FRAMEWORK CONTRACT

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FOR THE PROCUREMENT OF STUDIES AND OTHER SUPPORTING SERVICES ON COMMISSION IMPACT ASSESSMENTS AND EVALUATION

FINAL REPORT

FOR A STUDY ON COMPOSITION AND DRIVERS OF ENERGY PRICES AND COSTS IN ENERGY INTENSIVE INDUSTRIES: THE CASE OF THE CERAMICS INDUSTRY - WALL AND FLOOR TILES

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# Table of Contents

1. Wall and floor tiles ................................................................................................................................. 1

1.1 Description and production .................................................................................................................. 1

1.1.1 Introduction ........................................................................................................................................ 1

1.1.2 Production process ........................................................................................................................... 1

1.1.3 Value chain ....................................................................................................................................... 2

1.2 Global and European markets ............................................................................................................. 2

1.3 Selection of the sample and sample statistics ..................................................................................... 6

1.3.1 The selection of typical facilities ...................................................................................................... 6

1.4 Methodology ......................................................................................................................................... 9

1.4.1 Data collection ................................................................................................................................. 9

1.4.2 Data analysis and presentation ......................................................................................................... 9

1.4.3 Calculation of indirect ETS costs .................................................................................................... 10

1.4.4 Validation of information .................................................................................................................. 11

1.5 Energy prices trends ............................................................................................................................ 12

1.5.1 Introduction ..................................................................................................................................... 12

1.5.2 Natural gas ..................................................................................................................................... 13

1.5.3 Electricity ........................................................................................................................................ 15

1.6 Analysis of energy bills components .................................................................................................... 18

1.6.1 Introduction ..................................................................................................................................... 18

1.6.2 Natural gas ..................................................................................................................................... 18

1.6.3 Electricity ........................................................................................................................................ 21

1.7 Energy intensity .................................................................................................................................... 25

1.7.1 General trends ................................................................................................................................. 25

1.7.2 Plant case study ............................................................................................................................... 26

1.8 International comparison ...................................................................................................................... 27

1.8.1 Natural gas ..................................................................................................................................... 27

1.8.2 Electricity ........................................................................................................................................ 29

1.9 Indirect ETS costs for the wall and floor tiles sector ........................................................................... 31

1.9.1 Sample .......................................................................................................................................... 31

1.9.2 Results .......................................................................................................................................... 31

1.9.3 Key findings .................................................................................................................................... 33

1.10 Production costs and margins ............................................................................................................ 33

1.10.1 General figures .............................................................................................................................. 33

1.10.2 Impact of energy costs on production costs and margins ............................................................... 34

1.11 General impressions ............................................................................................................................ 35

References .................................................................................................................................................. 37
List of Figures and Tables

Figure 1. Ceramic tiles production in the EU-27 (2011 data) ............................................................. 3
Figure 2. Production value of ceramic tiles in the EU-27 (data expressed in billions of Euros) .......... 4
Figure 3. EU-27: Exports and import of ceramic tiles (in million sq. m.) ........................................... 5
Figure 4. Wall and floor tiles: division by regions .............................................................................. 8
Figure 5. Exemplary box plot ............................................................................................................ 10
Figure 6. Prices of natural gas paid by sampled EU producers (2010-2012) ..................................... 14
Figure 7. Prices of electricity paid by sampled EU producers (2010-2012) ..................................... 17
Figure 8. Components of the natural gas bills paid by the sampled producers in Europe ................. 20
Figure 9. Components of the natural gas bills paid by the sampled producers in Europe ............... 21
Figure 10. Components of the electricity bills paid by the sampled producers in Europe ................... 23
Figure 11. Components of the electricity bills paid by the sampled producers in Europe .................. 24
Figure 12. Natural gas intensity and natural gas prices of two plants (indexed values) ..................... 26
Figure 13. Prices of natural gas - EU vs. Russia (plant level data expressed in €/MWh) ............... 28
Figure 14. Prices of natural gas - EU vs. US (plant level data expressed in €/MWh) ....................... 28
Figure 15. Prices of electricity - EU vs. Russia (plant level data expressed in €/MWh) .................... 30
Figure 16. Prices of electricity - EU vs. US (plant level data expressed in €/MWh) ......................... 30
Figure 17. Production costs (indexed values), 2010-2012 ................................................................. 34
Figure 18. EBITDA (indexed values), 2010-2012 ............................................................................. 34

Table 1. Breakdown of production costs (wall and roof tiles) ............................................................. 2
Table 2. Ceramic tiles production by geographical areas (in 2011) ................................................. 3
Table 3. Ceramic tiles consumption by geographical areas (in 2011) .............................................. 4
Table 4. Average yearly prices per tonne of CO2 (€) ...................................................................... 11
Table 5. Number of questionnaires used in each section ................................................................. 12
Table 6. Descriptive statistics for natural gas prices paid by sampled EU producers (€/MWh) ......... 15
Table 7. Descriptive statistics for electricity prices paid by sampled EU producers (€/MWh) ........... 18
Table 8. Descriptive statistics for the natural gas intensities for 10 out of 12 sample production plants in terms of physical output (MWh/tonne) ................................................................. 25
Table 9. Descriptive statistics for the electricity intensities for 10 out of 12 sampled production plants in terms of physical output (MWh/tonne) ........................................................................ 26
Table 10. Wall and floor tiles indirect costs, averages per region ...................................................... 31
Table 11. Wall and floor tiles indirect costs, averages per region ...................................................... 32
Table 12. Wall and floor tiles indirect costs, averages per region ...................................................... 32
1. Wall and floor tiles

1.1 Description and production

1.1.1 Introduction

Wall and floor tiles (commonly known as ceramic tiles) are relatively thin plates made of ceramics. The forerunners of the ceramic tiles were invented in the times of the ancient Pharaohs. Tiles were shaped out of clay dug from the riverbanks; they were later burnt and exposed to the sun for drying (K. Radtke, 2010). Ancient civilisations upgraded these primitive materials, adding pigments and low-reliefs for decorative purposes. Greeks and Romans used ceramic tiles not only to cover the surfaces of their buildings; they also constituted an important element of their plumbing systems. As time passed, production techniques were improved and ceramic tiles became renowned for their usefulness and decorative values (G. Timellini et al., 2009).

Like any other ceramic materials, wall and floor tiles are long-lasting, fire-resistant and relatively easy to clean, yet fragile when exposed to shocks. Ceramic tiles can serve as a finishing material, but they also have an aesthetic function (EC, 2007). They can be used to cover and decorate internal facades (e.g. kitchens, bathrooms etc.) internal and external ground surfaces (e.g. garden alleys), swimming pools, and public areas (e.g. squares, fountains). Ceramic tiles are heterogeneous; they vary in dimensions (from few centimetres to 60 – 100 cm sided slabs), weight, shape (square, rectangular or other polygonal shapes), colour, surface (porous or vitrified, glazed or unglazed) etc. Nowadays, they are mainly used in the construction sector. Therefore, the performance of the construction industry has a direct impact on the production levels of ceramic tiles (G. Timellini et al., 2009).

1.1.2 Production process

The production of ceramic tiles consists of four main stages: (i) the preparation of the raw materials, (ii) shaping, (iii) drying and (iv) firing.

The raw materials are used to prepare of the extrusion paste. Thereafter, the paste is mechanically shaped by presses and dried in dryers. Firing is the most energy-consuming phase of the production process. Around 55-65% of the total volume of energy used during the production process is consumed at this stage. The majority of the kilns employed by the producers are heated by natural gas (in roughly 85% of cases). Coal, oil and biomass gas are usually applied when the latter is not available (EC, 2007). During the firing process, ceramic tiles acquire their main characteristics, namely water-resistance, fire-

---

1 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, calcium carbonate and others could be added to obtain different colors or porosity.

2 Depending of the characteristics of product, i.e. size, surface etc.
resistance and hardiness. After the firing process, the products are exposed for cooling and shipped to distribution sites (Cerame-Unie, 2012).

Environmental concerns related to the production of wall and floor tiles are similar to those concerning bricks and roof tiles (i.e. CO$_2$ emissions, deforestation and degradation of the extraction sites etc.).

1.1.3 Value chain

The sub-sector partially relies on imported raw materials applied in the production process. Clays, kaolins, quartz, chamotte, calcium carbonate (calcite), talc and dolomite are used in production. These raw materials combined with glaze frits, metal oxides and colorants are also used for glazes production. In addition, ceramic tiles are high added value products compared to other ceramic products. Design, the choice of materials, applied techniques, innovativeness are all contributing factors (Cerame-Unie, 2009). Overall, the sub-sector is very energy intensive. In 2008, the production of one tonne of ceramic tiles required 6GJ of energy (G. Timellini, 2008). According to the information collected through the questionnaires, the share of energy in the total productions costs varies between 17 and 29%.

Table 1 illustrates the breakdown of productions costs for the wall and floor tiles sub-sector. Note that the figures presented in Table 1 are referring to average EU values. According to the information provided by Cerame-Unie, the costs of raw materials are the most important cost-driver for the EU producers of wall and floor tiles. The costs associated with raw materials procurement account for roughly 30%-35% of the total production costs. According to Cerame-Unie, energy related costs represent 25% to 30% of total production costs. Labour costs also accounts for approximately 25%-30% of total production costs.

Table 1. Breakdown of production costs (wall and roof tiles)

<table>
<thead>
<tr>
<th>Share in production costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>25%-30%</td>
</tr>
<tr>
<td>Labour</td>
<td>25%-30%</td>
</tr>
<tr>
<td>Raw materials</td>
<td>30-35%</td>
</tr>
<tr>
<td>Other production costs</td>
<td>10%-15%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Cerame-Unie (2013).

1.2 Global and European markets

Production

Table 2 illustrates the production levels of ceramic tiles by geographical regions. In 2011, the global production of ceramic tiles breached the level of 10.5 billion square meters (sq. m.). Concentrating more than two-thirds of the world’s production, Asian producers largely dominated the global production. China itself amounts for 45.7% of the world production (i.e. 4.8 bn. sq. m.) and was the largest producing region. The EU-27 concentrated
11.2% of the global production and was the third largest producer in the world. It was followed by Central and Southern America, which concentrated roughly 10% of the global production. Other regions, namely “Other Europe”, North America, Africa, and Oceania jointly produced 1,105 bn. sq m., which corresponds to 11% of the world’s production.

Table 2. Ceramic tiles production by geographical areas (in 2011)

<table>
<thead>
<tr>
<th>GEOGRAPHICAL AREAS</th>
<th>2011 (sq. m MM.)</th>
<th>Percentage of world production</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>4,800</td>
<td>45.7</td>
</tr>
<tr>
<td>Other Asia (excluding China)</td>
<td>2,379</td>
<td>24.2</td>
</tr>
<tr>
<td>European Union (EU-27)</td>
<td>1,178</td>
<td>11.2</td>
</tr>
<tr>
<td>Central and Southern America</td>
<td>1,051</td>
<td>10.0</td>
</tr>
<tr>
<td>Other Europe (including Turkey)</td>
<td>490</td>
<td>4.7</td>
</tr>
<tr>
<td>Africa</td>
<td>326</td>
<td>3.1</td>
</tr>
<tr>
<td>Other America (including Mexico)</td>
<td>284</td>
<td>2.7</td>
</tr>
<tr>
<td>Oceania</td>
<td>5</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>WORLD TOTAL</strong></td>
<td>10,512</td>
<td>100</td>
</tr>
</tbody>
</table>

*Source: D. Stock (2012).*

Figure 1 illustrates the distribution of the EU production among its member states. In 2011, Italy was the biggest European producer of ceramic tiles (400 million sq. m.) followed by Spain (392 million sq. m.) and Poland (119 million sq. m.). These three member states concentrated 77% of the EU production (D. Stock, 2012). It is worth noting that within the EU, the sub-sector of wall and floor tiles is heavily populated by SMEs. Small companies manufacture approximately 80% of ceramic tiles produced in Europe (Cerame-Unie, 2013).

Figure 1. Ceramic tiles production in the EU-27 (2011 data)

*Source: D. Stock (2012).*
Figure 2 shows the most recent trend in production value of the EU’s wall and floor tiles industry which, between 2007 and 2012, decreased from 12.2 billion euros to a level of roughly 7.2 billion euros (i.e. -40.9%).

**Figure 2. Production value of ceramic tiles in the EU-27 (data expressed in billions of Euros)**

![Graph showing production value of ceramic tiles from 2007 to 2012](graph-image)

*Source: Eurostat (2012).*

**Consumption**

Table 3 shows the global consumption of ceramic tiles by geographical regions. In 2011, the world’s consumption of wall and floor tiles reached the level of 10.4 bn. sq. m. Asian clients were absorbed roughly 66% of the world’s consumption. Concentrating 9% of the global demand, the EU-27 was the third largest consuming region of ceramic tiles. Six member states (Italy, Spain, France, Germany, Poland and the UK) jointly concentrated 70.2% of the intra-EU consumption, namely 625 million sq. m. (D. Stock 2012).

**Table 3. Ceramic tiles consumption by geographical areas (in 2011)**

<table>
<thead>
<tr>
<th>GEOGRAPHICAL AREAS</th>
<th>2011 (sq. m MM.)</th>
<th>Percentage of world consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>4000</td>
<td>38.6</td>
</tr>
<tr>
<td>Other Asia (excluding China)</td>
<td>2,844</td>
<td>27.4</td>
</tr>
<tr>
<td>Central and Southern America</td>
<td>1,118</td>
<td>10.8</td>
</tr>
<tr>
<td>European Union (EU-27)</td>
<td>929</td>
<td>9.0</td>
</tr>
<tr>
<td>Other Europe (including Turkey)</td>
<td>520</td>
<td>5.0</td>
</tr>
<tr>
<td>Africa</td>
<td>517</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Trade

Due to their nature, ceramic tiles are highly tradable goods. As shown by Figure 3, the EU was a net exporter of ceramic tiles in 2011. The equivalent of roughly 27% of the EU production (i.e. 325 million sq. m.) was exported to third countries. EU-made ceramic tiles were mainly shipped to Russia, Switzerland, North Africa and North America. In 2011, the EU recorded a trade surplus of 230 million sq. m. worth €2.1 bn. (Cerame-Unie 2013).

**Figure 3. EU-27: Exports and import of ceramic tiles (in million sq. m.)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports</th>
<th>Exports</th>
<th>Trade balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>157</td>
<td>505</td>
<td>348</td>
</tr>
<tr>
<td>2008</td>
<td>140</td>
<td>349</td>
<td>208</td>
</tr>
<tr>
<td>2009</td>
<td>114</td>
<td>297</td>
<td>183</td>
</tr>
<tr>
<td>2010</td>
<td>119</td>
<td>350</td>
<td>231</td>
</tr>
<tr>
<td>2011</td>
<td>103</td>
<td>325</td>
<td>230</td>
</tr>
</tbody>
</table>

(Source: Cerame-Unie (2013)).
The sector of wall and floor tiles generates a net contribution to the trade balance of the EU. However, European producers are facing an increasing competition from foreign manufacturers. According to the industry, non-EU producers (especially based in Asia) benefit from:

- The abundant availability of some of the raw materials employed in the production process;
- Lower energy prices;
- Different (i.e., often laxer) environmental, health and labour regulations.

While clay can be commonly found in Europe, Beijing controls several additive raw materials employed in the production process. For instance, more than 80% of the world reserves of Bauxite and Graphite are located in China.

Moreover, China is the biggest exporter of ceramic tiles and fast growing. More importantly, Chinese counterfeit tiles, as well as pricing (dumping) of refractory products, have been major issues for EU producers. Following a request of the European Ceramic Tile Manufacturers’ Federation, the European Commission initiated an anti-dumping investigation on ceramic tiles imported from China. As a consequence, import duties have been raised from 26.3% to 36.5% for the Chinese companies - which cooperated in the investigation - and up to 69.7% for all other producers based in China.


### 1.3 Selection of the sample and sample statistics

#### 1.3.1 The selection of typical facilities

The objective of this sub-chapter is to define and assess the composition and drivers of energy prices and costs in the case of wall and floor tiles. A total of twelve plants have been sampled for the purpose of this exercise. To define the sample of typical facilities, the authors of this study applied the following criteria:

- Geographical coverage
- Capacity of plants
- Ownership
- Production technology

Not all of these general criteria are relevant for this sector; moreover, it was not possible to obtain sufficient information on the universe with regards to this criterion. This issue is further described hereunder.

#### 1.3.1.1 Geographical coverage

In this case, the following criteria were applied:

- Production per member state: three member states (Italy, Spain and Poland) account for 77% of the EU production of wall and floor tiles. Therefore, a representative number of sampled plants are located therein.
- Heterogeneity: to the extent possible, and without undermining the representativeness of the sample, an element of geographical diversity of the selected plants has been taken into consideration. In short, the sampled facilities are located in member
states differing in (i) geographical location and (ii) size and in (iii) the length of their membership in the EU.

For the abovementioned reasons, twelve sampled facilities have been allotted in the three geographical areas (as illustrated by Figure 4):

- **South-western Europe** (Spain, Portugal, France), which concentrated approximately 42% of the EU production in 2012. Five of the sampled facilities are located in this geographical area.

- **Central and Northern Europe** (UK, Ireland, Belgium, the Netherlands, Luxembourg, Denmark, Germany, Poland, the Czech Republic, Latvia, Lithuania, Estonia, Sweden and Finland), which concentrated approximately 20% of the EU production in 2012. Three of the sampled facilities are located in this geographical area.

- **South-eastern Europe** (Italy, Slovenia, Austria, Hungary, Slovakia, Croatia, Bulgaria, Romania, Greece, Malta and Cyprus), which concentrated approximately 38% of the EU production in 2012. Four of the sampled facilities are located in this geographical area.
1.3.1.2 Capacity of plants

Plant capacity is an important determinant of production costs and margins, and of technical efficiency, including energy efficiency. Ideally, plants that represent the spectrum of production sizes should figure among the sample. The authors of this study experienced difficulties in obtaining plant capacity data for the sub-sector of wall and floor tiles, as there is no external source of information. However, due to the fragmentation of the sub-sector, the European Ceramic Industry Association was not in a position to provide this information. Nevertheless, Cerame-Unie identified 22 plants producing wall and floor tiles willing to participate in the exercise. Two additional questionnaires were submitted by producers operating in third countries. Having received questionnaires from these facilities, CEPS researchers adjusted the sample, including plants of varied production capacities (ranging from >40,000 to <250,000 t/year).
1.3.1.3 Ownership

The sub-sector of wall and floor tiles is densely populated by SMEs amounting for 80% of the production. The sample aims at reflecting the structure of the sub-sector. For this reason, out of twelve sampled plants, eight are owned by SMEs and four by large multinational producers.

1.3.1.4 Production technology

The technology used by producers of wall and floor tiles is standardised and had little bearing as a criterion for the sample.

1.4 Methodology

As previously described, the data sample consists of 12 plants, which have been allotted to 3 different regions\(^4\). For all 12 plants, cost and consumption data are available, i.e. annual and specific costs for the total amount of electricity and the natural gas consumed. One monthly energy bill is available for 2 out of the 12 sampled plants. Annual bills (i.e. 12 monthly bills) are available for 5 more plants. Five facilities were unable to provide energy bills. This enabled CEPS researchers to perform a basic plausibility check of the information specified in the questionnaires.

1.4.1 Data collection

The analysis of the energy prices and costs for the sector of wall and floor tiles was based on questionnaires sent to all sampled plants. A confidentiality agreement was signed with Cerame-Unie. This agreement provided assurance that all collected data will be strictly treated as confidential.

All participants provided detailed data about their energy prices, structure of energy bills, and energy consumption. Having conducted a quality assessment of data collected from all participants, the consultant could use 12 questionnaires for the analysis.

1.4.2 Data analysis and presentation

Box plots are used to display the reported cost ranges and to give an indication of the distribution among the units in the sample. An exemplary a box plot is illustrated in Figure 5. The whiskers below and above the box represent the minimum and maximum value of the sample. The box itself is divided in two parts by a horizontal line. This line indicates the median of the sample, i.e. the numerical value separating the higher half of the data sample from the lower half. The lower border of the box represents the first (lower) quartile of the sample. It splits off 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%. Put differently, the box contains exactly the middle half of the data. The height of the box is also referred to as inter-

\(^4\) Regions were developed by taking into account the need to reconcile the need for an adequate geographical coverage with confidentiality considerations.
quartile range (IQR). It is a robust way of showing the variability of a data sample without having to make an assumption on the underlying statistical distribution.

**Figure 5. Exemplary box plot**

![Box plot](image)

*Source: Own illustration.*

In order to ensure that no data are attributable to any specific plant, box plots are not created for the regional subsets of the sample, as these consist of only 3-5 plants. Instead, weighted average values are calculated and displayed next to or inside the box plots (see Figure 5). As weighting factors, the corresponding consumption data are applied, i.e. the annual consumption for electricity or natural gas, respectively.

### 1.4.3 Calculation of indirect ETS costs

The objective of the ETS cost calculations per sector in this study to provide the indirect ETS cost for the sub-sector between 2010 and 2012. The level of information is aggregated on a regional level, though the definition of those regions differs from sector to sector.

The model for the indirect cost of EU ETS in is defined as:

**Indirect costs**

\[
\text{Indirect cost (€/Tonne of product)} = \text{Electricity intensity (kWh/Tonne of product)} \\
\quad \times \text{Carbon intensity of electricity (Tonne of CO}_2\text{/kWh)} \\
\quad \times \text{CO}_2\text{ Price (€/Tonne of CO}_2\text{)} \times \text{Pass-on rate}
\]

---

5 The same methodology has also been applied for the sub-sector of bricks and roof tiles. Alternatively, annual production data can be used as a weighting factor. This was not possible, as the data on annual production provided in the questionnaires was incomplete. However, consumption and production values are typically correlated, i.e. the difference between the two approaches is expected to be minor.
Where:

- **Electricity intensity of production**: the amount of electricity used to produce one tonne of product. This amount is sector, plant and process specific;

- **Carbon intensity of electricity generation** indicates the amount of tonnes of CO$_2$ emitted by utilities to generate one kWh;

- **CO$_2$ Price**: is the average yearly market price of CO$_2$.

- **Pass-on rate**: the proportion of direct costs faced by utilities (disregarding any mitigating effects from free allocation) that they pass on to electricity consumers.

Sources:

- **Electricity intensity of production**: this was acquired from interviews with and questionnaires answered by industry members.

- **Carbon intensity of electricity generation**: the maximum regional carbon intensity of electricity is utilised, provided by the Commission’s Guidelines on State aid measures.\(^6\) Note that these figures are not national. Member States who 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).

- **CO$_2$ Price**:
  - Yearly averages of the daily settlement prices for Dec Future contracts for delivery in that year. The daily settlement prices were reported by the European Energy Exchange.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO$_2$ Price</td>
<td>14.48</td>
<td>13.77</td>
<td>7.56</td>
</tr>
</tbody>
</table>

**1.4.4 Validation of information**

All sampled participants provided detailed figures on the level and structure of energy prices as well as on energy consumption. The data was assessed, e.g. through a plausibility check and then evaluated. Table 5 presents the number of questionnaires received, selected in the sample and used in the analysis of each section. Note that sampling has been carried out after the reception of the questionnaires due to lack of prior information about the universe\(^7\).

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\(^6\) Communication from 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)

\(^7\) In other words, we constructed the sample on the basis of the selection criteria illustrated above, once we received all answers to the questionnaires
CEPS conducted a validation of the collected data through EU energy statistics publications. To further assess consistencies in the responses, the research team performed targeted interviews with sampled producers. The consultant was not able to validate the energy prices data, for example, through external sources of information about the costs borne by EU producers at plant level.

Table 5. Number of questionnaires used in each section

<table>
<thead>
<tr>
<th>Total number received</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number included in the sample</td>
<td>12</td>
</tr>
<tr>
<td>Energy prices trends</td>
<td>12</td>
</tr>
<tr>
<td>Energy bill components</td>
<td>12</td>
</tr>
<tr>
<td>Energy intensity</td>
<td>6</td>
</tr>
<tr>
<td>International comparison</td>
<td>6</td>
</tr>
<tr>
<td>Indirect ETS costs</td>
<td>10</td>
</tr>
<tr>
<td>Production costs and margins</td>
<td>4</td>
</tr>
</tbody>
</table>

Please note that all of the figures presented in chapters 1.5, 1.6 and 1.8 include possible exemptions from taxes, levies or transmission costs. The consultant asked the producers to communicate the prices they paid for energy carriers between 2010 and 2012. Therefore, their answers include exemptions/reductions if these are applicable.

The consultant decided to use only 12 out of 24 collected questionnaires to (i) ensure the geographical representativeness of the sample and (ii) due to the poor quality of some of the submitted questionnaires. Note that all the questionnaires used by the consultant were submitted on a plant level.

1.5 Energy prices trends

1.5.1 Introduction

The most energy intensive stage of the production process is firing, where heating is typically provided by natural gas. This is reflected by the ratio of natural gas and electricity costs, which is in the range of 2.0 and 2.3. This means that electricity has a share of 30 to 34% on total energy costs, whereas natural gas has a share of 66 to 70%.

---

8 Validation was conducted through the EU Statistical Pocketbook 2013 (European Commission, 2013; available at: http://ec.europa.eu/energy/publications/doc/2013_pocketbook.pdf) and the EU Market Observatory & Statistics.

9 In some cases, respondents provided information at company level, not at plant level, as they were not able to attribute costs and consumptions to different plants.

10 Alternatives to natural gas such as solid fuels were not used by the sampled producers.
1.5.2 Natural gas

1.5.2.1 General trends

As shown by the median in Figure 6, the prices of natural gas paid by the sampled producers of wall and floor tiles are on the rise. In 2010, the median EU price of natural gas paid by the producers was of 25.7 €/MWh. By 2012, the price rose by 30.6% to a level of 33.5 €/MWh.

Furthermore, since 2010, the gap of prices paid by different EU producers kept growing. The increasing inter-quartile range, i.e. the difference between the lower and upper quartile, which represents the middle half of the data, also reflects this trend. From 2011 to 2012, the range between the median and the upper quartile increased considerably. This is particularly well illustrated when compared to the length separating the median from the lower quartile. Moreover, the total range of prices has also been increasing since 2010, as indicated by the whiskers of the box plot. According to the data, one or more producers are exposed to natural gas prices of up to 37.8 €/MWh.

1.5.2.2 Regional differences

Figure 6 also illustrates the average prices of natural gas paid by European producers operating in different geographical regions. The following trends can be observed at regional levels:

Central and Northern Europe

Augmenting from 25.7 €/MWh in 2010, to 28.7 €/MWh in 2012, the average price of natural gas in Northern Europe increased moderately. It is noteworthy to mention that from 2010 to 2011, the average price paid by Central and Northern European producers decreased by 1.9 €/MWh, falling below the lower quartile of prices for the whole sample. In 2012, despite rising prices (the average price increased by 4.9 €/MWh), the average price of gas paid by producers based in this region was still below the lower quartile of prices for the whole sample. This development is due to the soaring prices of gas in Southern Europe. Therefore, in 2012:

- Producers based in Central and Northern Europe paid lower prices than producers operating in South-Eastern and South-Western Europe;
- An average producer operating in Central and Northern Europe paid lower prices than 75% of the plants in the sample.

South-Western Europe

Ranging from 25.6 €/MWh in 2010 to 34.7 €/MWh in 2012, the average price of natural gas in South-Western Europe rose by 35.5% and was the highest among the three compared regions (see Table 6). The average price of natural gas paid by producers based in South-Western European was located between the median and the upper quartile of prices for all of Europe in 2011, remaining in this range in the following year.
South-Eastern Europe

In 2010, the price of natural gas in South-Eastern Europe was the lowest among the three compared regions (23.0 €/MWh). Between 2010 and 2012, this price rose by 36.5% to a level of 31.4 €/MWh. It is worth noting that in 2012, the average price of natural gas in South-Eastern Europe was closest to the average European price, namely 31.7 €/MWh.

Figure 6. Prices of natural gas paid by sampled EU producers (2010-2012)

Source: Own illustration.
Table 6. Descriptive statistics for natural gas prices paid by sampled EU producers (€/MWh)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe (average)</td>
<td>25.0</td>
<td>26.2</td>
<td>31.7</td>
</tr>
<tr>
<td>Europe (median)</td>
<td>25.7</td>
<td>27.8</td>
<td>33.5</td>
</tr>
<tr>
<td>Europe (IQR)</td>
<td>4.0</td>
<td>6.2</td>
<td>7.0</td>
</tr>
<tr>
<td>Europe (minimum)</td>
<td>21.0</td>
<td>23.1</td>
<td>27.6</td>
</tr>
<tr>
<td>Europe (maximum)</td>
<td>32.3</td>
<td>35.3</td>
<td>37.8</td>
</tr>
<tr>
<td>Central and Northern Europe (average)</td>
<td>25.7</td>
<td>23.8</td>
<td>28.7</td>
</tr>
<tr>
<td>South-Western Europe (average)</td>
<td>25.6</td>
<td>29.7</td>
<td>34.7</td>
</tr>
<tr>
<td>South-Eastern Europe (average)</td>
<td>23.0</td>
<td>25.0</td>
<td>31.4</td>
</tr>
</tbody>
</table>

Source: Own calculation.

1.5.3 Electricity

1.5.3.1 General trends

Similar to natural gas, the median of electricity prices is on the rise (see Figure 7). Overall, i.e. for all plants in the sample, the median of costs has increased steadily from 83.5 €/MWh in 2010 to 101.4 €/MWh in 2012. This corresponds to an increase of 21.4%, which is 9.2 percentage points less than the value for natural gas. In 2012, electricity costs up to 89.2 €/MWh (or less) occurred for 25% of the sampled units (first quartile). In the same year, electricity expenses for 25% of the units were higher than 114.4 €/MWh (third quartile). Between 2010 and 2012, the inter-quartile range enlarged moderately. This means that - for the middle half of the plants in the data sample - the spread of electricity costs has slightly increased within this period of time.

The whiskers of the box plot, which represent the outliers, indicate that the spread between the minimum and maximum cost levels was also on the rise between 2010 and 2012. Augmenting from 63.5 to 86.8 €/MWh in 2012, the total range of electricity prices paid by the sampled facilities increased by 24.7 €/MWh with a limited number of plants exposed to electricity costs of up to 163.7 €/MWh.

1.5.3.2 Regional differences

The same figure also shows the weighted average prices of electricity paid by European producers in different geographical regions. Overall, the regional developments are in line with the EU trend. Between 2010 and 2012, the prices of electricity increased in all of the geographical regions. However, price levels are different across the regions. The following trends can be observed at regional levels:

Central and Northern Europe

The prices in Central Northern Europe show a slight upward tendency, increasing from 74.4 €/MWh to 92.0 €/MWh (+23.6%). For all years considered in the analysis, the price is below the median price of the sample. In other words, during the entire observation pe-
period, an average producer based in Central and Northern Europe benefited of lower electricity prices than at least 50% of the sampled plants. Moreover, during the same period of time, the average price of electricity paid by producers based in Central and Northern Europe was the lowest among the three compared regions.

**South-Western Europe**

In South-Western Europe, the upward tendency is weaker than in Central and Northern Europe, as prices augmented from 85.3 €/MWh in 2010 to 92.9 €/MWh in 2012 (+8.9%). Since 2011, the price in South-Western Europe is located below the median price of the sample, meaning that in 2011 and 2012 an average producer based in this region paid lower electricity prices than at least 50% of the sampled plants. Furthermore, the costs of electricity in South-Western & Central and Northern Europe almost aligned in 2012 (92.9 €/MWh vs. 92.0 €/MWh respectively).

**South-Eastern Europe**

During the entire observation period, South-Eastern Europe was exposed to the highest prices of electricity. In 2010, the average price of electricity paid by producers based in South-Eastern Europe was of 99.5 €/MWh, exceeding the upper quartile of EU prices. In 2011, this price increased to 103.6 €/MWh (+4.1%), but because of the stronger increase in other European regions, it fell under the upper quartile of EU prices. Between 2011 and 2012, the average price of electricity in South-Eastern Europe increased by 7.2% to 120.1 €/MWh again surpassing the upper quartile of EU prices. In other words, in 2012, an average producer of ceramic tiles based in South-Eastern Europe paid higher electricity prices than 75% of all EU producers.
Figure 7. Prices of electricity paid by sampled EU producers (2010-2012)

Source: Own illustration based on questionnaires.
Table 7. Descriptive statistics for electricity prices paid by sampled EU producers (€/MWh)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe (average)</td>
<td>80.8</td>
<td>88.8</td>
<td>97.6</td>
</tr>
<tr>
<td>Europe (median)</td>
<td>83.5</td>
<td>95.0</td>
<td>101.4</td>
</tr>
<tr>
<td>Europe (IQR)</td>
<td>19.0</td>
<td>27.0</td>
<td>25.2</td>
</tr>
<tr>
<td>Europe (minimum)</td>
<td>64.1</td>
<td>71.4</td>
<td>76.9</td>
</tr>
<tr>
<td>Europe (maximum)</td>
<td>127.6</td>
<td>130.3</td>
<td>163.7</td>
</tr>
<tr>
<td>Central and Northern Europe (average)</td>
<td>74.4</td>
<td>86.3</td>
<td>92.0</td>
</tr>
<tr>
<td>South-Western Europe (average)</td>
<td>85.3</td>
<td>89.5</td>
<td>92.9</td>
</tr>
<tr>
<td>South-Eastern Europe (average)</td>
<td>99.5</td>
<td>103.6</td>
<td>120.1</td>
</tr>
</tbody>
</table>

Source: Own calculation.

1.6 Analysis of energy bills components

1.6.1 Introduction

In order to better understand the price developments, we now break down the total cost into its components. For natural gas, the total costs are grouped into the following three components: (i) the energy component, (ii) the grid fees and (iii) other levies and taxes (excluding VAT). For electricity, there is one additional component, the RES levies.

1.6.2 Natural gas

1.6.2.1 General trends

As shown by Figure 8 and Figure 9, the energy component is the major driver of natural gas prices for the sampled plants in Europe. In 2012, it accounted for 89.5% of the averaged price of gas. Between 2010, the cost of the energy component increased from 22.1 €/MWh, to 28.4 €/MWh (+ 28.5%).

Due to the importance of the energy component, the impact of grid fees, taxes and other levies on the prices of natural gas was limited. In 2012, transmission costs accounted for 9.7% of the average price of gas. Between 2010 and 2012, these costs augmented from 2.7 €/MWh to 2.9 €/MWh (+ 7.4%). Finally, the costs of taxes (excl. VAT) and other levies increased from 0.1 €/MWh in 2010 to 0.4 €/MWh in 2012 (+400%). Despite this significant increase, in 2012, they accounted for roughly 1.6% of the averaged price of gas paid by producers of wall and floor tiles.

1.6.2.2 Regional differences

Figure 8 also illustrates the breakdown of costs for the three different regions. The following trends can be observed at regional levels:
Central and Northern Europe

As shown by Figure 6, since 2010, the prices of gas in Central and Northern Europe increased slightly. In 2012, the prices of gas in this region were lower than in South-Western and South-Eastern Europe. This trend is reflected by the evolution of the different price drivers of natural gas in this geographical region. As illustrated by Figure 8, between 2010 and 2012, the cost of the energy component increased moderately from 23.5 €/MWh to 26.5 €/MWh (+12.7%). Therefore, in 2012, the cost of the energy component in Central and Northern Europe was lower than in the other two regions assessed. The impact of taxes and other levies remained insignificant, yet stable. In 2012, these costs accounted for less than 0.6% of the average price of natural gas paid by producers based in Central and Northern Europe.

South-Western Europe

The developments in South-Western Europe are in line with the EU trends (i.e. increase of all price drivers). It is noteworthy to mention that between 2010 and 2012, the cost of the energy component augmented by 39.5%, to the highest level among the three compared regions, namely 30.4 €/MWh in 2012. In the same period, grid fees have also increased (+8.6%) to the highest level among the compared regions, namely 3.8 €/MWh. Although the costs of taxes and other levies (excl. VAT) increased sharply (+67%), their impact on the final price of gas remained marginal. In 2012, they accounted for 1.4% of the average price of gas paid by producers operating in South-Western Europe.

South-Eastern Europe

Between 2010 and 2012, all price drivers in South-Eastern Europe were on the rise. During this period of time, the cost of the energy component increased by 37.7%, to 27.6 €/MW. It is worth noting that prior to this increase, the cost of the latter was lower in South-Eastern Europe (20.1 €/MW in 2010) than in the other geographical regions. After having decreased by 0.02 €/MW in 2011, the costs of transmission increased by 0.04 €/MW in 2012. Overall, between 2010 and 2012, costs related to grid fees augmented by 7.1% to a level of 3.0 €/MWh. It is noteworthy to remark that in 2010, costs related to taxation were non-existent in South-Eastern Europe (namely 0.01 €/MWh). By 2012, they rose to a level of 0.6 €/MWh (+6000%). However, just as in other geographical regions, their impact on the final price of natural gas was marginal. In 2012, they accounted for 1.8% of the average price of gas paid by producers operating in South-Eastern Europe.
Figure 8. Components of the natural gas bills paid by the sampled producers in Europe (in %)

<table>
<thead>
<tr>
<th>Natural gas cost components (€/MWh)</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (excl. VAT)</td>
<td>0.1</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Grid fees</td>
<td>2.7</td>
<td>2.7</td>
<td>2.9</td>
</tr>
<tr>
<td>Energy component</td>
<td>22.1</td>
<td>23.1</td>
<td>28.4</td>
</tr>
<tr>
<td>Central and Northern Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (excl. VAT)</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Grid fees</td>
<td>2.1</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Energy component</td>
<td>23.5</td>
<td>21.4</td>
<td>26.5</td>
</tr>
<tr>
<td>South-Western Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (excl. VAT)</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Grid fees</td>
<td>3.5</td>
<td>3.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Energy component</td>
<td>21.8</td>
<td>25.8</td>
<td>30.4</td>
</tr>
<tr>
<td>South-Eastern Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (excl. VAT)</td>
<td>0.0</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Grid fees</td>
<td>2.8</td>
<td>2.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Energy component</td>
<td>20.1</td>
<td>21.9</td>
<td>27.6</td>
</tr>
</tbody>
</table>

Source: Own calculation based on questionnaires.
1.6.3 Electricity

1.6.3.1 General trends

In accordance with the structure of natural gas prices, the energy component is the most significant component of the electricity price paid by the sampled production facilities in
Europe (see Figure 10 and Figure 11). However, in comparison to natural gas, this component is less dominant. In 2010, the energy component amounted for roughly 56.2 €/MWh, that is a share of 69.5% of the electricity price paid by an average sampled European producer of ceramic tiles. In the same year, grid fees amounted to 16.1 €/MWh (19.9%), RES levies to 6.7 €/MWh (8.3%) and other levies & taxes (excl. VAT) to 1.8 €/MWh (2.2%).

Augmenting from 56.2 in 2010 to 61.3 €/MWh in 2012 (+9.0%), the costs for the energy component remained fairly stable in absolute terms. Since 2010, its share diminished, reaching a value of 62.8%. This development is related to the stronger increase of other price drivers, mainly RES levies. From 2010 to 2012, grid fees have augmented by 3.3 €/MWh (+20.5%), RES levies by 8.0 €/MWh (+119.4%) and other levies & taxes (excl. VAT) by 0.4 (+22%).

### 1.6.3.2 Regional differences

On a regional level, the following trends can be observed:

**Central and Northern Europe**

In comparison to the general situation, Central and Northern Europe is marked by the smallest cost of the energy component. In 2012, the latter was of 57.5 €/MWh. Transmission costs were also lower than in other parts of Europe (namely 13.3 €/MWh in 2012). The sum of all components has increased from 74.5 to 91.9 €/MWh (+23.6%) in the observation period.

**South-Western Europe**

According to the questionnaires, sampled plants based in this region had no costs for RES levies between 2010 and 2012. In other words, it was not possible to single out RES costs for the plants in the sample. Possible reasons could be: (i) the producers were fully exempted from the payment, (ii) these costs were not reported separately (and instead fully or partly included in other cost components). In comparison to other geographical regions, South-Western Europe experienced higher transmission costs (26.7 €/MWh in 2012). The cost of the energy component augmented from 58.2 €/MWh in 2010 to 64.3 €/MWh in 2012 (+10.4%) and was the closest to the EU average (i.e. 61.3 €/MWh) among the three compared regions in that year.

**South-Eastern Europe**

During the observation period, South-Eastern Europe has shown the strongest increase of electricity prices among the three compared regions. Power prices have augmented from 99.5 to 120.1 €/MWh, which corresponds to a 20.7% increase. What is more, as of 2012, the sampled plants of South-Eastern Europe were exposed to the highest electricity prices among all the sampled facilities. Rising power prices in this region are mainly driven by the soaring costs of RES levies. Augmenting from 9.8 €/MWh in 2010 to 23.6 €/MWh in 2012, the costs of the RES levies increased by 140.8%. During the same period of time, the costs of transmission and the cost of the energy component have also been on the rise in this part of Europe (+16.0% and +7.8% respectfully). It is noteworthy to mention that South-Eastern Europe was the only region to have experienced a continuous decrease of
one of the price drivers during the entire observation period. Since 2010, taxes and other levies (excl. VAT) decreased by 34.1% to a level of 2.9 €/MWh in 2012. Nevertheless, despite this reduction, the cost of this price driver in South-Eastern Europe was the highest among the three compared regions.

**Figure 10. Components of the electricity bills paid by the sampled producers in Europe (in €/MWh)**

<table>
<thead>
<tr>
<th>Year</th>
<th>EU</th>
<th>Central and Northern Europe</th>
<th>South-Western Europe</th>
<th>South-Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>18.9</td>
<td>17.4</td>
<td>17.4</td>
<td>14.7</td>
</tr>
<tr>
<td>2011</td>
<td>18.9</td>
<td>17.4</td>
<td>17.4</td>
<td>14.7</td>
</tr>
<tr>
<td>2012</td>
<td>18.9</td>
<td>17.4</td>
<td>17.4</td>
<td>14.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RES levy</td>
<td>6.7</td>
<td>11.9</td>
<td>14.7</td>
<td>9.4</td>
<td>17.4</td>
<td>18.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other (excl. VAT)</td>
<td>1.8</td>
<td>1.9</td>
<td>2.2</td>
<td>1.3</td>
<td>1.4</td>
<td>2.3</td>
<td>1.7</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td>Grid fees</td>
<td>16.1</td>
<td>18.4</td>
<td>19.4</td>
<td>12.2</td>
<td>13.5</td>
<td>13.3</td>
<td>25.4</td>
<td>30.1</td>
<td>26.7</td>
</tr>
<tr>
<td>Energy comp.</td>
<td>56.2</td>
<td>56.6</td>
<td>61.3</td>
<td>51.6</td>
<td>54.0</td>
<td>57.5</td>
<td>58.2</td>
<td>57.7</td>
<td>64.3</td>
</tr>
</tbody>
</table>

*Source: Own calculation based on questionnaires.*
Figure 11. Components of the electricity bills paid by the sampled producers in Europe (in %)

Source: Own calculation based on questionnaires.
1.7 Energy intensity

1.7.1 General trends

The consultant asked the producers to provide information about the energy efficiency of their plants by disclosing figures on the energy intensity of their production processes.\(^{11}\) Intensity is typically measured in terms of value added (unit: MWh/€) or in terms of physical output (unit: MWh/tonne). As more than one energy carrier is used in the production process, separate intensities should be calculated for each energy source (e.g. electricity, natural gas) to allow for a correct interpretation of the data. Producers did not provide such a breakdown. However, it is possible to calculate carrier-specific energy intensities based on the consumption values of each energy source given in the questionnaires.

The completeness of answers on intensity data was varied. Out of the 12 sampled plants, only 10 provided intensity data in terms of physical output. In terms of value added, complete data was available for only 6 plants. The reduced size of the regional samples impedes the consultant to disclose regional statistics due to confidentiality reasons. Instead, only EU-wide figures are given. The weighted average and the median of both electricity and natural gas intensities in terms of physical output were calculated. To give an indication for the variability of the sample the inter-quartile range (IQR) is used. Minimum and maximum values cannot be disclosed due to confidentiality reasons.

### Table 8. Descriptive statistics for the natural gas intensities for 10 out of 12 sample production plants in terms of physical output (MWh/tonne)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe (average)</td>
<td>1.81</td>
<td>1.79</td>
<td>1.81</td>
</tr>
<tr>
<td>Europe (median)</td>
<td>1.73</td>
<td>1.68</td>
<td>1.69</td>
</tr>
<tr>
<td>Europe (IQR)</td>
<td>0.91</td>
<td>0.89</td>
<td>0.93</td>
</tr>
</tbody>
</table>

The figures for natural gas are reported in Table 8. Although some plant owners have indicated in the questionnaire that investments in energy efficiency have been made, the trend is not clear. The median of the intensity decreased from 2010 to 2012, while the weighted average stagnated during the observation period. Without further information, no interpretation for this development can be given. As indicated by the IQR, the difference between the 25% of the plants with the highest intensity and the 25% with the lowest intensity increased slightly from 2010 to 2012.

The figures for electricity are reported in Table 9. The median and the weighted average remained at the same level during the entire observation period. On the other hand, the IQR increased, but insufficiently to allow the observation of any particular trend.

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\(^{11}\) It is worth noting that energy intensity does not only depend on the physical features of machines and processes, but also on the capacity utilisation rate. Hence, difference in efficiency across multiple years may not only signal investments in energy efficiency, but also a better utilisation rate.

\(^{12}\) weighting factor: consumption.
Table 9. Descriptive statistics for the electricity intensities for 10 out of 12 sampled production plants in terms of physical output (MWh/tonne)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe (average)</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
</tr>
<tr>
<td>Europe (median)</td>
<td>0.19</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>Europe (IQR)</td>
<td>0.14</td>
<td>0.14</td>
<td>0.15</td>
</tr>
</tbody>
</table>

1.7.2 Plant case study

Figure 12 illustrates the gas intensity of two sampled plants. Natural gas prices paid by the two producers were also indexed and added to the figure. During the entire observation period plant “A” was more efficient than plant “B”. As of 2012, the latter showed a 71% lower intensity when compared to plant “A”. Between 2010 and 2012, the energy intensity of plant “A” increased by 2.5%. This development was more visible in the case of plant “B”: During the same period of time, its energy intensity augmented by 5.1%. This decreasing energy efficiency was accompanied by a significant augmentation of gas prices during the observation period (+46.6%).

Figure 12. Natural gas intensity and natural gas prices of two plants (indexed values, lowest value = 100)

Source: Own calculation.
1.8 International comparison

The aim of this chapter is to compare the prices of energy carriers paid by producers based in the EU with the prices paid by manufacturers based in third countries, namely Russia and the US. This section is based on a series of plant case studies. Data collected from two manufacturing sites located in Russia and the US has been confronted with figures collected through the questionnaires submitted by the sampled EU plants. All the plants selected for this assessment are of comparable production capacities in order to avoid distortions that are due to different consumption levels of natural gas or electricity. In other words, the Russian plant and the EU plants “A” and “B” have similar production capacities. Likewise, the US plant and the EU plants “C” and “D” have comparable production levels.

As the consultant received only monthly energy bills for the Russian and US plant, only plausibility checks could be performed. It is worth noting that the consultant cannot assess the representativeness of the Russian or US plants.

1.8.1 Natural gas

1.8.1.1 EU vs. Russia

As shown by Figure 13, between 2010 and 2012, the selected Russian facility benefited from the lowest price of natural gas among the three compared plants. Moreover, the prices paid by the Russian plant kept a fairly stable level. Between 2010 and 2012, the price of gas paid by the Russian-based facility increased from 8.1 €/MWh (+9.8%). In contrast, during the same period of time, the prices paid by plant “A” augmented from 25.9 €/MWh, to 35.6 €/MWh (+37.4%). The pace of increase was similar for plant “B”, as the prices increased from 22.1 €/MWh in 2010, to 27.5 €/MWh in 2012 (+30.3%). It is interesting to note, that despite this augmentation, the prices of gas paid by the second plant were lower than prices paid by all other European plants included in the sample (regardless of their size\(^3\)). Put differently, the prices of gas paid by this specific Russian plant were lower than that in any EU sampled plant. In 2012, the price of natural gas paid by plant “A” was four times higher than the price paid by the Russian-based facility. The differences between the two regions are probably due to the fact that prices are regulated in Russia.

1.8.1.2 EU vs. US

The natural gas prices paid by the selected US facility were the lowest among the three compared plants (see Figure 14). Decreasing from 11.3 €/MWh in 2010, to 8.7 €/MWh in 2012, prices diminished by 23.1%. Therefore, alike the selected Russian plant, during the entire observation period, the prices of gas paid by the US-based facility were lower than in all the European plants included in the sample. Contrary to the trend experienced by this specific US plant, the prices of natural gas paid by the European facilities increased constantly between 2010 and 2012. The prices paid by plant “C” augmented from 26.4 €/MWh, to 31.1 €/MWh (+17.8%). In the case of plant “D” the increase was more impor-

\(^3\) As indicated by the whiskers of Figure 6.
tant, as prices rose from 24.1 €/MWh in 2010, to 32.6 €/MWh in 2012 (+35.2%). The differences between the two regions are probably due to the fact that US consumers have access to abundant resources of unconventional fossil fuels driving natural gas prices down.

**Figure 13. Prices of natural gas - EU vs. Russia (plant level data expressed in €/MWh)**

![Chart showing prices of natural gas for EU vs. Russia](chart13.png)

**Source:** Own illustration.

**Figure 14. Prices of natural gas - EU vs. US (plant level data expressed in €/MWh)**

![Chart showing prices of natural gas for EU vs. US](chart14.png)

**Source:** Own illustration.
1.8.2 Electricity

1.8.2.1 EU vs. Russia

As shown by Figure 15, during the entire observation period, the selected Russian plant benefited from the lowest power prices among the three production sites. It is worth to note that in the same period of time, plant “B” paid lower power prices than any of the sampled EU facilities (see Table 7). In other words, between 2010 and 2012, this specific Russian plant paid lower power prices than any EU facility included in the sample. What is more, while the prices of electricity were on the rise in all of the plants presented in Figure 15, the prices paid by the two EU plants augmented more than in the manufacturing site based in Russia, both in absolute and relative terms. Between 2010 and 2012, the prices paid by the Russian facility increased by 0.9 €/MWh (+11.2%). The prices paid by plant “A” rose from 76.7 €/MWh in 2010, to 95.6 €/MWh in 2012 (+24.5%). In the case of plant “B”, this increase was less important, as prices augmented from 64.1 €/MWh, to 76.9 €/MWh (+20%), namely to the lowest level among the sampled EU plants. Yet the power prices paid by the latter were roughly nine times higher than the prices paid by the selected Russian plant. The differences between the two regions are probably due to the fact that prices are regulated in Russia.

1.8.2.2 EU vs. US

As shown by Figure 16, the power prices paid by the selected US plant were the lowest among the three compared facilities. However, it is worth to note that the prices of electricity paid by the US plant decreased from 2010 to 2011 (-11%) and then increased again from 2011 to 2012 (+3.9%). Without further information, no interpretation for this dip can be given. Overall, since 2010, the power prices paid by this specific US plant decreased by 7.4% and were lower than any of the EU plant included in the sample as of 2012. During the observation period power prices in Europe were on the rise (see Figure 7); plant “D” followed an opposite trend: between 2010 and 2012, power prices paid by this plant decreased from 98.9 €/MWh to 92.4 €/MWh (-6.6%). Plant “C” followed the EU overall development as prices power prices paid by that facility augmented from 93.3 €/MWh to 108.7 €/MWh (+16.5%). The differences between the two regions are probably due to the fact that US consumers have access to abundant resources of unconventional fossil fuels driving natural gas prices down, which also affects electricity prices. As no information was provided on the US structure of the electricity bill, no further interpretation is possible.
Figure 15. Prices of electricity - EU vs. Russia (plant level data expressed in €/MWh)

Source: Own illustration.

<table>
<thead>
<tr>
<th>Year</th>
<th>EU plant &quot;A&quot;</th>
<th>EU plant &quot;B&quot;</th>
<th>RU plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>76.7</td>
<td>64.1</td>
<td>8</td>
</tr>
<tr>
<td>2011</td>
<td>81.1</td>
<td>71.4</td>
<td>8.3</td>
</tr>
<tr>
<td>2012</td>
<td>95.6</td>
<td>76.9</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Figure 16. Prices of electricity - EU vs. US (plant level data expressed in €/MWh)

Source: Own illustration.

<table>
<thead>
<tr>
<th>Year</th>
<th>EU plant &quot;C&quot;</th>
<th>EU plant &quot;D&quot;</th>
<th>US plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>93.3</td>
<td>98.9</td>
<td>45</td>
</tr>
<tr>
<td>2011</td>
<td>103.4</td>
<td>96.7</td>
<td>40.1</td>
</tr>
<tr>
<td>2012</td>
<td>108.7</td>
<td>92.4</td>
<td>41.7</td>
</tr>
</tbody>
</table>
1.9 Indirect ETS costs for the wall and floor tiles sector

1.9.1 Sample

Information on the indirect costs of ETS was obtained from the industry via questionnaires. As mentioned above, wall and floor tiles producers are grouped in 3 different regions.

1.9.2 Results

In this sectorial analysis of indirect ETS costs, none of the plants in the sample have indicated that they have a long term contract with a utility. Two plants in the South-Eastern region generate electricity themselves. One of these plants covers around 40% of its electricity needs with self-generated electricity, the second one around 80%.

There are significant inter-regional differences in indirect costs, primarily caused by two outliers in the sample. One South-Eastern European plant has an average electricity intensity that is 16 times higher than the average electricity intensity over the sample. One Central and Northern European plant has an average electricity intensity that is 25 times higher than the average over the sample.

Because the sample size is limited, the effect of the outliers on the regional averages is significant. The regional average electricity intensity in Central and Northern Europe drops from around 1.7 MWh/tonne of wall and floor tiles to around 0.3 MWh/tonne of wall and floor tiles if the outlier in this region is excluded.

Therefore the analysis is presented without the two aforementioned outliers\(^{14}\).

Table 10. Wall and floor tiles indirect costs, averages per region

(Euro/tonne of wall and floor tiles)

<table>
<thead>
<tr>
<th></th>
<th>South-Western Europe</th>
<th>Central and Northern Europe</th>
<th>South-Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0.76</td>
<td>1.63</td>
<td>0.92</td>
</tr>
<tr>
<td>2011</td>
<td>0.73</td>
<td>1.50</td>
<td>0.84</td>
</tr>
<tr>
<td>2012</td>
<td>0.42</td>
<td>0.78</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Pass-on rate: 0.6

---

\(^{14}\)The analysis for the indirect cost for the Wall and Floor Tiles sector uses data from 10 plants.
Table 11. Wall and floor tiles indirect costs, averages per region (Euro/tonne of wall and floor tiles),

<table>
<thead>
<tr>
<th>Year</th>
<th>South-Western Europe</th>
<th>Central and Northern Europe</th>
<th>South-Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.02</td>
<td>2.17</td>
<td>1.22</td>
</tr>
<tr>
<td>2011</td>
<td>0.97</td>
<td>2.00</td>
<td>1.11</td>
</tr>
<tr>
<td>2012</td>
<td>0.56</td>
<td>1.03</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Pass-on rate: 0.8

Table 12. Wall and floor tiles indirect costs, averages per region (Euro/tonne of wall and floor tiles),

<table>
<thead>
<tr>
<th>Year</th>
<th>South-Western Europe</th>
<th>Central and Northern Europe</th>
<th>South-Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.27</td>
<td>2.72</td>
<td>1.53</td>
</tr>
<tr>
<td>2011</td>
<td>1.21</td>
<td>2.51</td>
<td>1.39</td>
</tr>
<tr>
<td>2012</td>
<td>0.70</td>
<td>1.29</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Pass-on rate: 1

The inter-regional differences are lower when excluding both outliers, but remain significant. Indirect ETS costs in South-western Europe and South-eastern Europe are comparable.

The significantly higher indirect cost per tonne of wall and floor tiles in Central and Northern Europe is caused by one factor: a higher average electricity intensity of production in that region. The plants in the South-Western and South-Eastern European regions consume on average circa 0.15 MWh/tonne of wall and floor tiles they produce, compared with circa 0.28 MWh/tonne of wall and floor tiles in Central and Northern Europe.

The drop in indirect-ETS costs across all regions between 2011 and 2012 can be largely attributed to a sharp decrease in EUA prices (from a yearly average of 13.77 Euros per EUA in 2011 to a yearly average of 7.56 Euros per EUA in 2012).
1.9.3  Key findings

Two plants in the initial sample report significantly higher levels of electricity consumption per tonne of wall and floor tiles produced. The following key findings are based on the sample without these plants.

Indirect costs in Central and Northern Europe are significantly higher than indirect ETS costs in South-Western and South-Eastern Europe.

The inter-regional variations are caused by higher electricity consumption per tonne of wall and floor tiles in Central and Northern Europe and by differences in electricity intensity of production between plants.

The ETS indirect cost was significantly lower in 2012 compared to the previous years, because the price of EUAs was significantly lower in 2012.

1.10  Production costs and margins

1.10.1  General figures

This section presents an analysis of the production costs and margins for EU producers of wall and floor tiles. As already pointed out, nine plants provided complete data on production costs and on financial indicators (e.g. EBITDA). However, seven out of nine plants are from the same EU member state. Thus, instead of presenting average values for the whole sample as in other sector reports, a case study covering four plants was prepared. It is worth noting that validating the data on margins provided by the producers was not possible.

For the case study, four producers from three different countries\(^{15}\) were selected. Two producers are SMEs, two are large enterprises. The original data was provided in Euro per tonne of product at current prices. Due to confidentiality reasons, it is not possible to present plant-specific figures in absolute terms. Therefore, all values presented in Figure 17 and Figure 18 are indexed to the lowest value. For the plants included in the sample, the following elements are estimated for the years 2010, 2011 and 2012:

- Total production costs per tonne of product, whose estimate includes all production costs, \(\textit{inter alia}\) cost of finished goods, other operating expenses, depreciation, amortization and financial expenses referred to the product line;

- EBITDA,\(^{16}\) i.e. the difference between plant market price and production costs, excluding capital costs.

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\(^{15}\) Referred to as C1 (1st country), C2 (2nd country) and C3 (3rd country).

\(^{16}\) EBITDA stands for Earnings Before Interest, Taxes, Depreciation and Amortisation.
As shown in the Figure above, production costs differ significantly between plants. This is likely due to the fact that, for wall and floor tiles, final products are not as homogeneous as in the case of e.g. float glass.

Figure 17. Production costs (indexed values), 2010-2012

Source: Authors’ own elaboration.

The same consideration applies for EBITDA figures. Moreover, it is worth noting that it is not possible to estimate a trend for financial indicators from only three years of observation.

Figure 18. EBITDA (indexed values), 2010-2012

Source: Authors’ own elaboration.

1.10.2 Impact of energy costs on production costs and margins

This subsection presents the impact of energy costs on production costs and on profit margins. Energy costs in terms of €/MWh have been converted into costs in terms
of €/tonne using the corresponding energy intensities (electricity, natural gas). Then, the ratio between these energy costs and production costs was calculated. The figures are reported in Table.

**Table 13. Impact of total energy costs on production costs (%), 2010-2012**

<table>
<thead>
<tr>
<th></th>
<th>Electricity</th>
<th></th>
<th>Natural gas</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant A, C1 (SME)</td>
<td>8.7%</td>
<td>9.4%</td>
<td>10.1%</td>
<td>18.8%</td>
<td>24.2%</td>
<td>25.6%</td>
</tr>
<tr>
<td>Plant B, C1</td>
<td>8.1%</td>
<td>7.4%</td>
<td>8.9%</td>
<td>23.0%</td>
<td>29.2%</td>
<td>37.3%</td>
</tr>
<tr>
<td>Plant C, C2 (SME)</td>
<td>1.6%</td>
<td>1.5%</td>
<td>1.8%</td>
<td>13.0%</td>
<td>13.4%</td>
<td>17.9%</td>
</tr>
<tr>
<td>Plant D, C3</td>
<td>6.5%</td>
<td>6.4%</td>
<td>7.2%</td>
<td>12.9%</td>
<td>14.8%</td>
<td>16.4%</td>
</tr>
</tbody>
</table>

*Source: Authors' own elaboration.*

Again, the differences between the various plants are significant: electricity costs have a share of 1.6% to 10.1% on total production costs, natural gas costs have a share of 12.9% to 37.3%. However, the sample indicates an upward trend when comparing 2010 and 2012 values.

A similar method has been applied to assess the impact of energy costs on EBITDA. Here, the focus is not on total energy costs but only on regulated costs (i.e. grid fees, RES levies and non-recoverable taxes). As before, the costs in terms of €/MWh were converted into costs in terms of €/tonne using the corresponding energy intensities. Then, the ratio between regulated energy costs and EBITDA was calculated. The figures are reported in Table. Here again, the spread between the values reported by the various plants is broad due to the heterogeneity of the final products.

**Table 14. Impact of regulated energy costs on margins (%), 2010-2012**

<table>
<thead>
<tr>
<th></th>
<th>Electricity</th>
<th></th>
<th>Natural gas</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant A, C1 (SME)</td>
<td>28.4%</td>
<td>31.9%</td>
<td>33.5%</td>
<td>23.3%</td>
<td>34.3%</td>
<td>26.6%</td>
</tr>
<tr>
<td>Plant B, C1</td>
<td>18.0%</td>
<td>14.5%</td>
<td>18.2%</td>
<td>21.4%</td>
<td>24.4%</td>
<td>26.4%</td>
</tr>
<tr>
<td>Plant C, C2 (SME)</td>
<td>1.9%</td>
<td>2.4%</td>
<td>4.0%</td>
<td>1.0%</td>
<td>2.5%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Plant D, C3</td>
<td>9.6%</td>
<td>18.0%</td>
<td>24.3%</td>
<td>15.9%</td>
<td>20.8%</td>
<td>23.1%</td>
</tr>
</tbody>
</table>

*Source: Authors’ own elaboration.*

### 1.11 General impressions

The consultant used the questionnaires to (*inter alia*) ask EU producers about their impressions of the effects of liberalisation, investments in energy efficiency or the energy intensity of the sector.

Some producers admitted that the liberalisation of the energy markets engendered increased competition among energy suppliers. However, the same interviewees claimed that liberalisation did not lead to lower energy prices. Roughly half of the respondents claimed...
that their facilities were not entitled to any reductions/exemptions from networks tariffs, taxes or levies. Nevertheless, manufactures listed favourable tax treatment as one of the main reasons behind investments in energy efficiency; most of the respondents admitted that investments in this field were savings-driven. Only few producers admitted that the price of CO\textsubscript{2} was included in their electricity contracts. Most of the manufacturers had yearly contracts with their energy utilities. Depending of their geographical location, wall and floor tiles producers associated the costs of natural gas with oil prices or spot prices. In the case of electricity, interviewees claimed that prices at power exchanges, taxes and oil prices were the main price drivers in their power contracts.

A producer based in Central Europe claimed that his competiveness is more affected by possible exemptions/reductions than by energy prices. In other words, this producer was more concerned by the obtention of the possible exemptions/reductions than changing energy prices.
References


