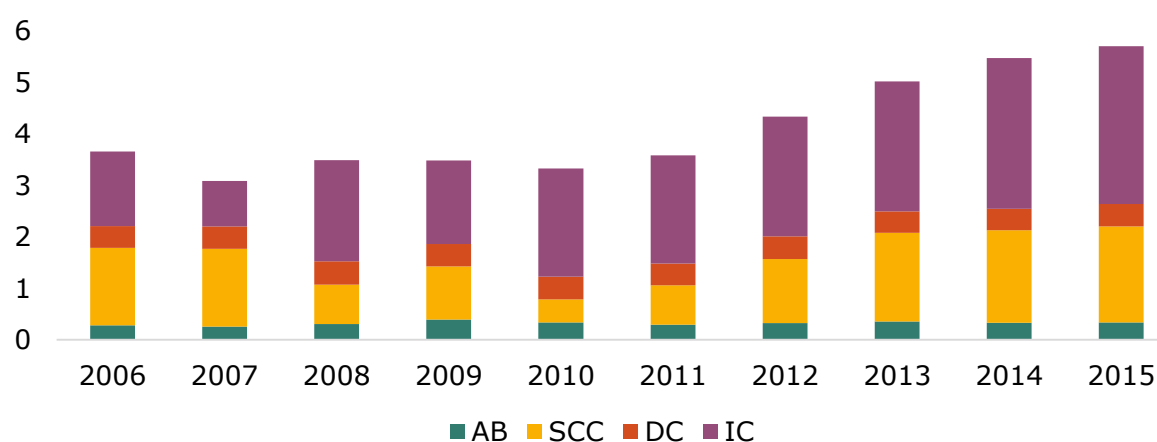


Note: EBITDA is estimated on a sample of five plants.  
Source: Authors' own elaboration.

### 13.1.3 Northern-Western Europe

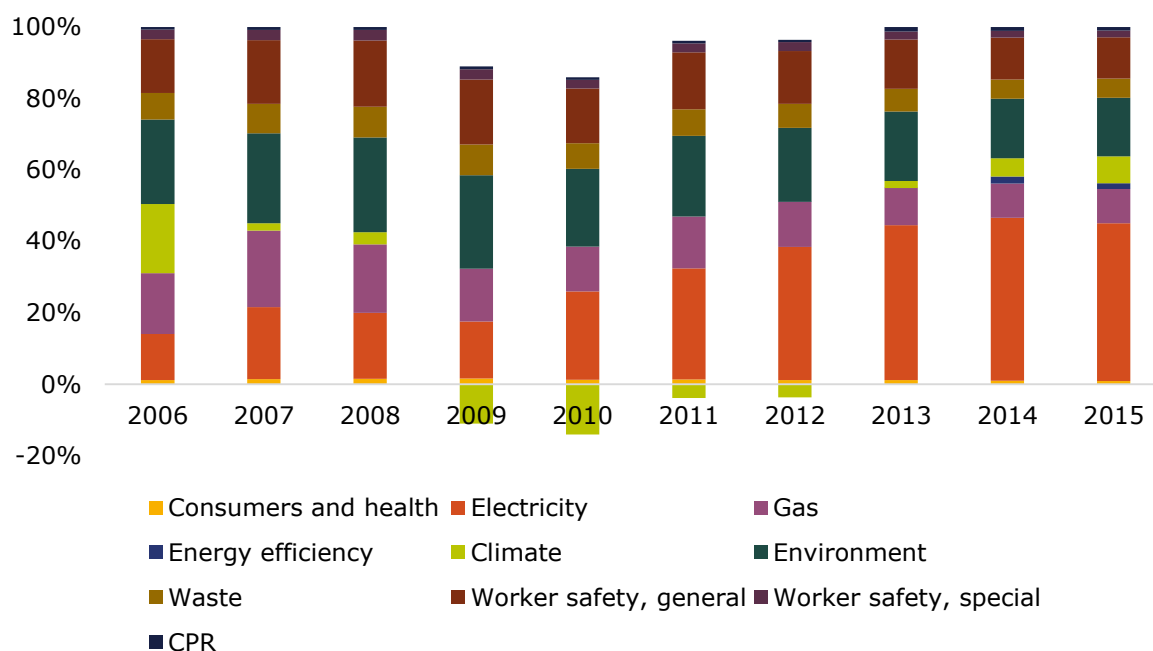
Regulatory costs incurred by brick and tile producers based in NWE appeared to be higher than those registered in SE. In fact, on average, **regulatory costs in this region were €4.11/tonne, ranging between €3.08/tonne in 2007 and €5.70/tonne in 2015.** In the last year covered by this Study, the greatest regulatory costs were indirect costs at €3.06/tonne and substantive compliance costs at €1.87/tonne, while direct charges and administrative burdens generated €0.43/tonne and €0.33/tonne, respectively (Figure 112). More specifically, in 2015, €2.52/tonne were linked to **rules affecting the electricity price**, €0.93/tonne to **environmental legislation**, €0.66/tonne to general workers' and workplace safety rules and €0.55/tonne to **rules affecting the price of gas** (Figure 113).

**Figure 112. Bricks and tiles: Cumulative cost by category of regulatory costs (€/tonne, Northern-Western Europe)**



Source: Authors' own elaboration.

**Figure 113. Bricks and tiles: Cumulative cost by area of legislation (% , Northern-Western Europe)**



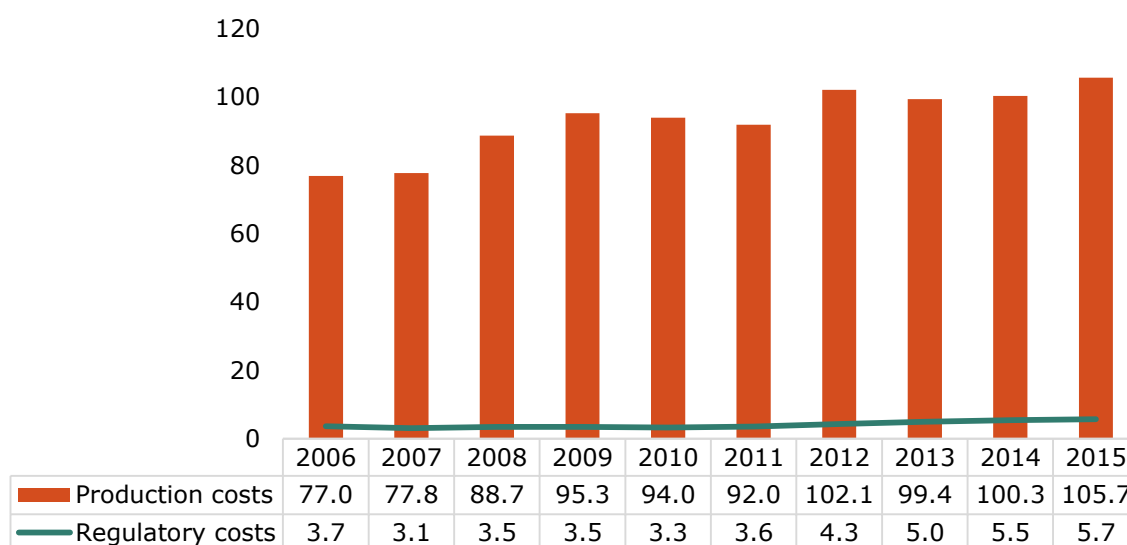
*Note: Between 2009 and 2012 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market; costs for "Internal Market chemicals" cannot be shown for this region due to confidentiality reasons.*

*Source: Authors' own elaboration.*

**Regulatory costs represented between 3.5% and 5.5% of total production costs** of NWE producers of bricks and tiles. Interestingly, this share increased in the last four years, passing from 4.2% in 2012 to 5.4% in 2015, although production costs in 2015 were higher than those registered in 2012 (Figure 114). The increase is mainly triggered by the proper functioning of the EU ETS and regulatory costs linked to energy legislation. On average, both production costs and regulatory costs were above those registered in other regions.

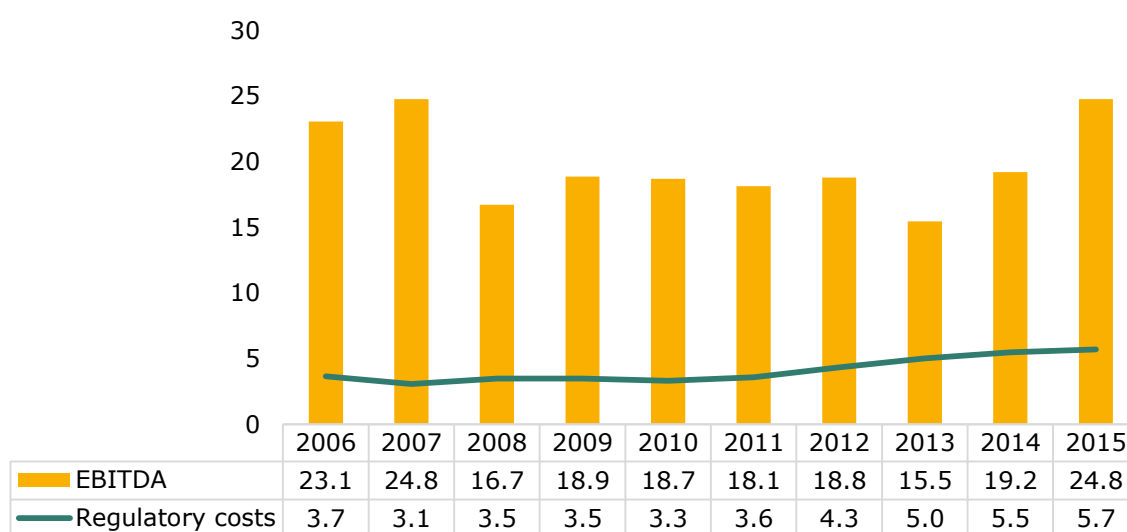
With regard to key performance indicators, **regulatory costs were on average 21% of EBITDA**. This indicator experienced a significant contraction in 2013 (Figure 115), which also reflected a strong decrease in EBIT (Figure 116). In 2015, regulatory costs represented 34.5% of the latter. Both EBITDA and EBIT registered in NWE were above the EU average.

**Figure 114. Cumulative cost versus production costs (€/tonne, Northern-Western)**



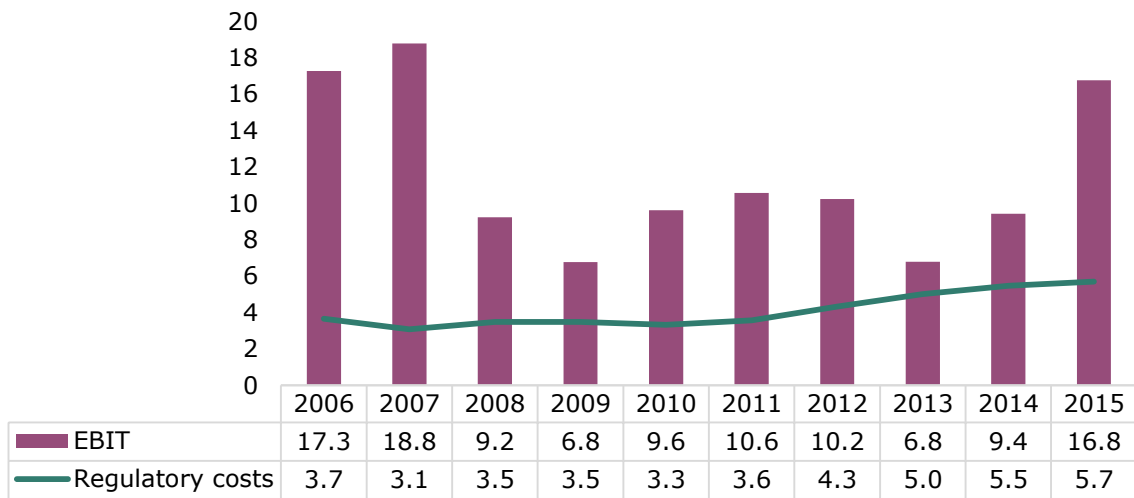
*Note: Production costs are estimated on a sample of six plants between 2006 and 2007, and of eight plants for the other years.  
Source: Authors' own elaboration.*

**Figure 115. Cumulative cost versus EBITDA (€/tonne, Northern-Western)**



*Note: EBITDA is estimated on a sample of six plants between 2006 and 2007, and of eight plants for the other years.  
Source: Authors' own elaboration.*

**Figure 116. Cumulative cost versus EBIT (€/tonne, Northern-Western)**



*Note: EBITDA is estimated on a sample of six plants between 2006 and 2007, and of eight plants for the other years.*

*Source: Authors' own elaboration.*

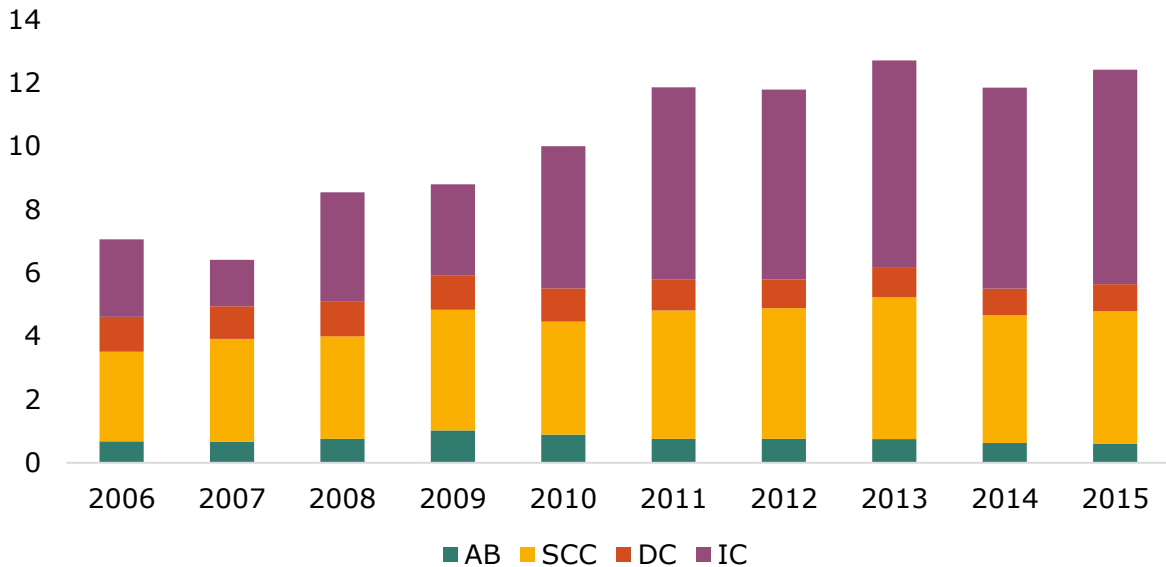
### 13.2 Ceramic tiles

#### 13.2.1 EU

The EU rules under investigation were responsible for regulatory costs borne by EU ceramic tiles producers of between **€6.40 and €12.40 per tonne of output** (Figure 117). Substantive compliance costs and indirect costs represented the bulk of regulatory costs, especially in later years; interestingly, in 2007 indirect costs were very low as a result of low prices for EUAs (climate legislation). On average, over the entire period under observation **rules affecting the electricity price were the most burdensome** (generating regulatory costs equal to €3.48/tonne), followed by **general workers' health and safety and workplace safety legislation** (€1.73/tonne) and **waste legislation** (€1.39/tonne; Figure 118).

**In 2015, cumulative regulatory costs were equal to 12.40 €/tonne**, including €0.61/tonne of administrative burdens, €4.18/tonne of substantive compliance costs, €0.85/tonne of direct charges and €6.77/tonne of indirect costs (mainly generated by energy and climate legislation). **Energy legislation in the field of electricity** generated 47% of total regulatory costs, followed by **waste legislation** (11%), environmental legislation and general workers' and workplace safety legislation (both at 10%; Figure 118).

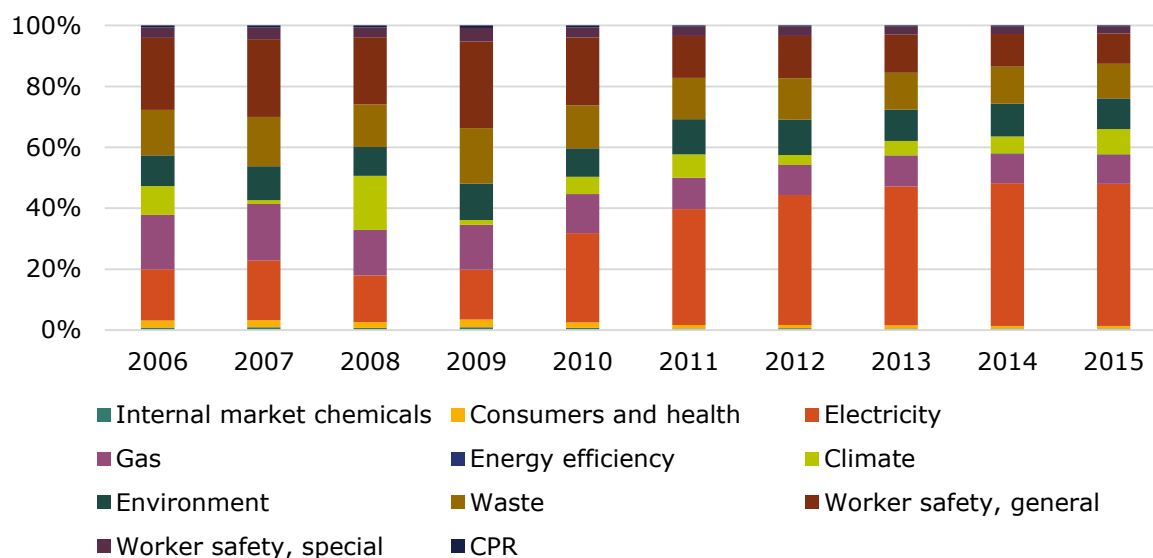
**Figure 117. Ceramic tiles: Cumulative cost by category of regulatory costs (€/tonne, EU)**



Source: Authors' own elaboration.



**Figure 118. Ceramic tiles: Cumulative cost by area of legislation (% , EU)**

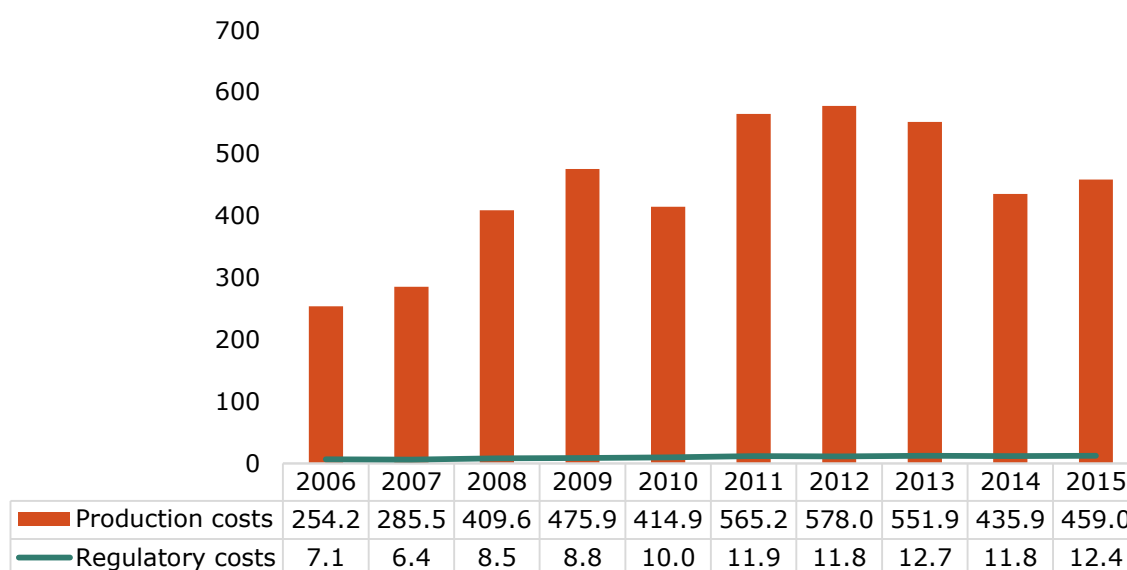


Source: Authors' own elaboration.

Cumulative regulatory costs were between **1.8% and 2.8% of production costs** incurred by producers of ceramic tiles over the period 2006-15 (Figure 119). Interestingly, in later years the share of regulatory costs over production costs was close to 3% (2.7% in 2014 and 2015), as a result of lower production costs as well as higher regulatory costs generated by climate and energy legislation.<sup>224</sup> EBITDA in the ceramic tiles sector was always positive and above €60/tonne (Figure 120); hence, on average, regulatory costs were in the region of **9% of this key performance indicator**. Finally, regulatory costs were on average **17% of EBIT** (Figure 121).

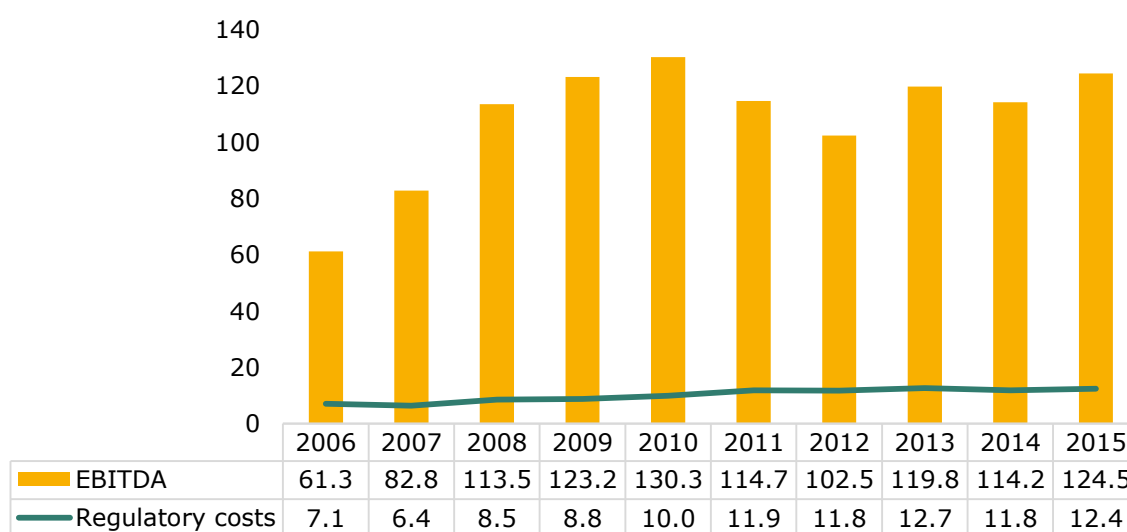
<sup>224</sup> The EU sectoral turnover per tonne of output ranged between €464 (in 2006) and €758 (in 2011). Cumulative regulatory costs represented between 1.3% and 2.0% of the turnover per tonne of ceramic tiles.

**Figure 119. Ceramic tiles: Cumulative cost versus production costs (€/tonne, EU)**



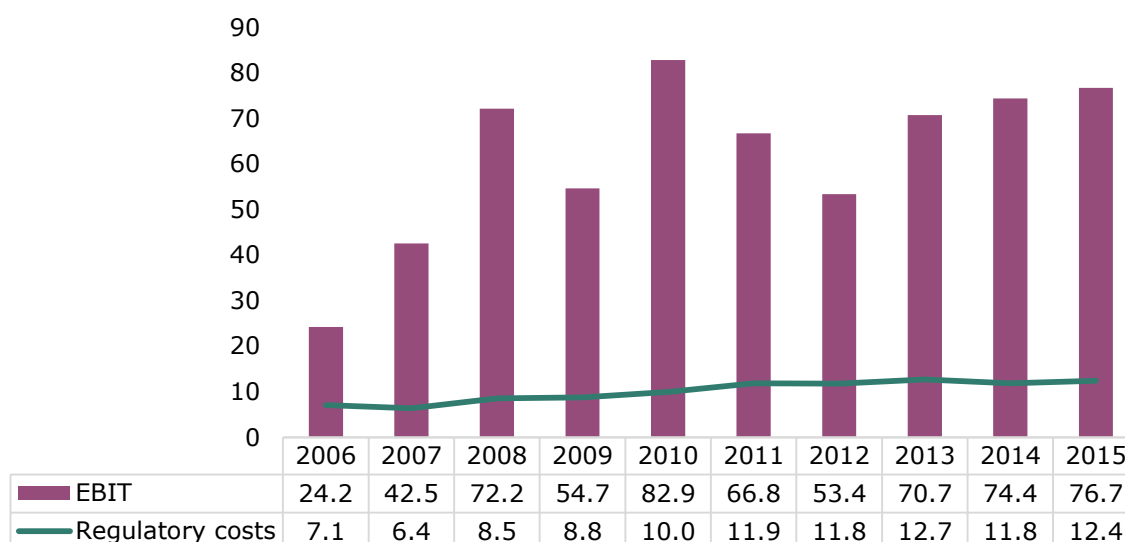
*Note: Production costs are estimated on a sample of 10 plants between 2006 and 2007, 12 plants in 2008, 13 plants between 2009 and 2013 and 15 in other years.  
Source: Authors' own elaboration.*

**Figure 120. Ceramic tiles: Cumulative cost versus EBITDA (€/tonne, EU)**



*Note: EBITDA is estimated on a sample of 10 plants between 2006 and 2007, 12 plants in 2008, 13 plants between 2009 and 2013 and 15 in other years.  
Source: Authors' own elaboration.*

**Figure 121. Ceramic tiles: Cumulative cost versus EBIT (€/tonne, EU)**



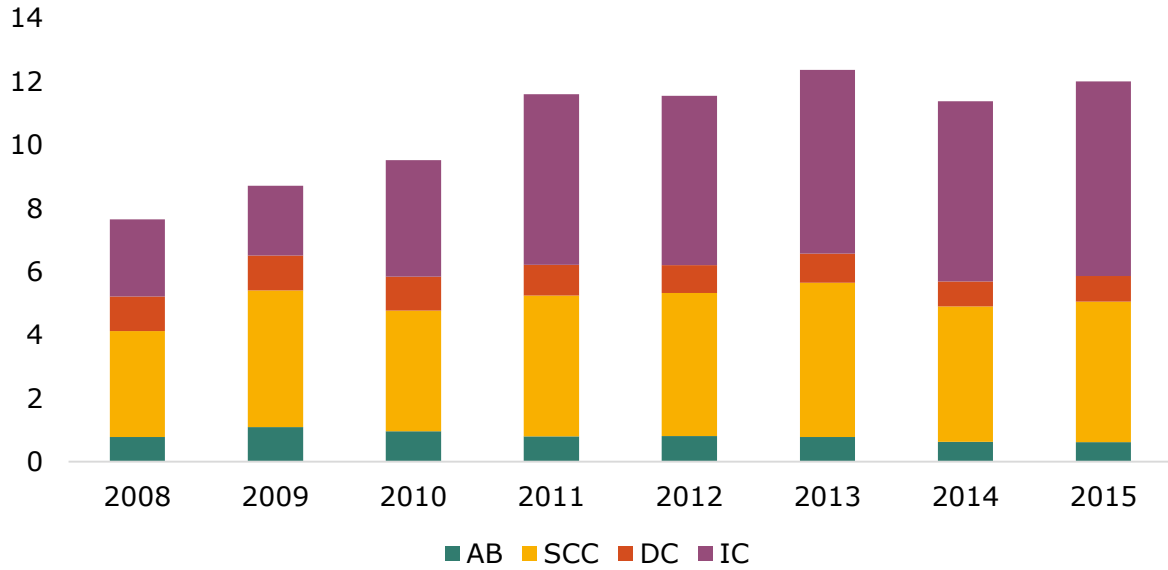
Note: EBIT is estimated on a sample of 10 plants between 2006 and 2007, 12 plants in 2008, 13 plants between 2009 and 2013 and 15 in other years.

Source: Authors' own elaboration.

### **13.2.2 Southern Europe**

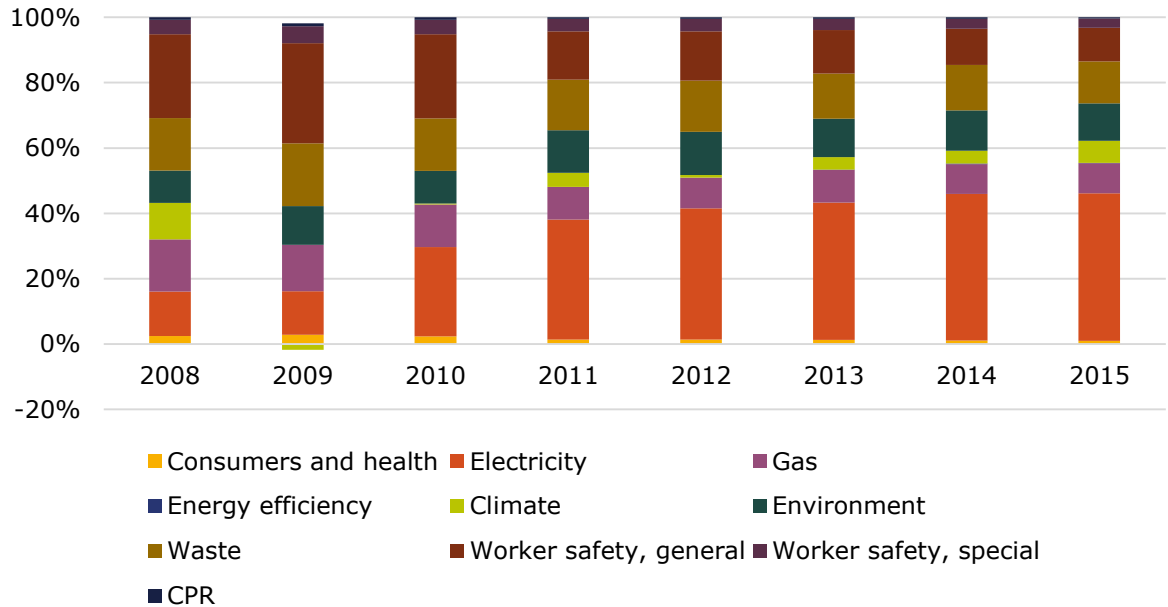
For SE producers of ceramic tiles, **total regulatory costs ranged between €8.70 and €12/tonne in the period 2008-15**. The weight of indirect costs out of total regulatory costs increased after 2010. In 2015, indirect costs were the largest category of regulatory costs for ceramic tile producers based in this region: out of total regulatory costs equal to **€12/tonne**, indirect costs constituted €6.14/tonne, substantive compliance costs were €4.43/tonne. A marginal role was played by administrative burdens and direct charges, generating €0.61/tonne and €0.81/tonne, respectively (Figure 122). In 2015, **rules affecting the electricity price** were responsible for 45% of total regulatory costs, i.e. €5.42/tonne, followed by **waste legislation** (13%) and **environmental legislation** (11%; Figure 123).

**Figure 122. Ceramic tiles: Cumulative cost by category of regulatory costs (€/tonne, Southern Europe)**



Note: Years 2006 and 2007 cannot be shown for this region due to confidentiality reasons.  
Source: Authors' own elaboration.

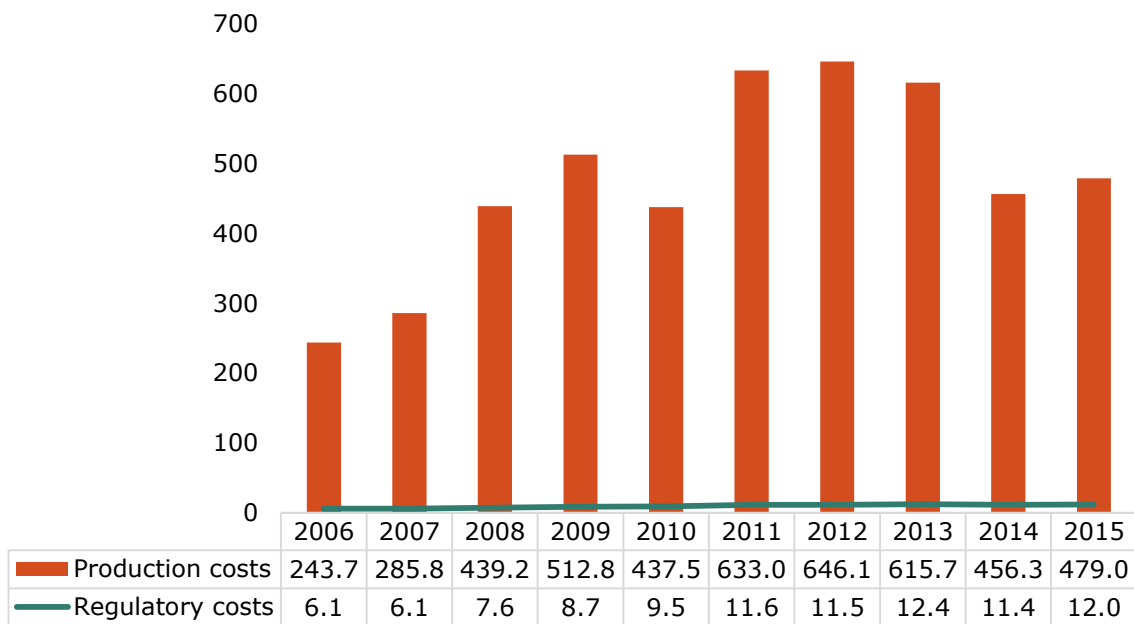
**Figure 123. Ceramic tiles: Cumulative cost by area of legislation (% , Southern Europe)**



Note: In 2009 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; 2006 and 2007 cannot be shown for this region due to confidentiality reasons.  
Source: Authors' own elaboration.

On average, **regulatory costs represented 2% of total production costs for SE producers of ceramic tiles**. In the last two years, this share increased to 2.5%, mainly due to a consistent decrease in production costs (Figure 124). The EBITDA was higher than €125/tonne in SE, leading to a relatively low share of total regulatory costs compared to this key performance indicator. Indeed, **regulatory costs amounted to around 8% of EBITDA** and this share was almost constant after 2011 (Figure 125). In the same vein, the EBIT in the region never went below the €60/tonne threshold; hence, regulatory costs were about **13% of this profitability indicator** (Figure 126). Interestingly, while regulatory costs registered in SE were below the EU average, production costs, EBITDA and EBIT were above the EU average.

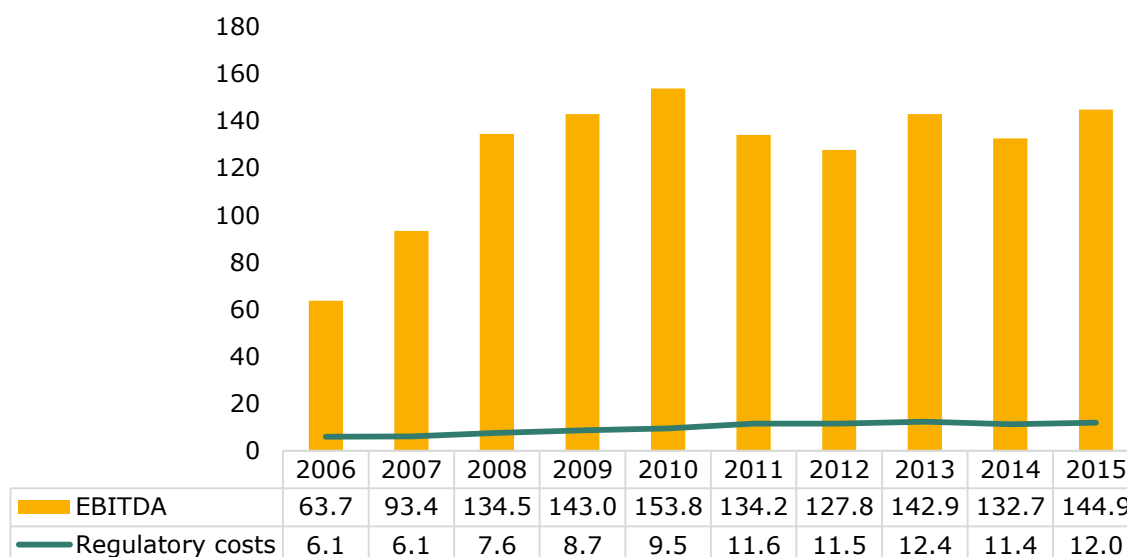
**Figure 124. Ceramic tiles: Cumulative cost versus production costs (€/tonne, Southern Europe)**



*Note: Years 2006 and 2007 cannot be shown for this region due to confidentiality reasons; Production costs are estimated on a sample of five plants between 2008 and 2010, six plants between 2011 and 2013, and seven for the other years.*

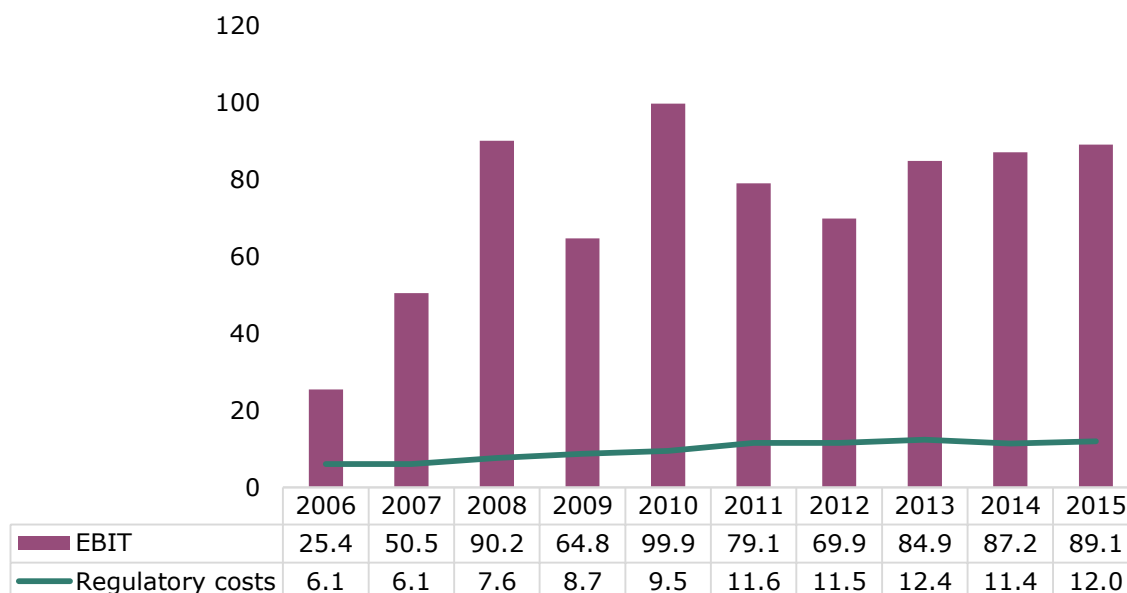
*Source: Authors' own elaboration.*

**Figure 125. Ceramic tiles: Cumulative cost versus EBITDA (€/tonne, Southern Europe)**



*Note: Years 2006 and 2007 cannot be shown for this region due to confidentiality reasons; EBITDA is estimated on a sample of five plants between 2008 and 2010, six plants between 2011 and 2013, and seven for the other years.  
Source: Authors' own elaboration.*

**Figure 126. Ceramic tiles: Cumulative cost versus EBIT (€/tonne, Southern Europe)**

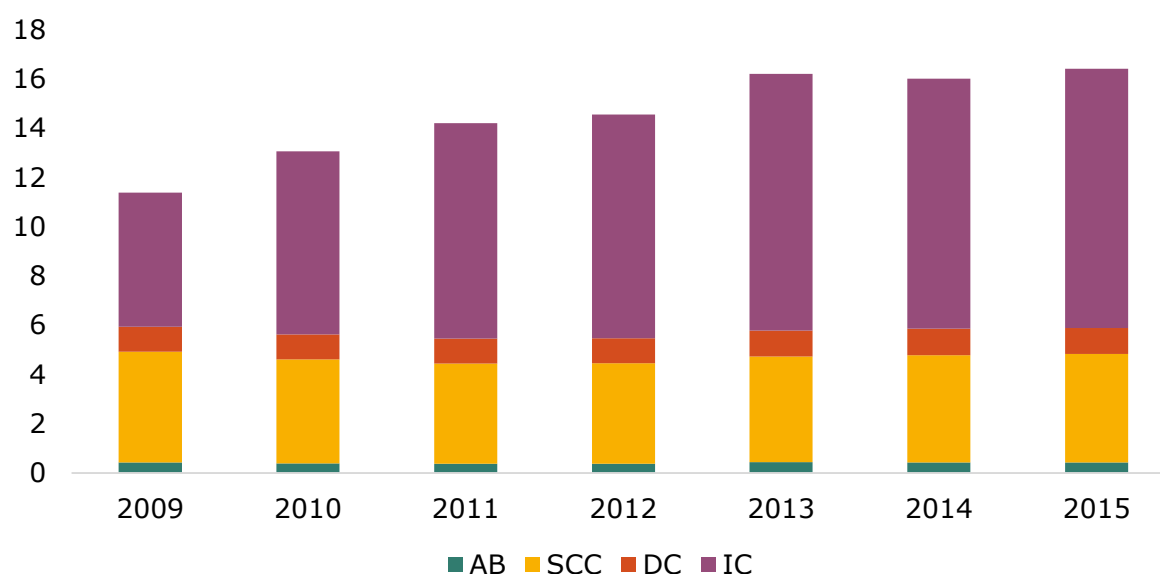


*Note: Years 2006 and 2007 cannot be shown for this region due to confidentiality reasons; EBITDA is estimated on a sample of five plants between 2008 and 2010, six plants between 2011 and 2013, and seven for the other years.  
Source: Authors' own elaboration.*

### 13.2.3 Northern-Western Europe

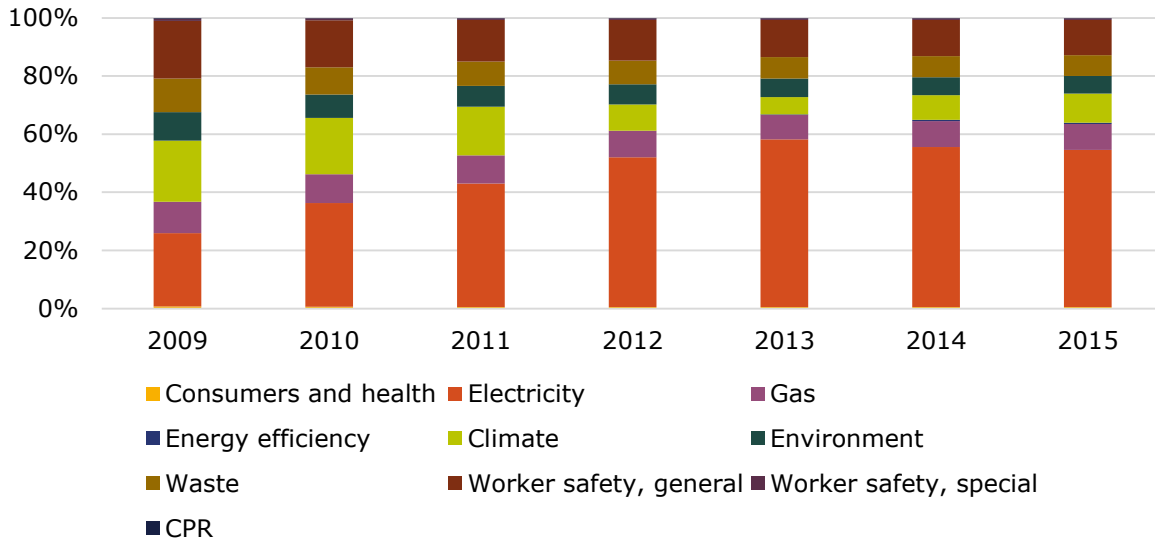
In NWE, total regulatory costs for producers of ceramic tiles lay **between €11.3 and €16.4/tonne over the period 2009-16, which was above the EU average**. Indirect costs were without a doubt the main category of regulatory costs, mainly generated by energy and climate legislation. In 2015, **indirect costs amounted to €10.52/tonne out of total regulatory costs equal to €16.4/tonne**; they were followed by substantive compliance costs (€4.40/tonne), direct charges (€1.05/tonne) and administrative burdens (€0.43/tonne) (Figure 127). In the same year, **rules affecting the price of electricity generated more than half of total regulatory costs (€8.88/tonne)**. The second-most burdensome area of legislation was general workers' and workplace safety (€2/tonne, i.e. 12% of total regulatory costs), while the third was climate (€1.65/tonne, i.e. 10%; Figure 128).

**Figure 127. Ceramic tiles: Cumulative cost by category of regulatory costs (€/tonne, Northern-Western Europe)**



*Note: Years 2006 to 2008 cannot be shown for this region due to confidentiality reasons.  
Source: Authors' own elaboration.*

**Figure 128. Ceramic tiles: Cumulative cost by area of legislation (% , Northern-Western Europe)**

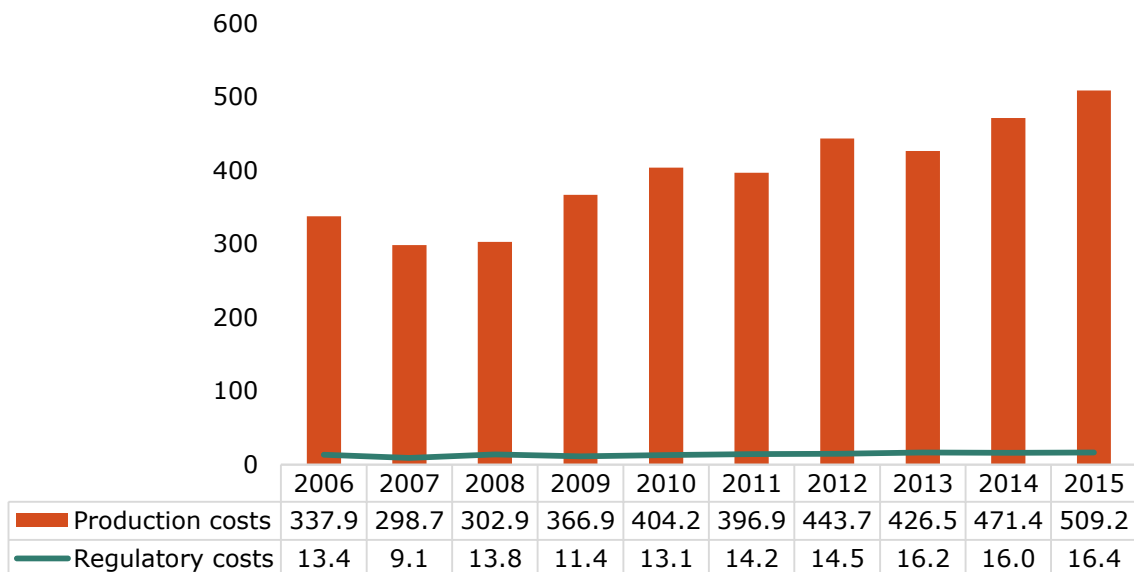


*Note: Costs for "Internal Market for chemicals" cannot be shown for this region due to confidentiality reasons; years 2006 to 2008 cannot be shown for this region due to confidentiality reasons.*

*Source: Authors' own elaboration.*

If one compares key performance indicators registered in this region with those of SE producers, it appears that production costs, EBITDA and EBIT were lower and below the EU average. Accordingly, **regulatory costs represented on average 3.4% of production costs** (Figure 129) and **30% of the EBITDA** (Figure 130). When it comes to EBIT, between 2009 and 2015 regulatory costs ranged from 30% to 54% of this indicator, except for 2012 when EBIT for producers based in the NWE were negative (Figure 131).

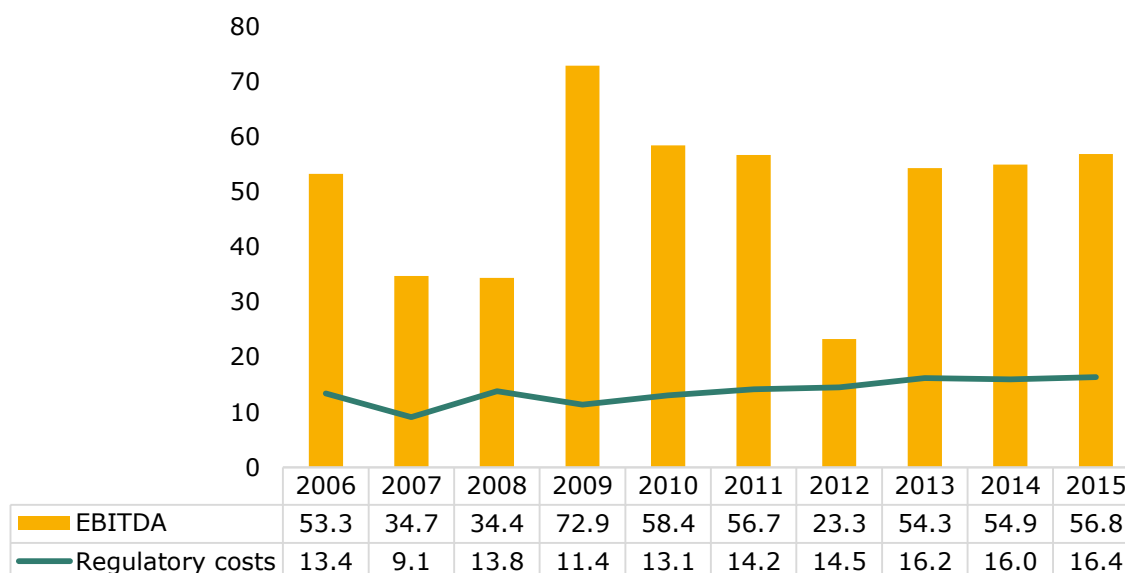
**Figure 129. Ceramic tiles: Cumulative cost versus production costs (€/tonne, Northern-Western Europe)**





Note: Years 2006 to 2008 cannot be shown for this region due to confidentiality reasons; production costs are estimated on a sample of three plants.  
Source: Authors' own elaboration.

**Figure 130. Ceramic tiles: Cumulative cost versus EBITDA (€/tonne, Northern-Western Europe)**



Note: Years 2006 to 2008 cannot be shown for this region due to confidentiality reasons; EBITDA is estimated on a sample of three plants.  
Source: Authors' own elaboration.

**Figure 131. Ceramic tiles: Cumulative cost versus EBIT (€/tonne, Northern-Western Europe)**



Note: Years 2006 to 2008 cannot be shown for this region due to confidentiality reasons; EBIT is estimated on a sample of three plants.  
Source: Authors' own elaboration.

### 13.3 Fired refractories

#### 13.3.1 EU

The EU rules in the scope of this CCA generated regulatory costs for the EU fired refractories subsector of between **€15.60 and €28.50 per tonne of output** (Figure 132). Substantive compliance costs were the bulk of regulatory costs. This was mainly due to **environmental legislation, which was on average the most burdensome area** over the period under observation (**€9.84/tonne on average**), followed by **rules affecting the price of electricity** (€3.74/tonne) and **general workers' health and safety and general workplace safety** (€2.86/tonne) (Figure 133).

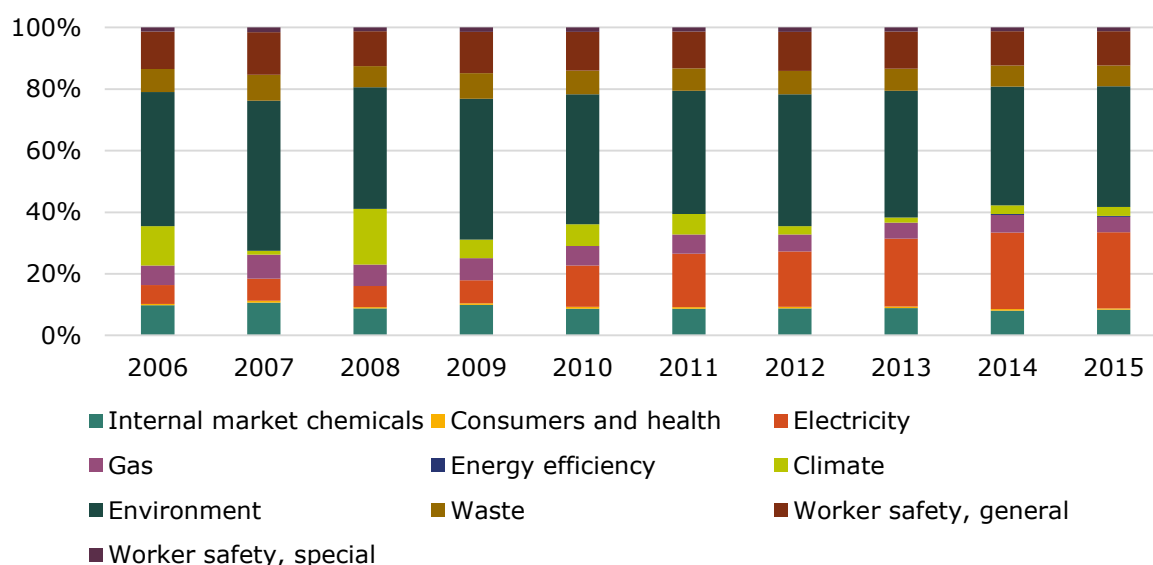
**In 2015, the cumulative regulatory costs were equal to €28.52/tonne**, comprising €3.56/tonne of administrative burdens, €15.14/tonne of substantive compliance costs, €1.02/tonne of direct charges and €8.81/tonne of indirect costs (mainly generated by energy and climate legislation). Environmental legislation generated 39% of total regulatory costs, i.e. €11.17/tonne, followed by rules affecting the electricity price (25%) and general workers' health and safety and general workplace safety legislation (11%).

**Figure 132. Fired refractories: Cumulative cost by category of regulatory costs (€/tonne, EU)**



Source: Authors' own elaboration.

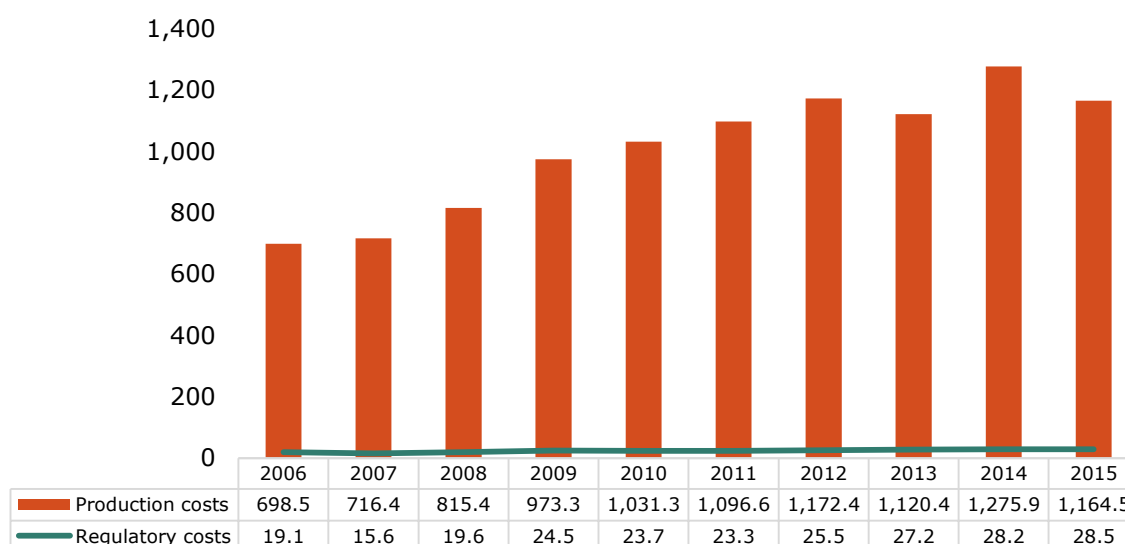
**Figure 133. Fired refractories: Cumulative cost per area of legislation (% , EU)**



Source: Authors' own elaboration.

Cumulative regulatory costs represented a **stable share of production costs** borne by EU producers of fired refractories (**between 2.1% and 2.7%**; Figure 134).<sup>225</sup> EBITDA of the sector was rather stable and constantly above €150/tonne over the period 2006-15 (Figure 135); accordingly, regulatory costs were in the region of **13% of this key performance indicator**, ranging from 9.3% in 2007 to 18.5% in 2015. Finally, the share of regulatory costs in terms of EBIT was on average 17%, **reaching 27% in 2015** (Figure 136).

**Figure 134. Fired refractories: Cumulative cost versus production costs (€/tonne, EU)**

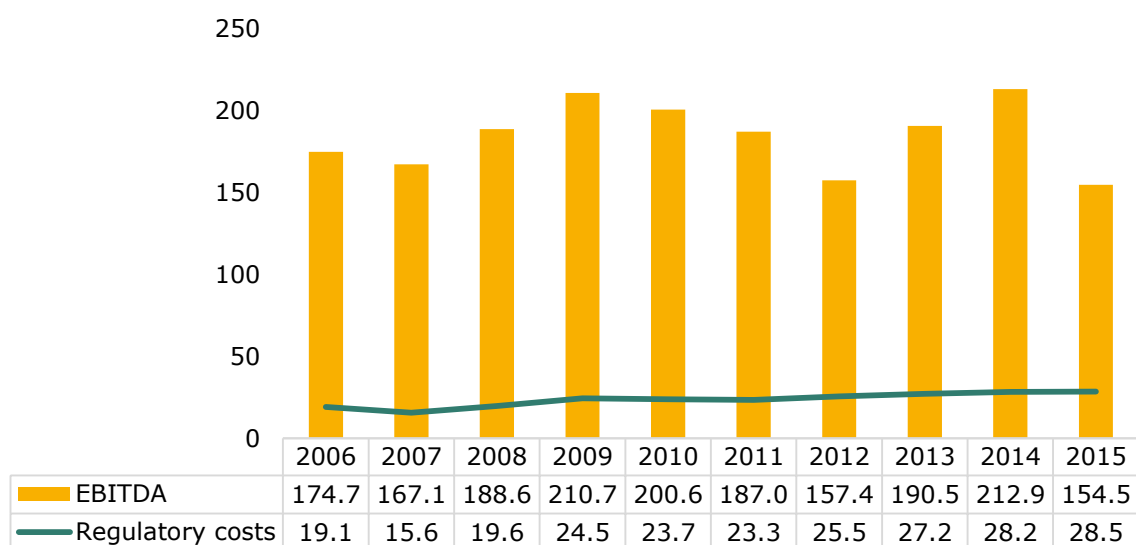


Note: Production costs are estimated on a sample of 11 plants.

<sup>225</sup> The EU sectoral turnover per tonne of output ranged between €1,111 (in 2007) and €1,763 (in 2014). Cumulative regulatory costs represented between 1.4% and 1.8% of the turnover per tonne of fired refractories.

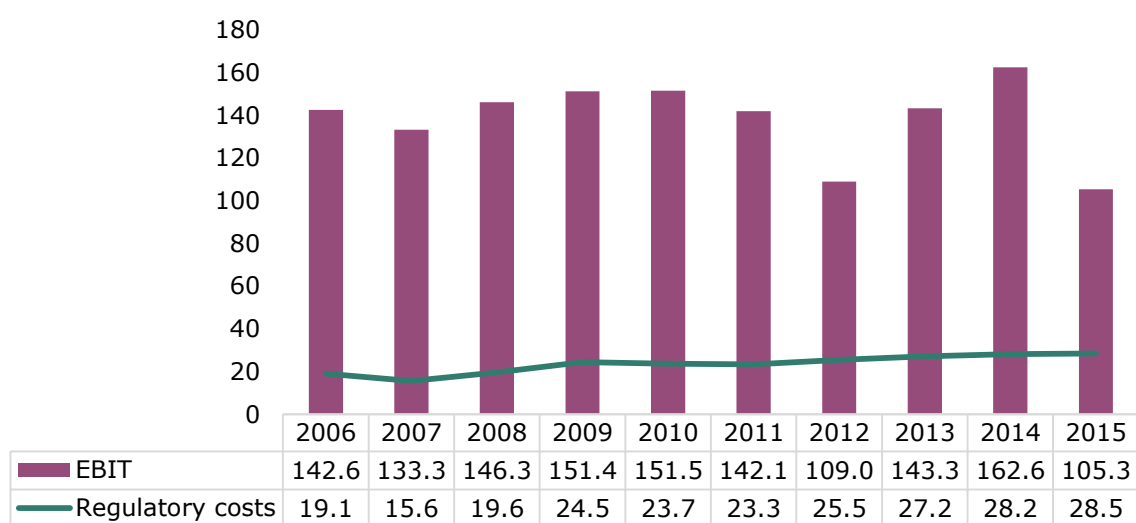
Source: Authors' own elaboration.

**Figure 135. Fired refractories: Cumulative cost versus EBITDA (€/tonne, EU)**



Note: EBITDA is estimated on a sample of 11 plants.  
Source: Authors' own elaboration.

**Figure 136. Fired refractories: Cumulative cost versus EBIT (€/tonne, EU)**



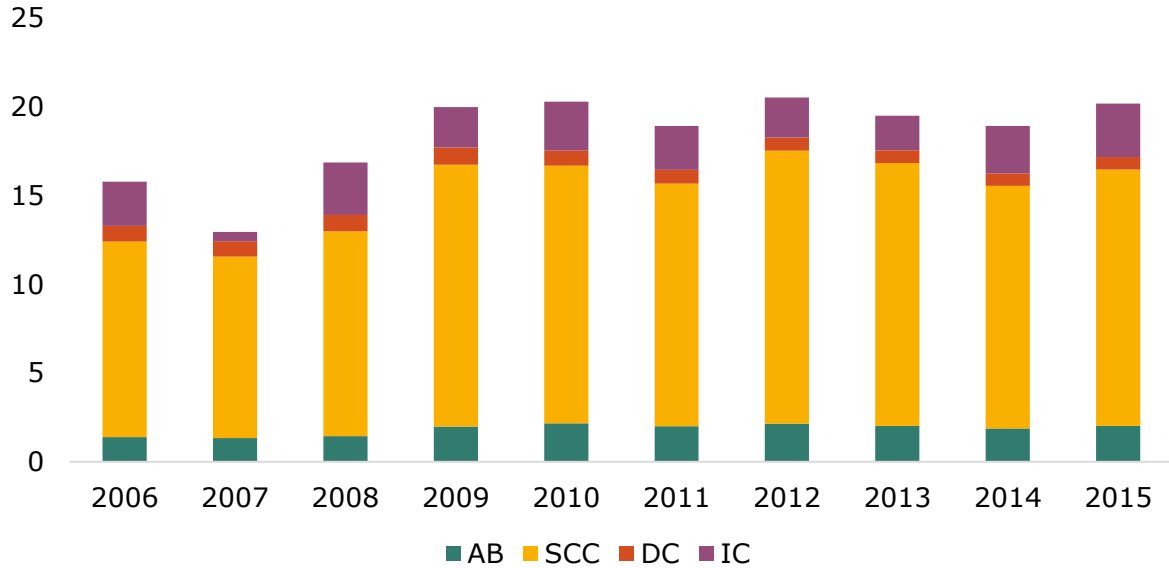
Note: EBIT is estimated on a sample of 11 plants.  
Source: Authors' own elaboration.

### 13.3.2 Southern Europe

Since 2009, regulatory costs in SE were around €20/tonne. **In 2015, total regulatory costs were equal to €20.18/tonne**, including substantive compliance costs equal to €14.45/tonne (Figure 136). More specifically, €7.90/tonne were generated by **environmental legislation**, €5.05/tonne by **general workers' and workplace safety legislation** and €2.48/tonne by **waste legislation** (Figure 137). In fact, in the same way as for the EU average, in this region environmental legislation represented the bulk of regulatory costs (on average 39% of the total). It is worth stressing that, this region was

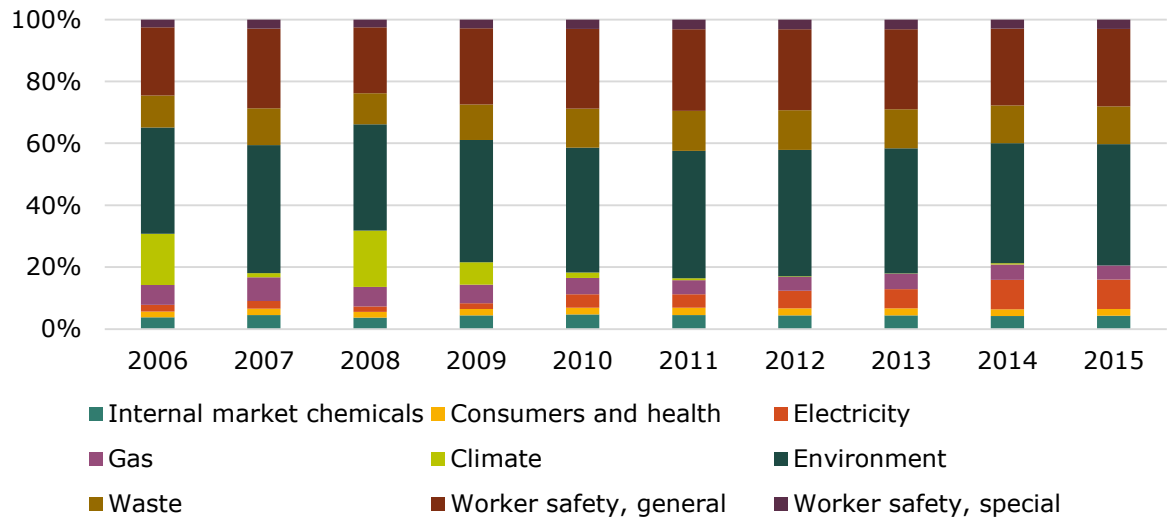
dominated by Spanish producers and, as mentioned above, in Spain RES levies are not visible in the electricity bill; hence, in SE, indirect costs generated by rules affecting the electricity prices are certainly underestimated.

**Figure 137. Fired refractories: Cumulative cost by category of regulatory costs (€/tonne, Southern Europe)**



Source: Authors' own elaboration.

**Figure 138. Fired refractories: Cumulative cost by area of legislation (% , Southern Europe)**

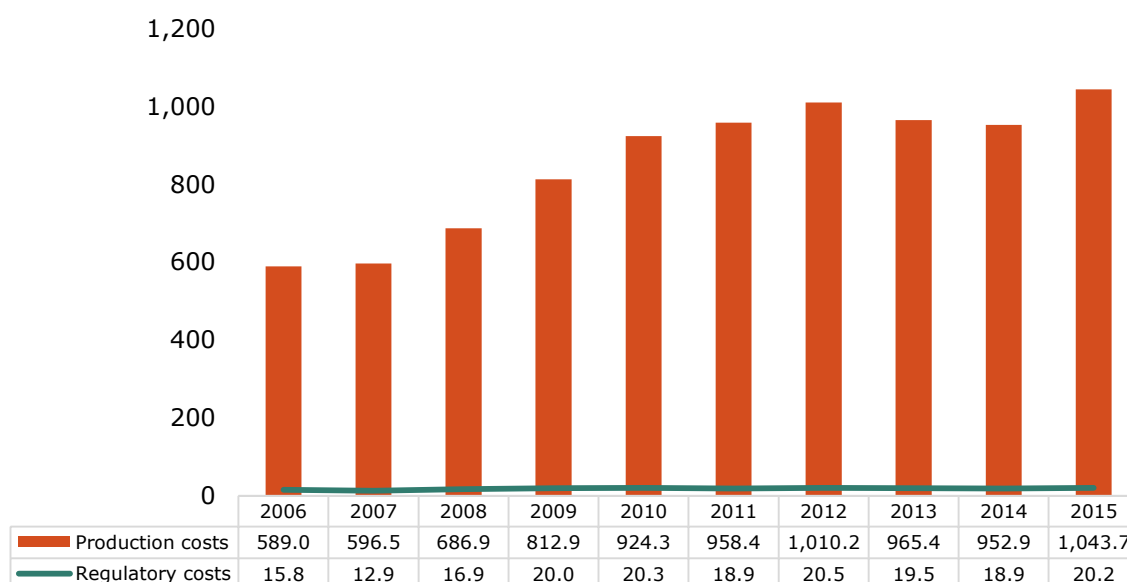


Note: Costs for "energy efficiency" cannot be shown for this region due to confidentiality reasons.  
Source: Authors' own elaboration.

Regulatory costs, production costs, EBITDA and EBIT registered by producers based in SE were all below the EU average. **The share of total regulatory costs out of production costs was rather stable at around 2%** over the period under observation (Figure 139).

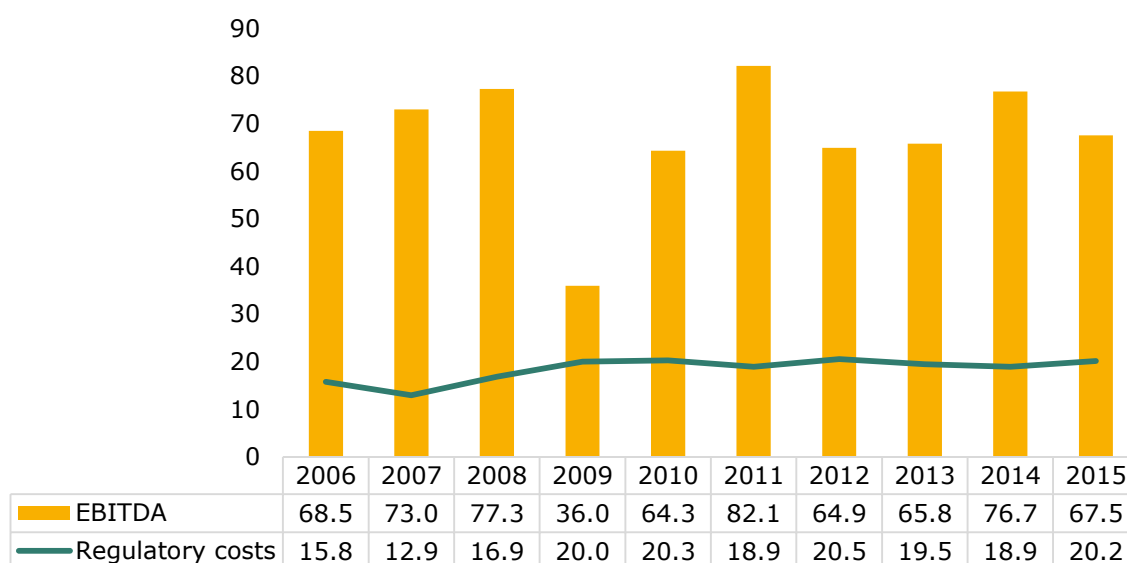
With regard to **profitability indicators**, between 2007 and 2008 regulatory costs were on average 20.9% of EBITDA and 32.7% EBIT; between 2010 and 2015, regulatory costs represented 28.4% of EBITDA and 60.7% of the EBIT (Figure 140 and Figure 141). In fact, profitability indicators per tonne of output were still below pre-crisis levels (except for 2014 when EBIT was higher than in 2008).

**Figure 139. Fired refractories: Cumulative cost versus production costs (€/tonne, Southern Europe)**



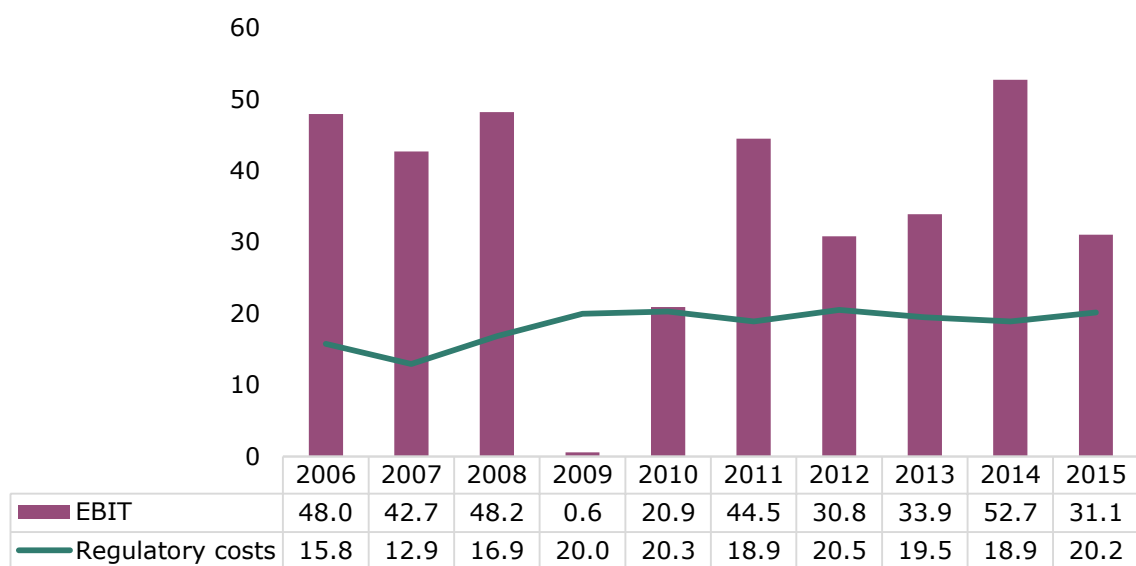
*Note: Production costs are estimated on a sample of four plants.  
Source: Authors' own elaboration.*

**Figure 140. Fired refractories: Cumulative cost versus EBITDA (€/tonne, Southern Europe)**



*Note: EBITDA is estimated on a sample of four plants.  
Source: Authors' own elaboration.*

**Figure 141. Fired refractories: Cumulative cost versus EBIT (€/tonne, Southern Europe)**



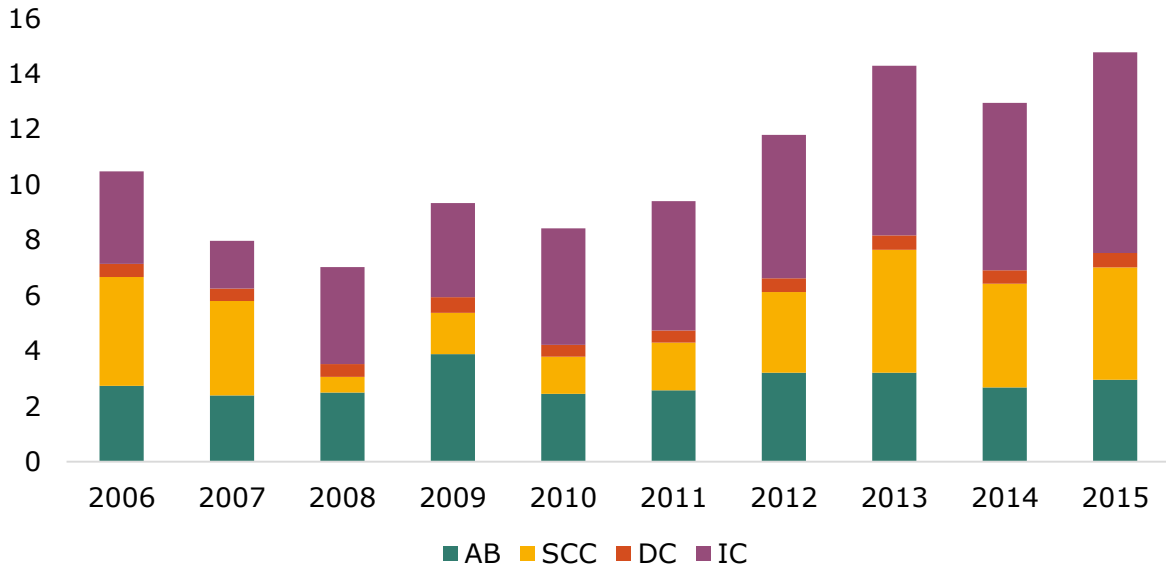
*Note: EBIT is estimated on a sample of four plants.  
Source: Authors' own elaboration.*

### 13.4 Unfired Shaped Refractories

#### 13.4.1 EU

The EU rules covered by this CCA generated regulatory costs for the EU unfired shaped refractories subsector of **between €7 and €15/tonne**. In 2015, indirect costs amounted to €7.24/tonne, substantive compliance costs amounted to €4.06/tonne, administrative burdens to €2.96/tonne and direct charges to €0.51/tonne, **for a total of €14.77/tonne** (Figure 142). In the same year, the most burdensome areas of legislation were: i) **rules affecting the price of electricity** (44% of total costs); ii) **Internal Market for chemicals** (16% of total costs); iii) **waste legislation** (15%) and **general workers' and workplace safety legislation** (12%) (Figure 143). In this subsector, environmental legislation did not generate any costs, as producers of unfired shaped refractories were generally not covered by the IED. In addition, only a very limited number of sampled plants covered by the EU ETS (climate legislation) and between 2008 and 2012 might have sold extra allowances generating net revenues; the remaining plants were affected by indirect ETS costs.

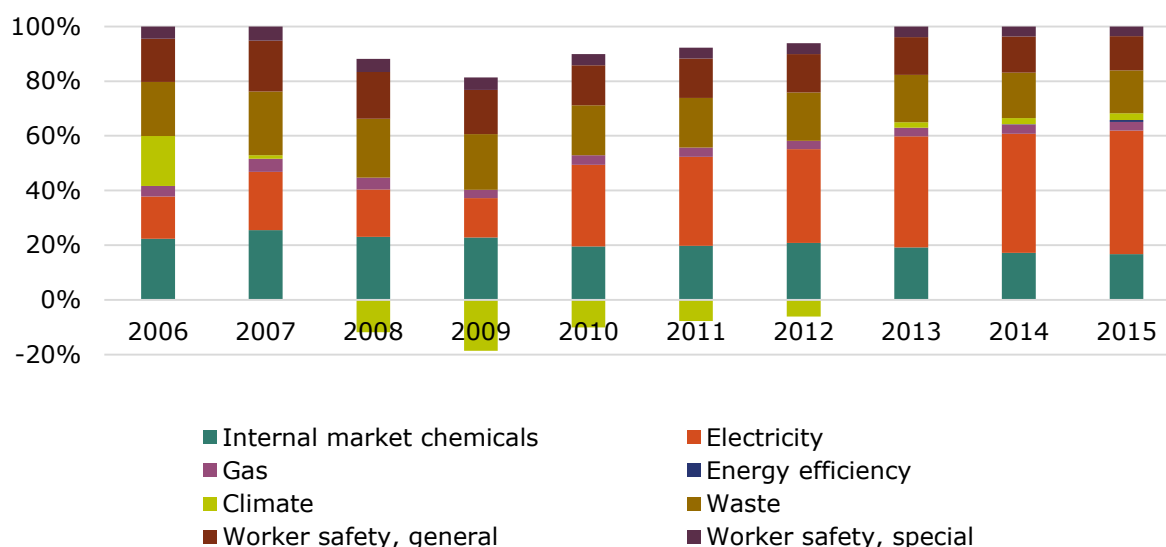
**Figure 142. Unfired shaped refractories: Cumulative cost by category of regulatory costs (€/tonne, EU)**



Source: Authors' own elaboration.



**Figure 143. Unfired shaped refractories: Cumulative cost by area of legislation (% , EU)**

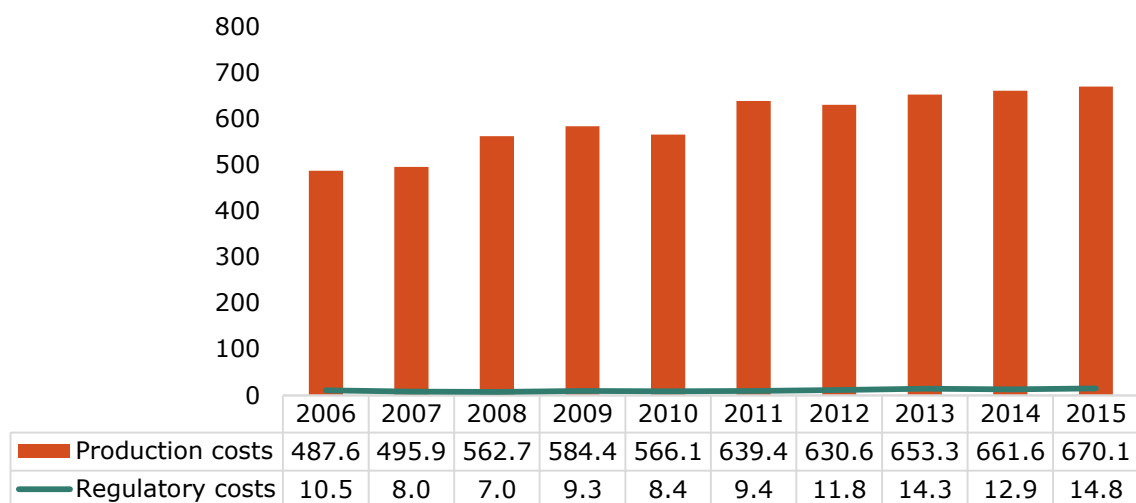


*Note: Between 2008 and 2012 climate legislation might have led to potential net revenues generated by the opportunity to sell EUAs on the carbon market; costs for "Consumers and health" cannot be shown due to confidentiality reasons.  
Source: Authors' own elaboration.*

The share of regulatory costs out of production costs was on average 1.8% over the period under observation. In later years, **the share slightly increased, reaching 2.2% in 2015** (Figure 144); again, the proper functioning of the EU ETS and regulatory components of the electricity bill represented the main drivers behind the increase.<sup>226</sup> EBITDA of the unfired shaped refractories subsector fluctuated severely over the 10-year period, and after 2012 decreased while regulatory costs increased. In 2015, the EBITDA fell to €34.70/tonne while regulatory costs reached their peak at €14.77/tonne; accordingly, **in the last year under analysis, regulatory costs were 42.5% of EBITDA** (Figure 145). It is worth remarking that, due to the limited number of sampled plants and volatile trends, data for EBIT cannot be presented, as no meaningful average can be computed.

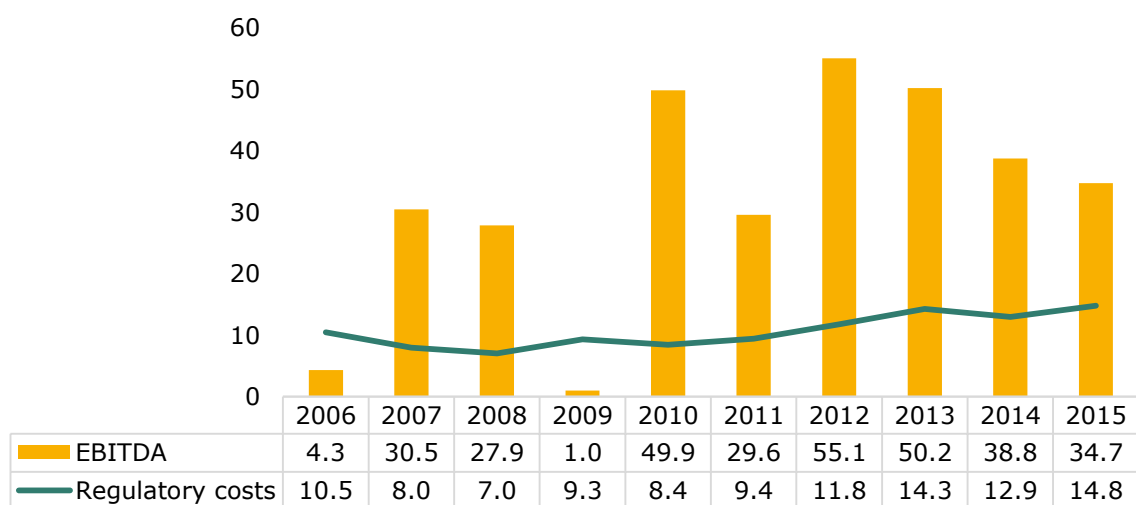
<sup>226</sup> The EU sectoral turnover per tonne of output ranged between €566 (in 2006) and €779 (in 2013). Cumulative regulatory costs represented between 1.0% and 1.9% of the turnover per tonne of unfired shaped refractories.

**Figure 144. Unfired shaped refractories: Cumulative cost versus production costs (€/tonne, EU)**



*Note: Production costs are estimated on a sample of four plants.  
Source: Authors' own elaboration.*

**Figure 145. Unfired shaped refractories: Cumulative cost versus EBITDA (€/tonne, EU)**



*Note: EBITDA is estimated on a sample of four plants.  
Source: Authors' own elaboration.*

## 14 Relevance 'heat maps'

Table 106 provides a **relevance 'heat map' of EU legislation** discussed in previous Chapters. 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 ceramics manufacturers; other areas are classified as either slightly relevant (below 5%) or not relevant (no regulatory costs were detected).

**Table 106. Relevance heat map of the EU legislation affecting the EU ceramics industry: regulatory costs generated by specific areas of legislation as a share of total regulatory costs (2015)**

Legislation		Bricks and tiles	Ceramic tiles	Fired Refractories	Unfired shaped refractories
Internal Market	<i>Internal Market for construction products</i>	1.3%	0.4%		
	<i>Internal Market chemicals</i>	0.2%	0.5%	8.3%	16.3%
Energy	<i>Electricity</i>	45%	46.7%	24.8%	44%
	<i>Gas</i>	10.4%	9.5%	5%	3.1%
	<i>Energy efficiency</i>	1.5%	0.2%	0.3%	**
Climate		7.8%	8.3%	2.9%	2.4%
Environmental	<i>Industrial emissions</i>	14.6%	10.1%	39.2%	
	<i>Waste</i>	5.2%	11.3%	6.7%	15.3%
Consumers & health		1.4%	0.8%	0.5%	*
Worker safety	<i>Worker safety, general</i>	10.7%	10%	11.1%	12.2%
	<i>Worker safety, special</i>	1.9%	2.3%	1.2%	3.4%

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 "Consumers and health" cannot be shown due to confidentiality reasons; \*\*shares for "energy efficiency" are not shown to ensure confidentiality of shares for "Consumers and health".

Source: Authors' own elaboration.

Table 107 provides another **relevance 'heat map' of EU legislation** discussed in previous Chapters. 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 ceramics manufacturers; other areas are classified as either slightly relevant (below 0.5%) or not relevant (no regulatory costs were detected).

**Table 107. Relevance heat map of the EU legislation affecting the EU ceramics industry: regulatory costs generated by specific areas of legislation as a share of total production costs (2015)**

Legislation		Bricks and tiles	Ceramic tiles	Fired refractories	Unfired shaped refractories
Internal Market	<i>Internal Market for construction products</i>	0.07%	0.01%		
	<i>Internal Market chemicals</i>	0.01%	0.01%	0.2%	0.36%
Energy	<i>Electricity</i>	2.43%	1.26%	0.61%	0.97%
	<i>Gas</i>	0.56%	0.26%	0.12%	0.07%
	<i>Energy efficiency</i>	0.08%	0.01%	0.01%	**
Climate		0.42%	0.22%	0.07%	0.05%
Environmental	<i>Industrial emissions</i>	0.79%	0.27%	0.96%	
	<i>Waste</i>	0.28%	0.31%	0.17%	0.34%
Consumers & health		0.07%	0.02%	0.01%	*
Worker safety	<i>Worker safety, general</i>	0.58%	0.27%	0.27%	0.27%
	<i>Worker safety, special</i>	0.10%	0.06%	0.03%	0.08%

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 "Consumers and Health" cannot be shown due to confidentiality reasons; \*\*shares for "energy efficiency" are not shown to ensure confidentiality of shares for "Consumers and health".

Source: Authors' own elaboration.

## **Annex I – Sectoral analysis of ceramics sectors not covered by the CCA**

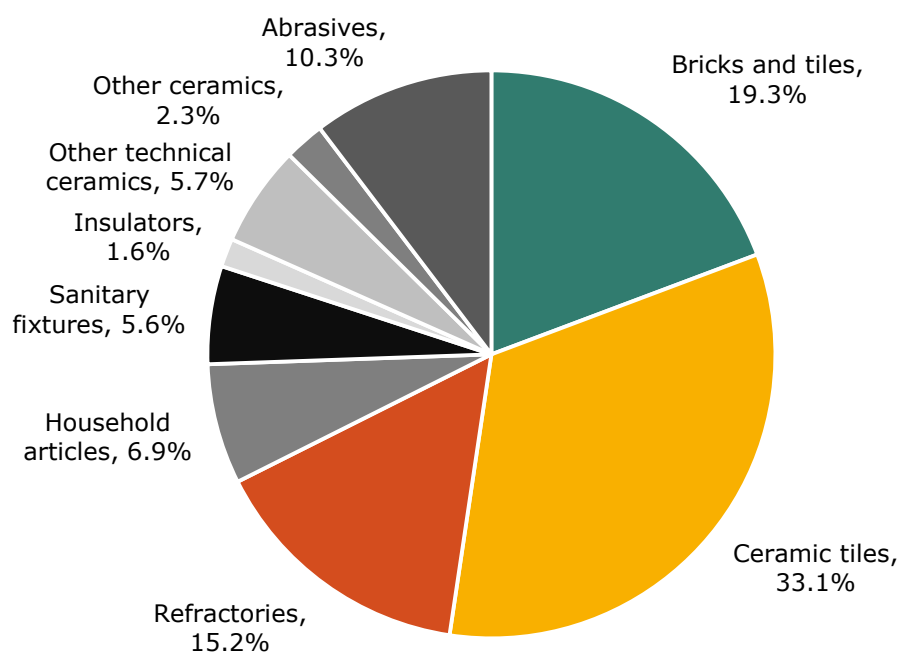
### **Introduction**

This Annex presents sectoral statistics for the following sectors belonging to the ceramics industry:

- NACE rev.2. 23.41 Manufacture of ceramic household and ornamental articles;
- NACE rev.2. 23.42 Manufacture of ceramic sanitary fixtures;
- NACE rev.2. 23.43 Manufacture of ceramic insulators and insulating fittings;
- NACE rev.2. 23.44 Manufacture of other technical ceramic products;
- NACE rev.2. 23.49 Manufacture of other ceramic products;
- NACE rev.2. 23.91 Production of abrasive products.

As mentioned in Box 5 in Chapter 3.2 above, while these sectors were listed in the Technical Specifications for this Study, in agreement with the Commission they are not covered by the CCA for two main reasons: i) difficulties of collecting plant-level data, which were 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 (bricks and tiles, ceramic tiles and refractories) accounted for some 70% of the total value of production sold by the EU ceramics sectors listed in the Technical Specifications for this Study (Figure 146); the share covered by the CCA is even larger if one considers that only 14% of the value of production sold by EU producers of abrasives is made of ceramics.

**Figure 146. Share of the value of production sold by the EU ceramics sectors listed in the Technical Specifications (2015)**



*Note: Only 14% of the value of production sold by EU producers of abrasives is generated by products made of ceramics.*

*Source: Authors' own elaboration on PRODCOM*

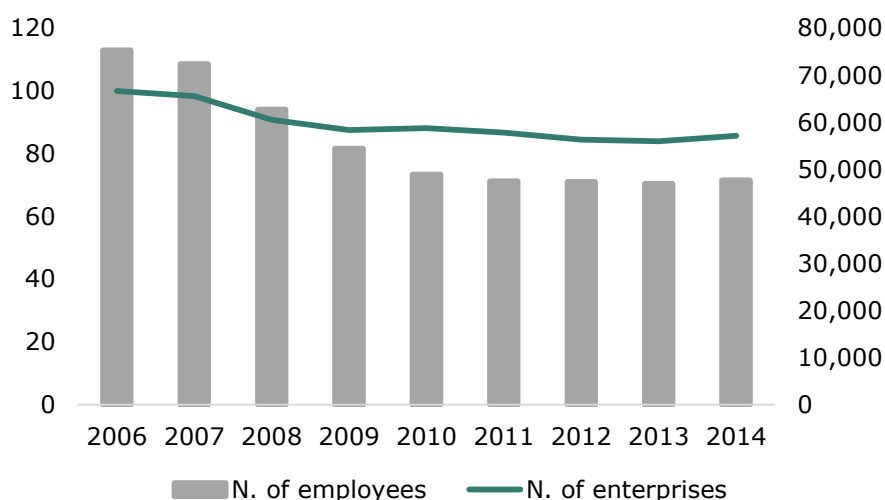
### **Ceramic household and ornamental articles**

This sector is covered by the NACE rev. 2 code 23.41 "manufacture of ceramic household and ornamental articles" and it includes household ceramics of all kinds such as plates, dishes, cups, bowls, jugs and vases. These are either mass produced (less specialised) or handmade.<sup>227</sup> **The production process depends on the specific product at hand.** The starting point is either a potter's wheel, pinching by hand, coiling, slab-making or other methods, followed by firing, painting/glazing and reheating.<sup>228</sup> Even though some products are produced in large quantities and hence compete on price, e.g. standard plates, the sector can be described as **heterogeneous** due to its broad range of products and its possibility for customised and special design products. As a result, competition is mainly on quality and originality of the product and to a minor extent on price. The main distribution is **B2B**, but direct customer selling is also possible (**B2C**).

### **Sectoral statistics**

As for the other ceramic sectors, ceramic household and ornamental article sectors are experiencing a contraction in size. Since the beginning of the financial crisis, both the number of employees and enterprises constantly decreased. Between 2006 and 2014, the number of employees dropped from 75,000 to 47,000, while the number of enterprises decreased by almost 15% (Figure 147).

**Figure 147. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture of ceramic household and ornamental articles**



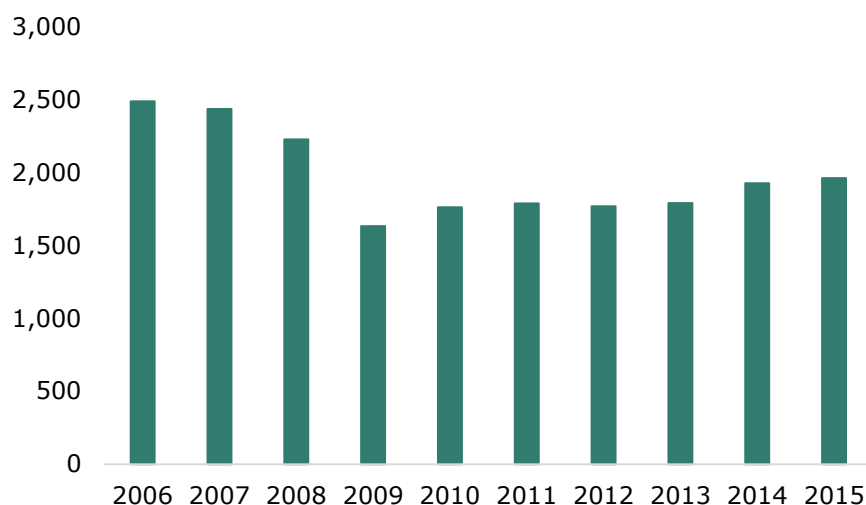
Source: Authors' own elaboration on Eurostat Structural Business Statistics.

The overall contraction of the sector is also confirmed by the decrease in total value of production sold shown in Figure 148. After a considerable drop between 2007 and 2009, the sector slowly started recovering; yet in 2015 the value of production was still below pre-crisis levels.

<sup>227</sup> European Commission, (2007), "Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, 2007" (<http://tinyurl.com/njerd3h>).

<sup>228</sup> [www3.epa.gov/ttnchie1/ap42/ch11/final/c11s07.pdf](http://www3.epa.gov/ttnchie1/ap42/ch11/final/c11s07.pdf).

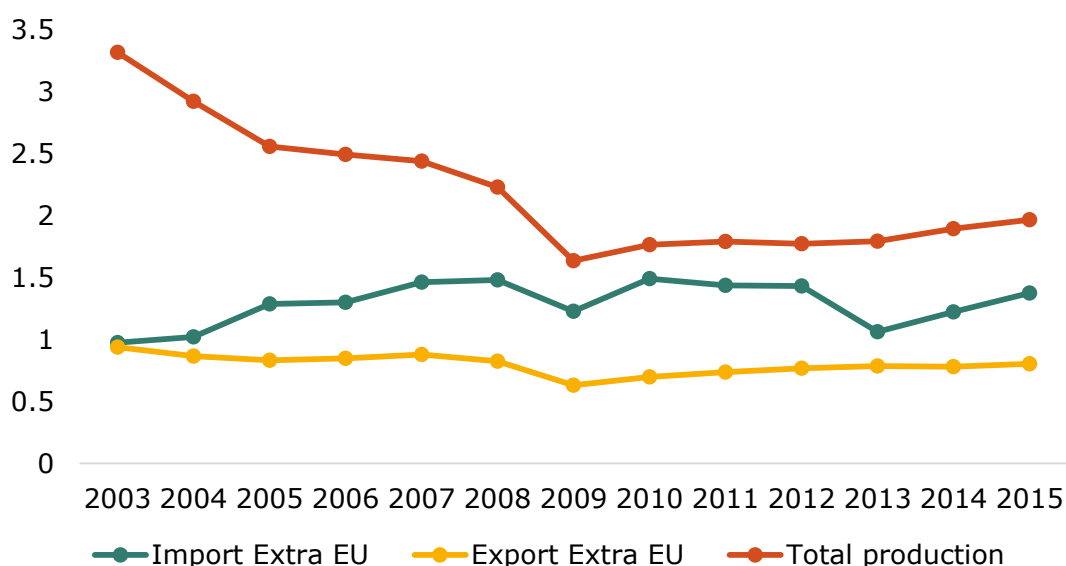
**Figure 148. Value of production sold by EU producers of ceramic household and ornamental articles (€ millions)**



Source: Authors' own elaboration on PRODCOM.

In this sector, **extra EU trade appears to play a major role** compared to overall EU production (Figure 149). More specifically, the EU was a **net importer** for the entire period under observation, with trade deficit of €570 million in 2015.

**Figure 149. Extra-EU-28 trade and total production in manufacture of ceramic household and ornamental articles (€ billions)**



Note: The category "Manufacture of ceramic household and ornamental articles" (C2341 NACE Rev.2) corresponds to the sum of the following categories in HS: 69.11; 69.12; 69.13).

Source: Authors' own elaboration on COMEXT (2016).

As shown in Table 108, the main driver of the trade deficit is the **import flow from China**, as it represents almost 75% of all European imports from third countries. In fact, imports from the second main exporter to the EU, Thailand, are about one-tenth of imports from China and represent only 7.8% of all European extra-EU imports. The United States leads

the ranking of destination markets for EU production, with a share of 26%, followed by Switzerland and South Korea, with 8.8% and 7.5%, respectively.

**Table 108. Top 10 markets for ceramic household and ornamental articles in 2015, (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to EU	
United States	26.0%	China	73.1%
Switzerland	8.8%	Thailand	7.8%
South Korea	7.5%	Turkey	4.1%
Norway	7.3%	Vietnam	3.5%
Japan	6.8%	Indonesia	1.9%
Russia	6.6%	Bangladesh	1.4%
United Arab Emirates	3.6%	India	1.0%
Taiwan	2.1%	United Arab Emirates	0.9%
Saudi Arabia	2.0%	United States	0.8%
Australia	1.9%	Japan	0.8%

Note: the category 'Manufacture of ceramic household and ornamental articles' (C2341 NACE Rev.2) corresponds to the sum of the following categories in HS: 69.11; 69.12; 69.13).

Source: Authors' own elaboration on COMEXT (2016).

During the 10 years under study, this sector was increasingly subject to international competition, registering a negative trade balance every year. The main issue was represented by imports from China, which is currently subject to anti-dumping measures by the EU. Reportedly, overcapacity along with an often subsidised industrial system allows China to place its products in international markets at artificially low prices.

### ***Ceramic sanitary fixtures***

This sector is encompassed by the NACE rev. 2 code 23.42 "manufacture of ceramic sanitary fixtures". Typical sanitary fixtures (such as toilets, bidets and sinks) are made of a mixture of clay. The standard production process is comparable to the one adopted for other ceramic products. Selected materials are prepared and formed according to final design wishes. The forms are dried, fired and glazed before reheating and inspection.<sup>229</sup> The products are mainly made of vitreous china (semi-porcelain) or earthenware.<sup>230</sup>

This sector can be described as **homogeneous within heterogeneity**: while production processes are rather homogeneous for similar products, substantial elements of heterogeneity emerge between different products comprised in the sector. Despite the broad range of products, companies still aim to produce items in large quantities with high automation. The products are sold to the bathroom or kitchen sectors or directly to wholesalers and retailers (**B2B**). Market competition is a mix between price competition and quality competition. This also largely depends on the specific customers. Those looking for special designs are willing to pay higher prices, while others simply looking for functional products will emphasise to a much greater extent the price aspect.

### **Sectoral statistics**

The ceramic sanitary fixtures sector registered a peculiar evolution in terms of number of employees and enterprises. In fact, whereas the former decreased over the time span 2006-14 by more than 10,000 employees, the number of enterprises increased (Figure 150). However, despite the increasing number of enterprises, the value of production sold

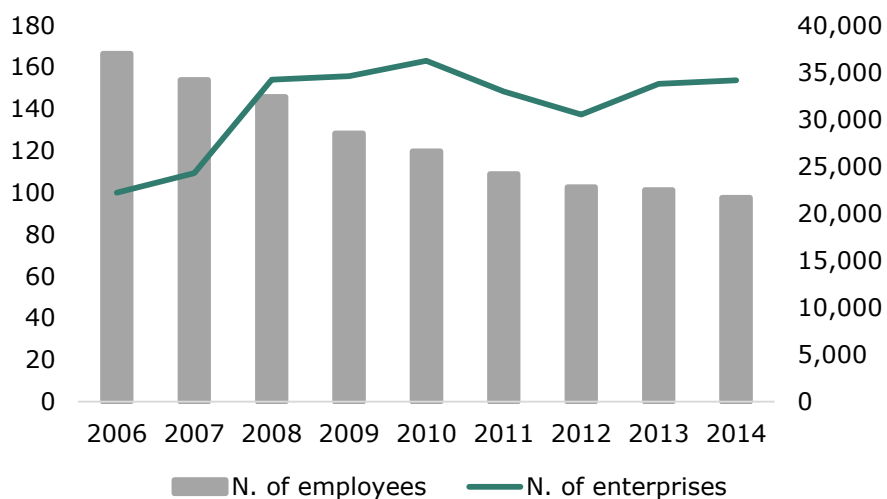
<sup>229</sup> [www.madehow.com/Volume-5/Toilet.html](http://www.madehow.com/Volume-5/Toilet.html).

<sup>230</sup> European Commission (2007), "Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, 2007" (<http://tinyurl.com/njerd3h>).



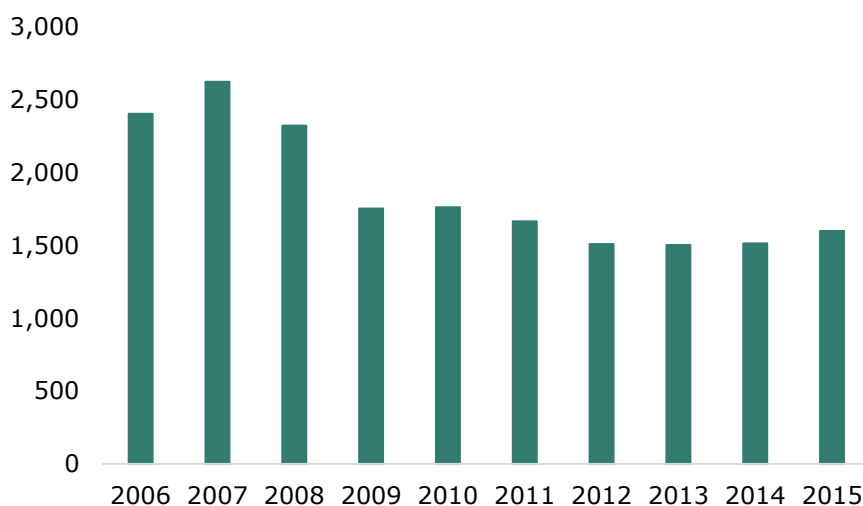
significantly decreased after 2007 and stabilised at around €1.5 billion after 2012 (Figure 151).

**Figure 150. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture of ceramic sanitary fixtures**



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

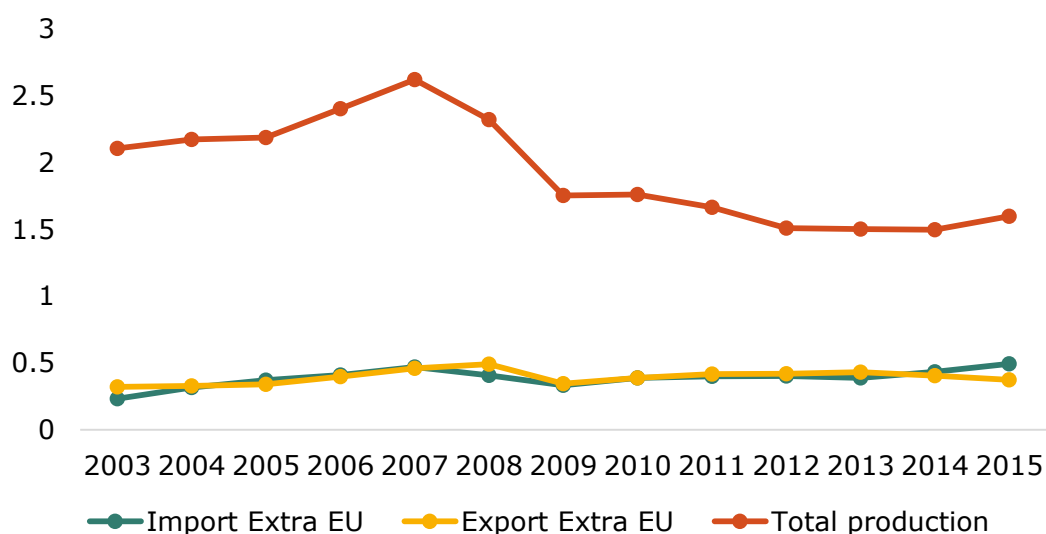
**Figure 151. Value of production sold by EU producers of ceramic sanitary fixtures (€ millions)**



Source: Authors' own elaboration on PRODCOM.

Figure 152 shows trade flows in ceramic sanitary fixtures. Whereas production decreased after 2007, the EU reported a **stable trade balance** over the entire period under analysis, with import and export values that tend to be similar. Interestingly, a small trade deficit was registered in 2015.

**Figure 152. Extra-EU-28 trade and total production in manufacture of sanitary fixtures (€ billions)**



Note: The category "Manufactures of ceramic sanitary fixtures" (C2342 NACE Rev.2) corresponds to HS 69.10.

Source: Authors' own elaboration on COMEXT (2016).

In particular, in 2015, as shown in Table 109, **imports from China** (the top exporter to the EU, with a share of 43.4%) were almost double **those from Turkey**. Turkey was the second main exporter to the EU in 2015, with a share of 24.1%, followed by Egypt with 9.2%. On the other side of the spectrum, the top three destinations for EU exports of ceramic sanitary fixtures were, in descending order, Switzerland, Russia and Norway, with 13.7%, 11.1% and 7.1% shares, respectively.

**Table 109. Top 10 markets for sanitary fixtures in 2015 (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to the EU	
Switzerland	13.7%	China	43.4%
Russia	11.1%	Turkey	24.1%
Norway	7.1%	Egypt	9.2%
United States	6.4%	Morocco	6.4%
United Arab Emirates	5.1%	United Arab Emirates	4.8%
Australia	3.9%	Ukraine	2.1%
Saudi Arabia	3.9%	Thailand	1.9%
China	2.8%	Switzerland	1.4%
Morocco	2.2%	Mexico	1.3%
Israel	2.1%	India	1.2%

Note: The category "Manufactures of ceramic sanitary fixtures" (C2342 NACE Rev.2) corresponds to HS 69.10.

Source: Authors' own elaboration on COMEXT (2016).

### **Ceramic insulators and insulating fittings**

This sector is defined by the NACE rev.2 code 23.43 "manufacture of ceramic insulators and insulating fittings". The production process in principle consists of preparation of materials (clay, quartz, alumina, feldspar, etc.), spray-drying them, pressing, turning,

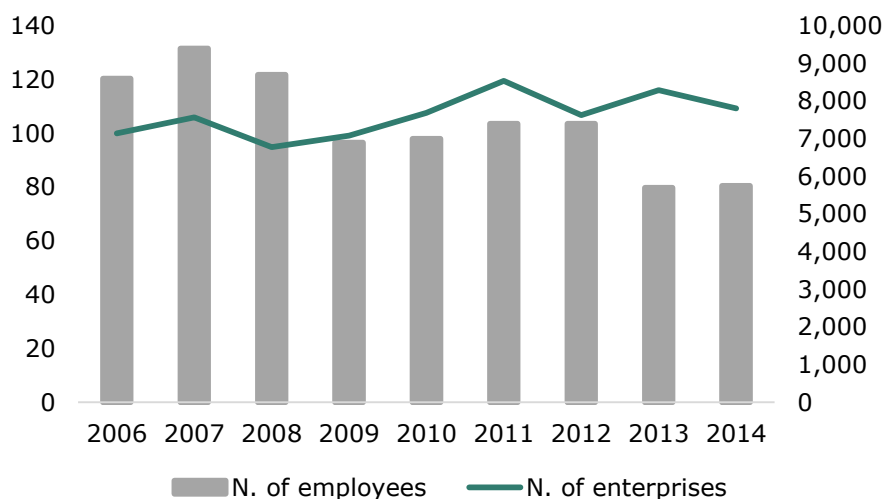
glazing, firing, cutting and assembling and performing quality inspections.<sup>231</sup> Products are used as insulators, for example, in electrical substations.

In the manufacture of electrical insulators sector, we need to distinguish between standardised mass products and special innovative solutions. In principle, the products are quite **heterogeneous** and sold **B2B** to electrical engineering and construction sectors. In more recent years, efficiency greatly increased.<sup>232</sup> The precise form of the value chain therefore depends to a large extent on the **individual business model of a company**. Interestingly, in terms of value of production output, the sector represents a very small share of the EU ceramics sector (some 1.5% in 2015)

### ***Sectoral statistics***

As in the case of ceramic sanitary fixtures, the number of enterprises in the manufacture of ceramic insulators and insulating fittings sector slightly increased over the period under examination, while the number of people employed decreased by more some 3,000 (Figure 153).

**Figure 153. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture of ceramic insulators and insulating fittings**



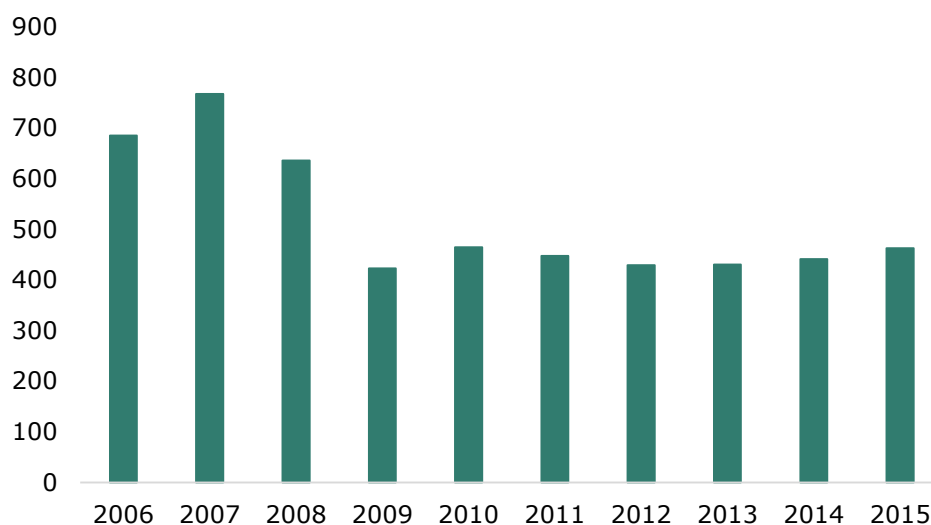
*Source: Authors' own elaboration on Eurostat Structural Business Statistics.*

The value of production sold basically halved between 2007 and 2009, then remained stable at around €450 million (Figure 154).

<sup>231</sup> Mukherjee, S. (2013), *The Science of Clays: Applications in Industry, Engineering, and Environment*, Dordrecht: Springer Netherlands.

<sup>232</sup> Ibid.

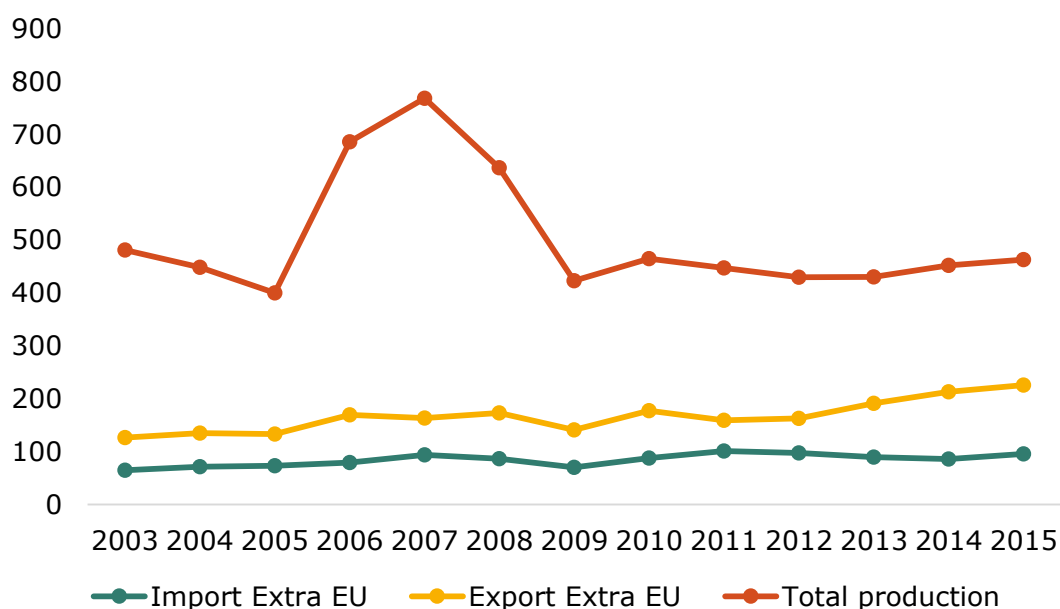
**Figure 154. Value of production sold by EU producers of ceramic insulators and insulating fittings (€ millions)**



Source: Authors' own elaboration on PRODCOM.

Trade flows in ceramic insulators and insulating fittings are presented in Figure 155. The EU was a **net exporter**, with a stable trade surplus registered from the beginning of the period under analysis, which reached €130 million in 2015.

**Figure 155. Extra-EU-28 trade and total production in manufacture of ceramic insulators and insulating fittings (€ millions)**



Note: Nace Rev.2 2343 corresponds to the sum of HS/CN 8546 20 and 8547 10.

Source: Authors' own elaboration on COMEXT (2016).

**China** accounted for 47.2% of all European imports. The top destination markets for EU exports were Saudi Arabia and the United States, with market shares of 27.5% and 24.7%, respectively.

**Table 110. Top 10 biggest markets in ceramic insulators and insulating fittings in 2015 (% of overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to the EU	
Saudi Arabia	27.5%	China	47.2%
United States	24.7%	United States	12.0%
Switzerland	6.9%	Japan	9.7%
China	6.7%	South Korea	9.2%
Russia	2.6%	India	7.6%
Turkey	2.6%	Switzerland	6.0%
India	2.4%	Turkey	1.8%
South Korea	2.3%	Malaysia	1.6%
Canada	1.8%	Brazil	1.0%
Malaysia	1.5%	Norway	0.9%

Note: Nace Rev.2 2343 corresponds to the sum of HS/CN 8546 20 and 8547 10.

Source: Authors' own elaboration on COMEXT (2016).

### ***Other technical ceramic products***

This sector is a residual category covered by the NACE rev.2 code 23.44 "manufacture of other technical ceramic products". The sector covers **a large variety of products** which at least partially are based on clays. Like the other ceramic products, technical ceramics are also produced using a mixture of raw materials which are fired in kilns (using mainly natural gas). The category partially overlaps with the manufacture of ceramic insulators (used for electrical installations).

Products covered in this sector have a high value added and are often consumed by into high-tech industries.<sup>233</sup> In fact, technical ceramics supply sectors such as aerospace and automotive, electronics, but also biomedical and environmental protection sectors.<sup>234</sup> Therefore, the sector can be classified as **heterogeneous** and **B2B**. Consequently, price is not the main driver of competition. The sector is R&D-intensive and demands a high-skilled labour force.

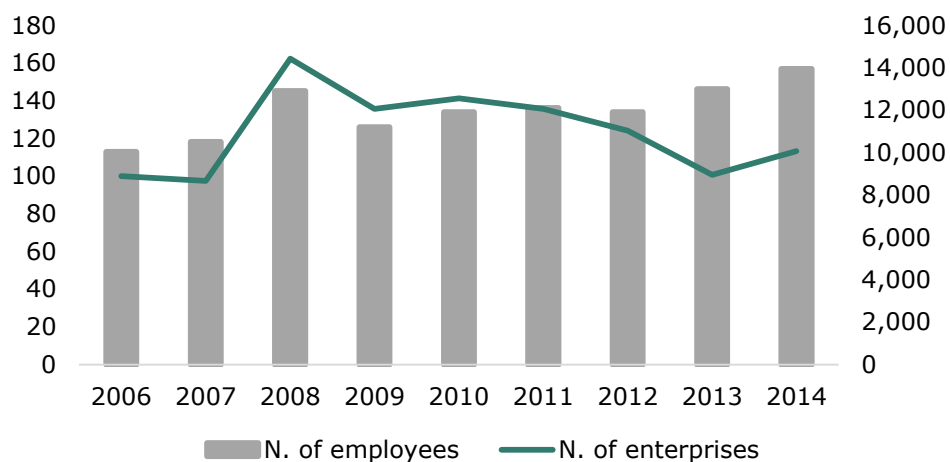
### ***Sectoral statistics***

The sector encompassing manufacture of other technical ceramic products increased in size after 2006 in terms of the number of both enterprises and employees. In particular, the number of people employed in this sector grew by 4,000 (Figure 156).

<sup>233</sup> European Commission (2007), "Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, 2007" (<http://tinyurl.com/njerd3h>).

<sup>234</sup> Ibid.

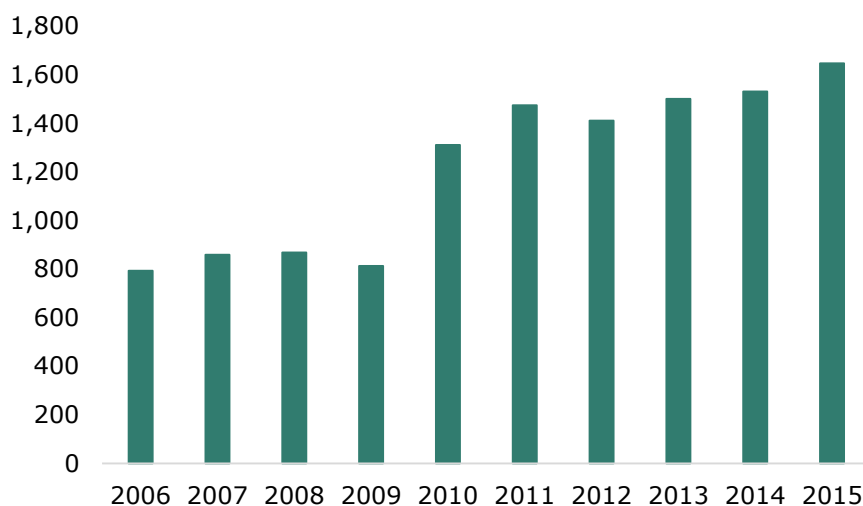
**Figure 156. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture of other technical ceramic products**



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

The positive evolution of the sector is also apparent if one considers constant growth of production sold by EU producers, which was more than €1.6 billion in 2015.

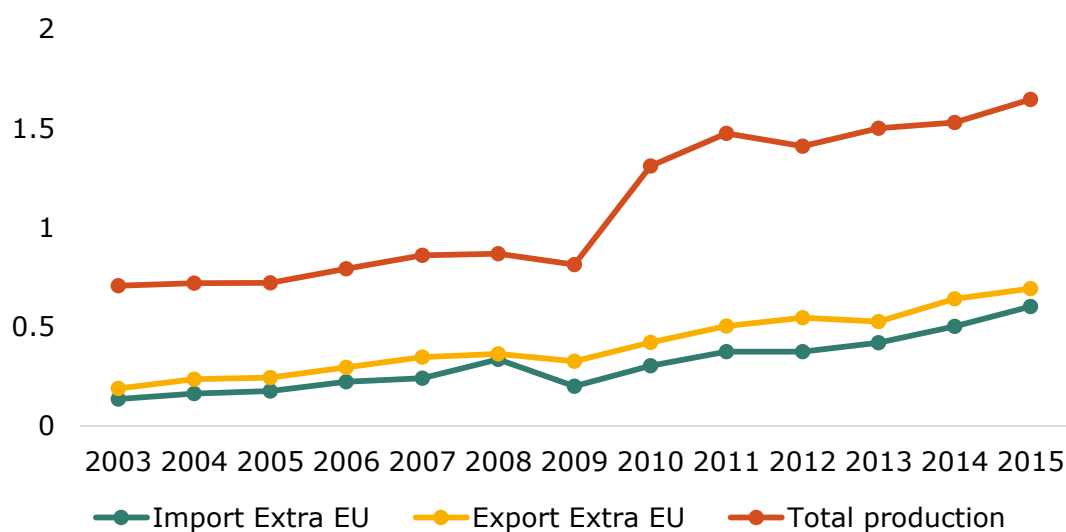
**Figure 157. Value of production sold by EU producers of other technical ceramic products (€ millions)**



Source: Authors' own elaboration on PRODCOM.

Figure 158 displays trade flows in the manufacture of other technical ceramic products: the EU registered **a small trade surplus from 2006 onwards**. In this sector, extra-EU trade flows as well as the value of the production steadily increased.

**Figure 158. Extra-EU-28 trade and total production in manufacture of other technical ceramic products (€ billions)**



Note: The category "Manufacture of other technical ceramic products" (C2344 NACE Rev.2) corresponds to HS 690911, 690912, 690919.

Source: Authors' own elaboration on COMEXT (2016).

Interestingly, **China** ranks only third among exporters to the EU. In fact, a central role was played by the US and Japan, which together accounted for almost 60% of total EU imports (Table 111). The US was the second-largest destination market for EU exports, with 14.7% of the overall export value, just behind Macedonia (21.9%).

**Table 111. Top 10 markets for other technical ceramic products and other products in 2015 (% of the overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to the EU	
Macedonia	21.9%	United States	40.1%
United States	14.7%	Japan	27.7%
South Africa	11.7%	China	9.3%
South Korea	9.6%	Mexico	8.7%
Turkey	5.4%	South Africa	3.2%
China	4.7%	Switzerland	3.1%
Japan	3.6%	South Korea	2.4%
Switzerland	3.3%	Indonesia	1.3%
Brazil	3.1%	Thailand	0.8%
India	2.7%	Israel	0.7%

Note: The category "Manufacture of other technical ceramic products" (C2344 NACE Rev.2) corresponds to HS 690911, 690912, 690919.

Source: Authors' own elaboration on COMEXT (2016).

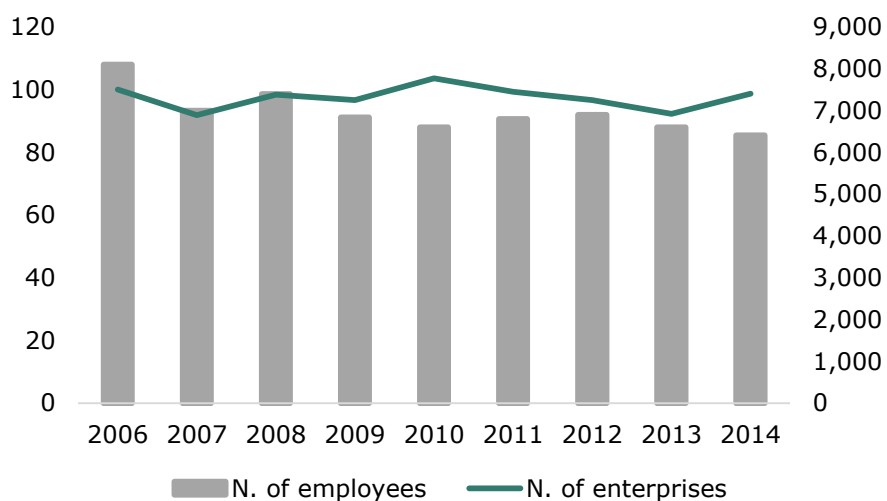
### Other ceramic products

This sector represents a residual category encompassed by the NACE 2 code 23.49 "manufacture of other ceramic products". The key raw material for this type of product is clay. Other ceramic products falling under this NACE code are in general **heterogeneous** with a mainly **B2B** business relationship towards downstream industries such as retail. However, there are also standardised designs which are sold in larger quantities (and can hence be described as homogenous).

### **Sectoral statistics**

The size of this sector remained relatively constant over the period under analysis. In fact, the number of employees decreased by only 1,600, while the number of enterprises was stable (Figure 159).

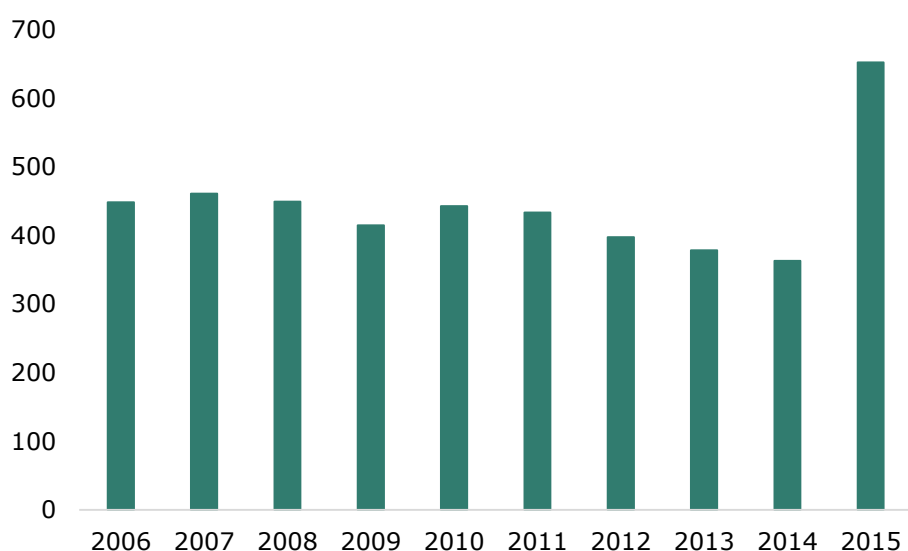
**Figure 159. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in manufacture of other ceramic products**



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

A comparable trend is observable for the value of production sold, which remained flat at €400 million (Figure 160). In 2015, it appears that a significant positive increase in production sold took place, but Eurostat data for the eight-digit NACE line "Ceramic articles, n.e.s. (excluding of porcelain or china)" are still provisional.

**Figure 160. Value of production sold by EU producers of other ceramic products (€ millions)**



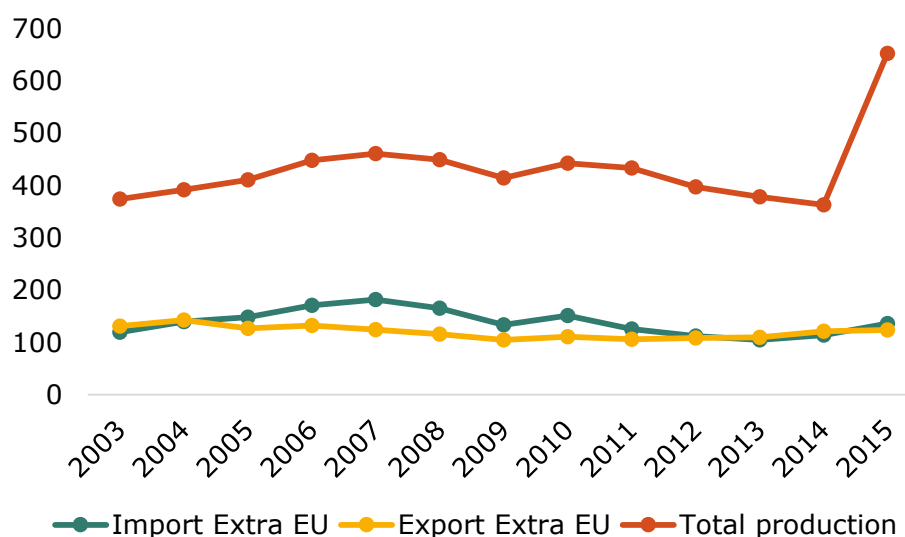
*Note: For 2015, values for the NACE code 23.49.12.50 "Ceramic articles, n.e.s. (excluding of porcelain or china)" are provisional.*



Source: Authors' own elaboration on PRODCOM.

As regards international trade, **the EU ceased to be a net exporter in 2012**, when extra-EU imports and exports basically equalised (Figure 161).

**Figure 161. Extra-EU-28 trade and total production of other ceramic products (€ millions)**



Note: The category "Manufacture of other ceramic products" (C2349 NACE Rev.2) corresponds to HS 690990, 6914.  
For 2015, values for the NACE code 23.49.12.50 "Ceramic articles, n.e.s. (excluding of porcelain or china)" are provisional.  
Source: Authors' own elaboration on COMEXT (2016).

Again, **China** was the leading exporter to the EU, with 30.1% of total EU imports in 2015, followed by Vietnam (21.4%) and the US (18.8%). The most common destination market for the EU's other ceramic products was the US, attracting more than one-third of total EU exports registered in 2015 (Table 112).

**Table 112. Top 10 markets for other ceramic products in 2015 (% of the overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to the EU	
United States	35.3%	China	30.1%
Switzerland	9.6%	Vietnam	21.4%
Australia	8.9%	United States	18.8%
Norway	6.2%	Malaysia	3.7%
China	5.3%	India	2.9%
Canada	3.9%	Japan	2.9%
Japan	3.6%	Mexico	2.3%
Russia	2.0%	Turkey	1.9%
Saudi Arabia	1.9%	South Korea	1.7%
Turkey	1.8%	Thailand	1.5%

Note: The category "Manufacture of other ceramic products" (C2349 NACE Rev.2) corresponds to HS 690990, 6914.  
Source: Authors' own elaboration on COMEXT (2016).

## **Abrasive products**

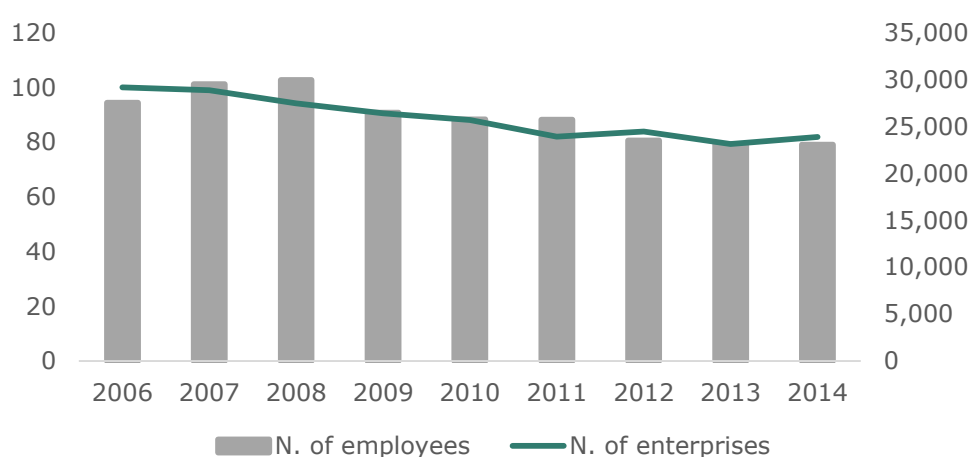
This sector includes producers covered by the NACE rev.2 code 23.91 "production of abrasive products". Abrasive products are used in e.g. cutting-off, deburring, grinding, polishing works with different materials and are available in many forms, often coming as bonded or coated abrasives, including blocks, belts, discs, wheels, sheets, rods and loose grains.<sup>235</sup> The main raw materials used to produce abrasives are aluminium oxides and silicon carbide, cubic boron nitride (CBN), synthetic diamonds, garnet and emery are also used. It is worth remarking that only a minor share of abrasive products (about 14% of the sectoral turnover in 2015) are made of ceramics.

Some abrasive products are standardised and usually produced in high quantities using high automation to generate economies of scale and reduce relative labour costs. Other abrasives products require high technological development in small ranges, exactly adapted to non-standard technological applications. Abrasives and super-abrasives producers are continuously developing new grinding and polishing materials, processes and technologies in order to achieve better performance for their customers, adapt to new materials and requirement, save raw materials and improve energy efficiency. Abrasive products are mainly sold to industrial clients, such as furniture manufacturers or construction companies (**B2B**); a small share of the output also goes to individual clients through wholesalers and retailers.<sup>236</sup> The European abrasives industry has a major impact on productivity in other sectors, including the steel industry, metal processing, automobile manufacturing, space industry, glass, construction, stone processing, shipbuilding, clean-tech, machine building, wood processing and defence.

## **Sectoral statistics**

The abrasive sector experienced a minor contraction in terms of both employees and enterprises between 2006 and 2014. After reaching a peak of 29,950 employees in 2008, employment figures constantly declined to 23,000 in 2014. In the same way, the number of enterprises producing abrasive products dropped by 20% (Figure 162).

**Figure 162. Number of employees (right axis, absolute value) and enterprises (left axis, index number 2006=100) in production of abrasive products**



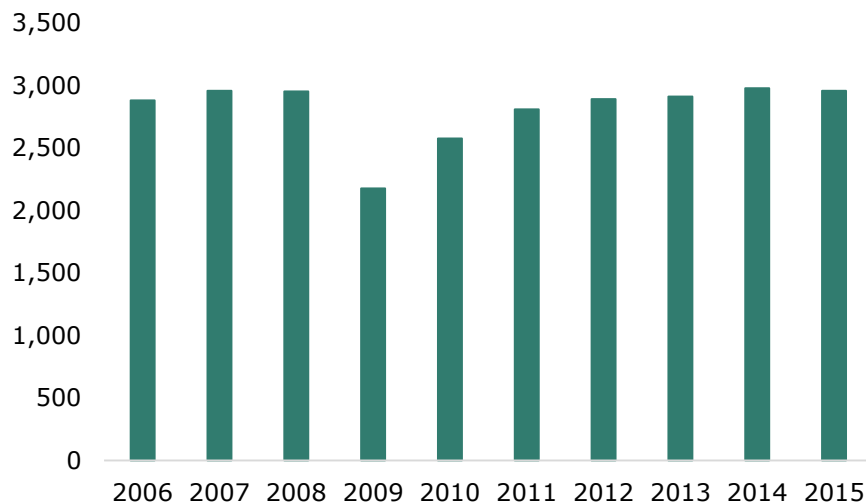
Source: Authors' own elaboration on Eurostat Structural Business Statistics.

<sup>235</sup> Ibid.

<sup>236</sup> European Commission (2007), "Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, 2007" (<http://tinyurl.com/njerd3h>).

The contraction in number of employees and companies is not reflected by the trend in the value of production sold by EU players. As shown in Figure 163, after a major drop between 2008 and 2009, the value of production sold increased to some €3 billion in 2014; a small decrease was registered in 2015.

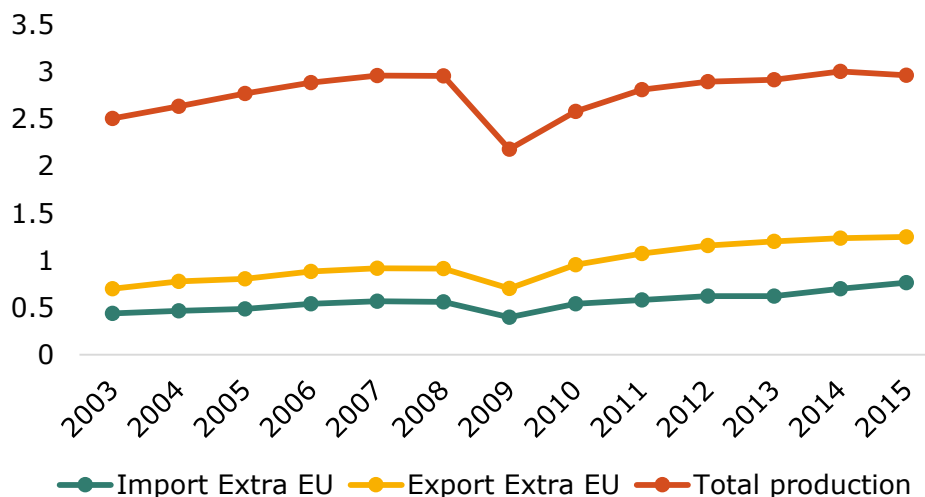
**Figure 163. Value of production sold by EU producers of abrasive products (€ millions)**



Source: Authors' own elaboration on PRODCOM.

**Extra-EU trade plays an important role for the EU abrasive sector;** this is apparent when comparing trade flows with total production (Figure 164). Interestingly, **the EU is a net exporter of abrasive products**, and the positive margin remained quite stable across the period under observation. In terms of bilateral trade, the US and China were, once again, the two major trading partners; the US ranked first among destination markets for EU products and second among exporters to the EU; China is the second-largest destination market and the first source of EU imports (Table 113).

**Figure 164. Extra-EU-28 trade and total production of abrasive products (€ billions)**



Note: The category "Production of abrasive products" (C2391 NACE Rev.2) corresponds to HS 6804, 6805.

Source: Authors' own elaboration on COMEXT (2016).

**Table 113. Top 10 markets in abrasive products in 2015 (% of the overall export/import values)**

Top 10 Destination Markets		Top 10 Exporters to the EU	
United States	19.5%	China	29.1%
China	7.5%	United States	19.9%
Switzerland	7.3%	Switzerland	18.1%
Brazil	6.0%	South Korea	10.2%
Turkey	5.3%	Japan	5.2%
Russia	5.1%	India	2.8%
India	3.0%	Turkey	2.5%
United Arab Emirates	2.9%	Thailand	2.4%
Mexico	2.8%	Liechtenstein	1.3%
Canada	2.5%	Taiwan	1.3%

Note: The category "Production of abrasive products" (C2391 NACE Rev.2) corresponds to HS 6804, 6805.

Source: Authors' own elaboration on COMEXT (2016).



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