EUROPEAN
COMMISSION

Brussels, XXX
[…](2014) XXX draft

COMMISSION STAFF WORKING DOCUMENT

Energy prices and costs report

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Energy prices and costs in Europe

Table of Contents

Introduction

Europe's energy sector is in the midst of a major transformation. Its gas and electricity sectors are moving from public monopolies into competitive private companies in liberalised markets and electricity generation is being decarbonised, with strong growth of wind and solar power in particular. At the same time, alternative gas supplies are being developed and diversified and the transport sector is becoming more fuel efficient and starting to use cleaner, alternative fuels.

There are different expectations and understanding of how all these changes affect each other. The liberalisation of the market is expected to deliver more competitive and therefore efficient and cheaper energy; environment and climate policy and decarbonisation is meant to ensure a sustainable energy sector for the long run, with acknowledged short term costs. Governments expect such changes to deliver short term benefits to consumers as well as longer term sustainability objectives. And the energy industry itself has to adapt to very different environmental, commercial, regulatory and technological regimes.

These efforts of Member State governments to create a more competitive and sustainable energy sector coincide with a major economic downturn in Europe's economic activity. Such economic hardship often triggers reluctance to change, and this is becoming visible in the energy sector: measures to protect jobs and enhance the competitiveness of national industry are impacting market liberalisation; the affordability of the short term costs of achieving sustainability is questioned; reliance on existing market players, structures and technologies grows heavier.

In light of such questions of the high costs to consumers and reduced European competitiveness, it is important to scrutinise and analyse the details of what is happening in the energy sector. There is a need to ensure that the changes and transformation underway are not undermining Europe's competitiveness, and that competitive and cost effective solutions are sought out to minimise negative impacts. This is why the conclusions of the 2013 May European Council announced a forthcoming analysis from the Commission on "*the composition and drivers of energy prices and costs in Member States (…), with a particular focus on the impact on households, SMEs and energy intensive industries, and looking more widely at the EU's competitiveness vis-à-vis its global economic counterparts*"

This report has been produced to support such scrutiny. Chapter 1 starts with a review of recent trends in energy prices and breaks down energy prices to explore the trends in separate price drivers (the electricity or gas costs, network and taxation elements of retail prices). The relationship between wholesale and retail prices is examined for gas and electricity markets and the consequences of regulating household and industrial consumer prices is examined. Chapter 2 looks at the impact and the evolution of energy costs, comparing household and industry costs across time, different industry sectors and Member States, with aggregated data and with case studies[1]. Chapter 3 provides international comparisons of energy prices and costs, looking at disaggregated prices and comparisons of taxation in particular, and explores the global nature of some hydrocarbon markets compared with the regional markets of natural gas and electricity. Chapter 4 examines the possible macroeconomic and sectoral consequences of *ongoing* European cost increases.

[1] Including seven energy intensive industries: bricks and roof tiles, wall and floor tiles, float glass, ammonia, chlorine, primary aluminium and steel

1. Energy prices in the EU

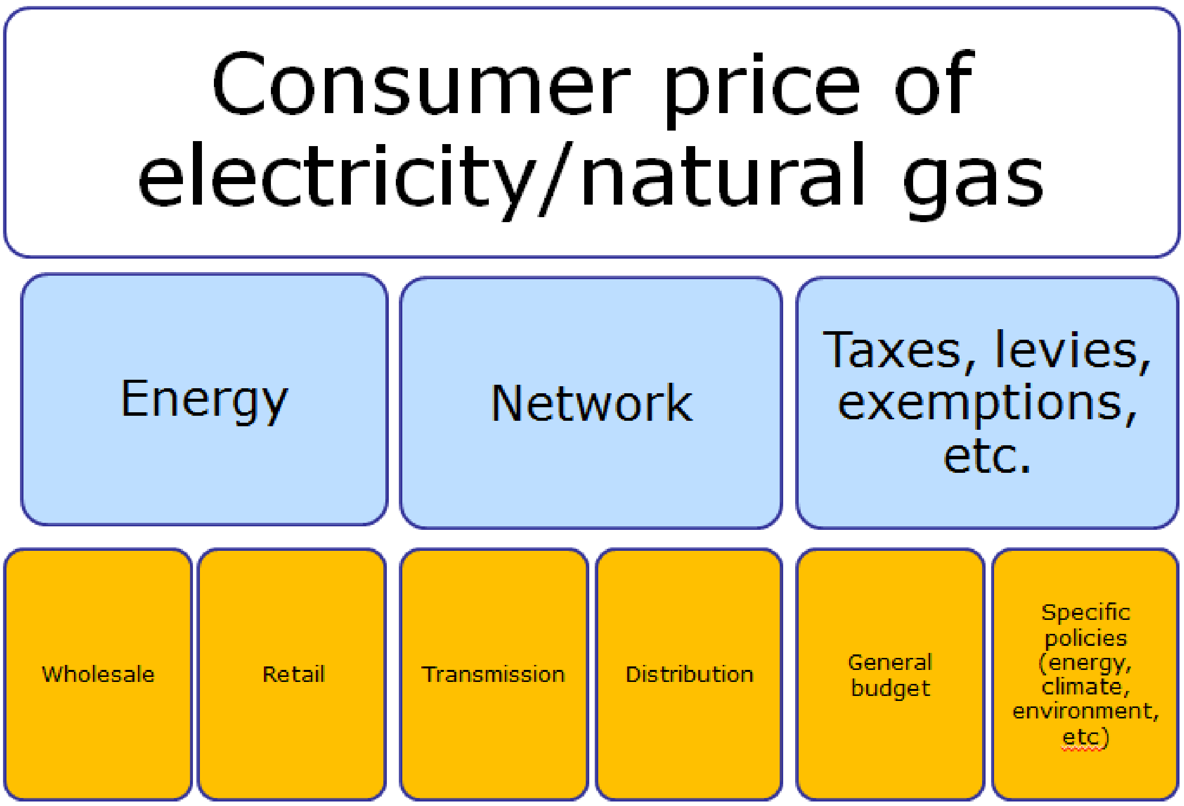
Key global energy commodity prices have increased in recent years, including oil and coal. However in the global markets for oil and coal, prices move in step and energy consumers across the globe pay broadly the same price. So price differentials - that can raise costs to consumers and generate competitive advantages or disadvantages – are not a concern. That is why these two fuels and the transport sector are not covered extensively in the report.

However in gas and electricity markets, despite a degree of global tradability of fuels and equipment (such as wind turbines), there are at best regional prices, and more often national or sub national prices, which change retail costs and prices for consumers and can generate inefficiencies or competitive disadvantages in what should be the single market.

The figure below presents a diagram of the basic elements of the final electricity and natural gas bills. All components and subcomponents listed below contain many elements that cover costs incurred by economic agents along the value chain on the one hand and financial charges and exemptions imposed upon taxpayers by the legislative authority of Member States on the other.

To a certain extent, the electricity and natural gas sectors operate under comparable industrial structures as both are fairly capital intensive, deliver energy products which are often used as inputs by other businesses, and rely upon a complex grid structure to ship the product from generators / extractors to final consumers (thus both are referred to as "network industries"). The similar industrial features explain to a large extent the similarity of the first and second tier elements of the end consumer bill. Yet, looking into more detail, differences start to emerge.

Figure 1. Schematic break-down of an end consumer bill for electricity and natural gas



The wholesale element covers the costs incurred by companies to deliver the energy product on the grid.

In the case of natural gas, it covers the costs of production and processing of domestic hydrocarbon resources or the costs of acquisition of imported gas which contain those elements plus costs related to shipping to a delivery point on the high pressure system.

In the case of electricity this element covers direct costs related to the construction, operation and decommissioning of electricity generating units which can further be broken down to capital expenditures, (CAPEX) - which includes for instance overnight costs[2], capital costs, liability insurance and decommissioning - and operating expenses, (OPEX) which includes for instance costs of operation, maintenance, refurbishment, fuel and carbon as well as costs related to the operation of wholesale trading activities.

A robust competitive market, as foreseen by the IEM legislative packages[3], ensures that the optimal available mix of assets and suppliers is used to deliver the energy needed by end consumers in the most cost efficient manner.

The retail element covers costs related to the sale of energy products to final consumers, including (but not limited to) portfolio management (size and structure of client base), personnel, IT, overheads, insurance for imbalance, etc.

The transmission and distribution elements can be similarly broken down into CAPEX- and OPEX- related components which include infrastructure costs (maintenance and grid expansion), system services (costs by use or by availability), network losses and other charges such as (but not limited to) stranded costs, public service obligations, policy support to certain technologies, etc.

Finally, the elements related to taxation policy can be grouped along several criteria to two or more sub-categories.

From the perspective of the taxpayer, the tax-related elements can be broken down into recoverable, partially recoverable and non-recoverable parts. Recoverable taxes or levies include full or partial recovery of taxes paid on purchases, either as a payment or as an offset against taxes owed to the tax authorities. VAT is an example of a recoverable tax but there may be more such taxes and levies which may be imposed on different administrative levels (local authorities, regions, states, federal authorities etc.). Partially recoverable taxes include a combination of taxable and exempted levels of consumption. In the case of non-recoverable taxes or levies, the full amount of collected proceeds is transferred to the tax authorities. This distinction is important when it comes to retail prices for different types of final consumers of electricity and natural gas. For example, the tax-related elements for households would most often be non-recoverable whereas at least some part of the taxes and levies companies that are paid by companies would be recoverable and companies may further benefit for some special exemption regime.

When it comes to the destination of the proceeds collected, the third part of the consumer bill can be broken down by taxes, which are unrequited payments to finance the general public budget, and charges/levies, which are ear-marked to different energy or other policy measures.

---

[2] Overnight cost is the cost of a construction project if no interest was incurred during construction, as if the project was completed "overnight". It is the value of the investment project to be paid upfront as a lump sum that would cover the construction costs (including pre-construction costs and Engineering, Procurement and Construction (EPC) costs) and any additional contingency costs.

[3] Communication from the Commission on delivering the internal electricity market and making the most of public intervention http://ec.europa.eu/energy/gas_electricity/doc/com_2013_public_intervention_en.pdf

Different taxes, levies, non-tax levies, fees and fiscal charges include value added tax (VAT), concession fees, environmental taxes or levies, other taxes or levies linked with the energy sector (such as public service obligations/charges, levies to financing energy regulatory authorities, etc.), other taxes or levies not linked with the energy sector (national, local or regional fiscal taxes on energy consumed, taxes on gas distribution, etc.). As specified in Directive 2008/92/EC, taxes on income, property-related taxes, oil for motor cars, road taxes, taxes on licences for telecom, radio, advertising, fees for licences, taxes on waste, etc. are excluded from the taxation element and included in energy and supply because they are part of the operators' costs and apply also to other industries or activities.

It should also be noted that the break-down in Figure 1 is schematic and that in reality policy support measures may appear in different parts of the electricity or natural gas bill, including the energy, network and taxation parts. One example of such measure that will be looked at in greater detail is the policy support measures that were put in place by Member States to reach the 2020 targets on climate change and energy sustainability.

Methodological issues

Most of the analysis of Chapter 1 concentrates on the evolution of the different components of the end consumer bill from a **top-down perspective**, based on harmonized collection methodologies over broad segments of the economy which were identified by the level of energy consumption rather than by industrial sectors or specific groups of household consumers.

Special attention is given to prices for household consumer bands DC (electricity) and D2 (natural gas) as these are the median bands with the highest number of electricity and gas consumers in the majority of Member States[4]. For the industrial sector[5], the focus is on the medium price data for bands IC and I3 as those groups typically represent medium size enterprises. As such, DC and IC (electricity) and D2 and I3 (natural gas) are the most representative consumer bands.

The prices reported in this and following Chapters cover the period from 2008 to 2012 as these are the first (and respectively the last) full year with complete retail price data for all MS and under the new Eurostat methodology at the time of drafting.

The top-down price developments inform mostly on general developments. The specific, on-the-ground conditions can be quite different from these developments, especially for the energy intensive industries. For example, companies can operate under special regimes, pay or be exempted from extra taxes or levies (ETS), be subject to a special state aid regime etc.

The current legal basis for data collection on retail prices for electricity and natural gas does not allow for a detailed breakdown of costs related to energy, network and taxation[6]. In addition, there is no harmonised methodology specifying under which category – energy, network or taxation - Member States should attribute costs related to specific public policies.

[4] The limiting values for the consumer bands are as follows:
Electricity households DC 2 500 kWh < Consumption < 5 000 kWh. Electricity industrial IC 500 MWh < Consumption < 2 000 MWh. Natural gas households D2 20 GJ < Consumption < 200 GJ equivalent to 5.56 MWh < Consumption < 55.56 MWh. Natural gas industrial I3 10 000 GJ < Consumption < 100 000 GJ equivalent to 2.78 GWh < Consumption < 27.78 GWh

[5] Industrial prices reported in line with Directive 2008/92/EC on industrial electricity and gas price data collection may include other non-residential user. In the case of gas all industrial uses are considered. However, the system excludes consumers who use gas for electricity generation in power plants or in CHP plants, in non-energy uses (e.g. in the chemical industry), above 4,000,000 GJ/y.

[6] For example Directive 2008/92/EC. paragraph (m) of Annex I and II specifies that taxes, levies, non-tax levies, fees and any other fiscal charges not identified in the invoices provided to industrial end-users go under the reported figures for the price level 'Prices excluding taxes and levies'.

The main purpose of a bottom-up assessment of the evolution and composition of energy prices and costs at the level of individual industry sectors and plant level is to complement the information already available at a macro level with a fundamental bottom-up perspective on the operating conditions that industry stakeholders need to deal with. **Section 1.1.2** and **section 1.2.2** provide price assessments for electricity and natural gas prices for a select group of European industries based on a methodology which is described in Annex 2.

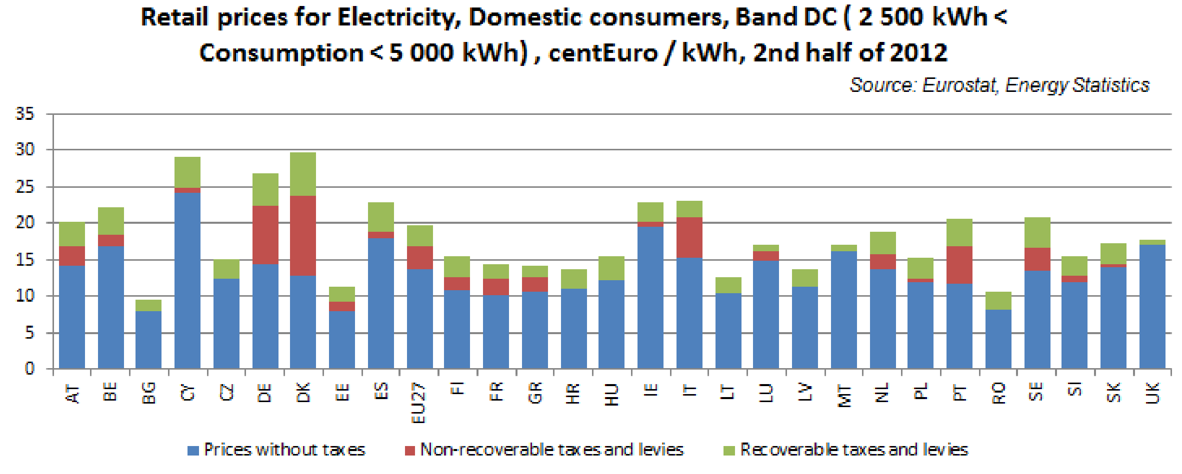
Retail price trends

Figure 2 presents electricity and natural gas prices for the median household consumer bands expressed in Euro per kWh of energy. The remaining sections of this chapter provide a detailed analysis of the various components of retail prices. Figure 2 illustrates the variation of price conditions across Member States ("price dispersion").

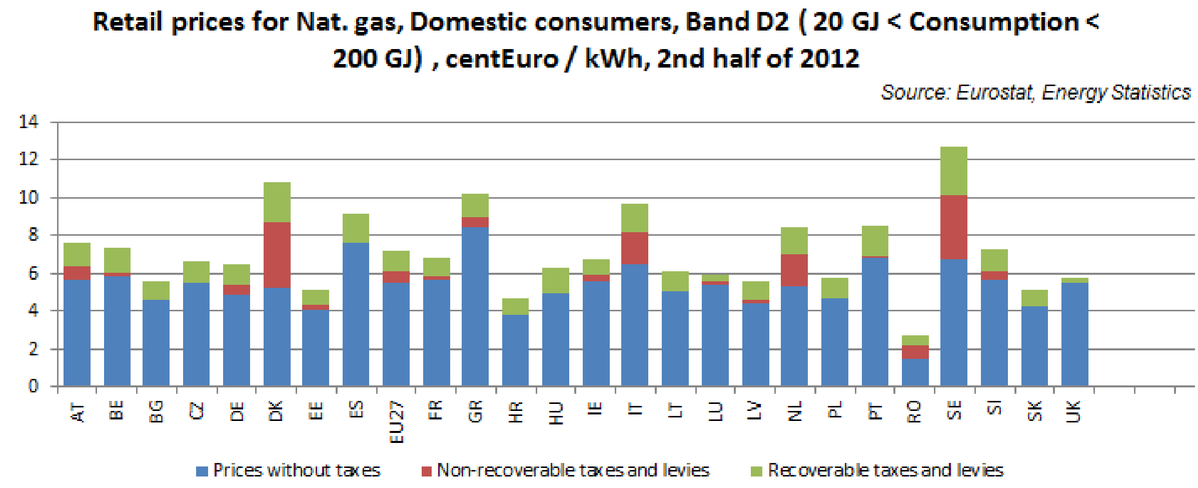
A similar pattern seems to apply: **the ratio of highest to lowest price in the Member States is in the range of 4 – 2.5 to 1.** Similar ratios are observed for all energy products (electricity or gas); consumer types (domestic or industrial), consumer bands (modest, median or big consumers), monetary units (Euro, national currency or purchasing power standards[7]) and periods (2008 - 2012)**.**

Despite efforts towards the creation a single EU market for energy, **retail price conditions remain persistently different** across borders. This development contrasts sharply with what is observed in the **wholesale markets for electricity and natural gas where the major benchmarks are broadly aligned**. A combination of factors could explain why the introduction of market mechanisms has proved to be more difficult in the retail segment. These are further discussed in Sections 1.1.1.1 and 1.2.1.1.

Figure 2. Retail prices for electricity in EUR



[7] The purchasing power standard, abbreviated as PPS, is an artificial currency unit. Theoretically, one PPS can buy the same amount of goods and services in each country. However, price differences across borders mean that different amounts of national currency units are needed for the same goods and services depending on the country. See more at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Purchasing_power_standard_(PPS). Purchasing power parities, abbreviated as PPPs, are indicators of price level differences across countries ,see more at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Purchasing_power_parities_(PPPs)



To indicate the degree of divergence of the prices of electricity and natural gas in the EU, Table 1 provides dispersion metrics of price levels for a variety of markets and illustrates that price dispersion remains high in electricity and natural gas.

In 2012 the dispersion - measured as standard deviation divided by mean - was about 0.30 in the case of retail price of electricity and gas (including taxes in the case of households and excluding VAT and recoverable taxes in the case of industry), while it was below 0.1 in the case of motor fuels (including taxes). The variation coefficient for total labour costs stood much higher, at around 0.6.

While the levels of price variation on the EU retail electricity and natural gas market appear to be on par with what is observed in the market of mobile telephony, these same levels seem almost insignificant when compared to the variation in labour costs across the EU: the ratio of highest to lowest average salary in the EU is more than 3 times larger than what can be observed for electricity or natural gas prices for final consumers. In that sense, the variation of labour-related costs may appear as more important driver impacting competitiveness and investment decisions than energy-related costs; at least for industries that are relatively less energy intensive.

Another report from the Commission[8] finds that price dispersion increases when taxes are included, which confirms the contribution of taxes to the heterogeneity of energy prices. Interestingly, price dispersion is not observed on electricity wholesale markets where spot price has progressively converged over the past years. In well-functioning energy markets, retail prices would be expected to mirror the process of convergence observed upstream (wholesale). Obviously, the relative higher dispersion of retail prices has to do with other factors than wholesale market fragmentation.

Yet, the dispersion of electricity and gas retail prices for households and industry within the EU appears about 3 times larger than in the case of retail prices of motor fuels (gasoline had a variation coefficient of 0.12 in 2008 and 0.10 in 2012, while coefficient for diesel has been stable across the period at 0.09). The market for motor fuels provides a good benchmark for the gas and electricity markets: it is a mature energy product market where the taxation element has a relatively big share of the final price. Still price conditions are in general quite similar across borders, consumers can choose from several competitive offers and price levels (which are not regulated) react relatively quickly to signals from the wholesale market.

[8] European Commission, DG ECFIN, Market functioning in network industries, Occasional Paper 129, February 2013.

Table 1. Dispersion metrics, all taxes included

Market	Year	Max/Min	Variation coefficient[9]
Electricity, households	**2008**	3.38	0.30
	2012	3.11	0.28
Electricity, industrial consumers	**2008**	3.15	0.29
	2012	3.85	0.32
Natural gas, households	**2008**	3.67	0.30
	2012	4.62	0.29
Natural gas, industrial consumers	**2008**	2.60	0.26
	2012	3.02	0.26
Gasoline	**2008**	1.58	0.12
	2012	1.43	0.10
Diesel	**2008**	1.52	0.09
	2012	1.41	0.09
Mobile communications[10]	**2008**		0.21
	2010		0.30
Labour market, Industry, consumption, service	**2008**	14.54	0.54
	2012s	13.42	0.56

Source: European Commission (Eurostat, DG ENER, DG ECFIN)

A Commission consumer market study on the functioning of the vehicle fuels market[11] confirms that major components of the final consumer prices are due to fuel taxes and VAT rates, which differ among Member States. Differences in pre-tax prices are much less than those of post-tax prices, which shows that national tax policies explain much of the observed differences in prices experienced by consumers. This is true for both average gasoline and diesel prices. The highest price components are generally found in EU15 Member States, with absolute highest levels for petrol seen in the Netherlands, Italy, the UK, Greece and Sweden and for diesel prices in the UK, Italy, Sweden and Ireland in 2012.

1.1. Developments in the retail markets for electricity

Retail electricity prices expressed in Euros

Looking at the period between 2008 and 2012, nearly every EU Member State has seen an increase in household electricity prices. **On average, the EU household electricity prices increased by more than 4% a year between 2008 and 2012**[12]. Whilst Romanian electricity prices have actually declined since 2008, others have experienced average annual increases of 9-10% (Latvia, Spain, Cyprus).

In the same period **industrial electricity prices (excluding VAT and recoverable taxes) have gone up by about 3.5% per year**. In some countries retail industrial prices have actually decreased over the period in question (Czech republic, Denmark, Croatia, Hungary,

[9] The variation coefficient is a normalized measure of dispersion. It is defined as the ratio of the standard deviation to the mean. The higher the ratio, the more dispersed the data.

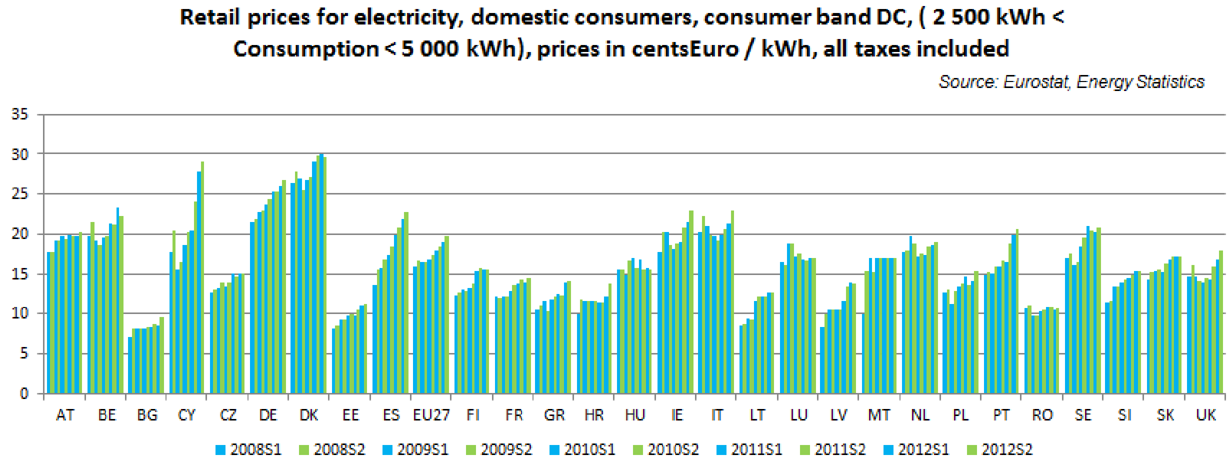
[10] The dispersion reported for 2010 refers to the average revenue per minute of mobile communications, whose definition is slightly modified with respect to the former: nevertheless, its commonality among Member States should not justify significant changes in the dispersion thereof. More information available in Annex 1 of the report mentioned in the footnote above.

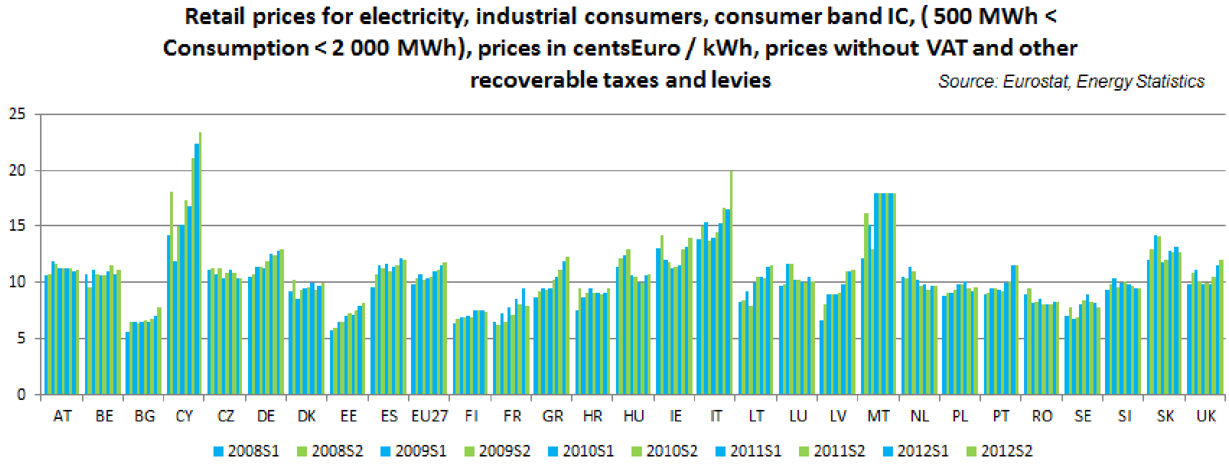
[11] To be published by DG Health and Consumers during the first semester of 2014

[12] Median household consumer band with annual consumption between 2 500 and 5 000 kWh per year. Prices measured in cents EUR / kWh.

Ireland, the Netherlands, Romania, Slovenia and Slovakia), while industrial users in countries such as Estonia, Lithuania and Latvia have experienced annual growth of more than 8%.

Figure 3. Evolution of retail prices, electricity, domestic and industrial consumers, centsEuro / kWh



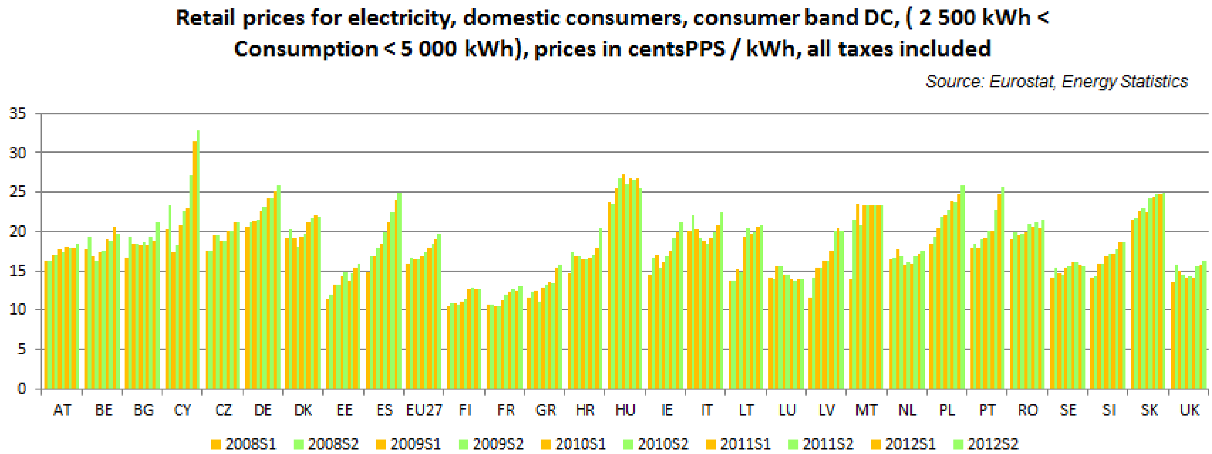


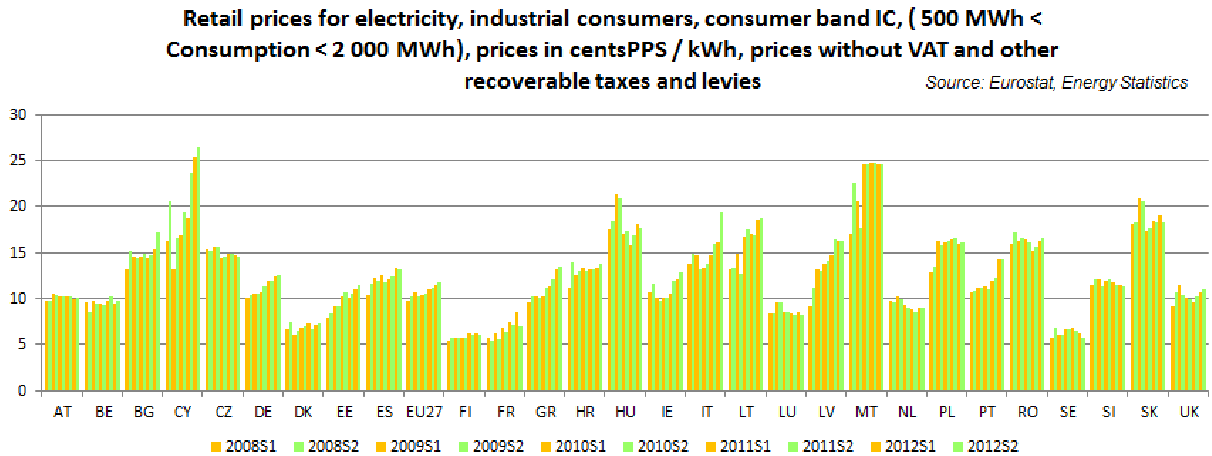
Retail electricity prices expressed in purchasing power standards

Taking into account purchasing power effects does not change the picture above in terms of **price trends** but **it does change substantially the relative position of the Member State**. The most pronounced increases are those observed in new Member States. As a group these countries register price increases in terms of PPS, indicating that the median household and industrial consumers from new Member States spend a relatively larger portion of their budgets to the purchase of the same amount of electrical energy.

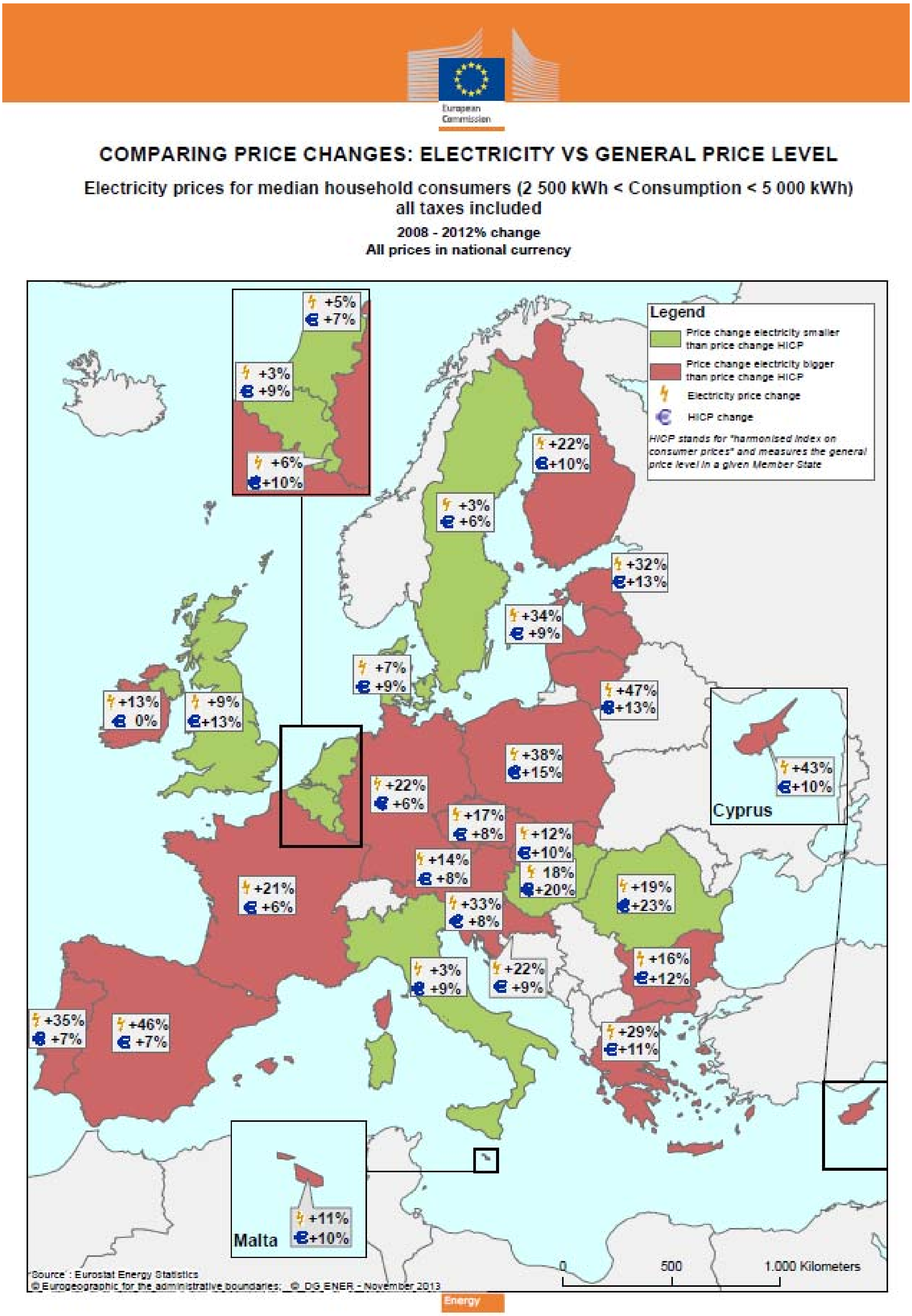
Taking into account the relatively higher levels of energy intensity of new Member States suggests that those economies might be more vulnerable to price risks related to the different components of the electricity and natural gas bill.

Figure 4. Evolution of retail prices, electricity, domestic and industrial consumers, cents PPS / kWh

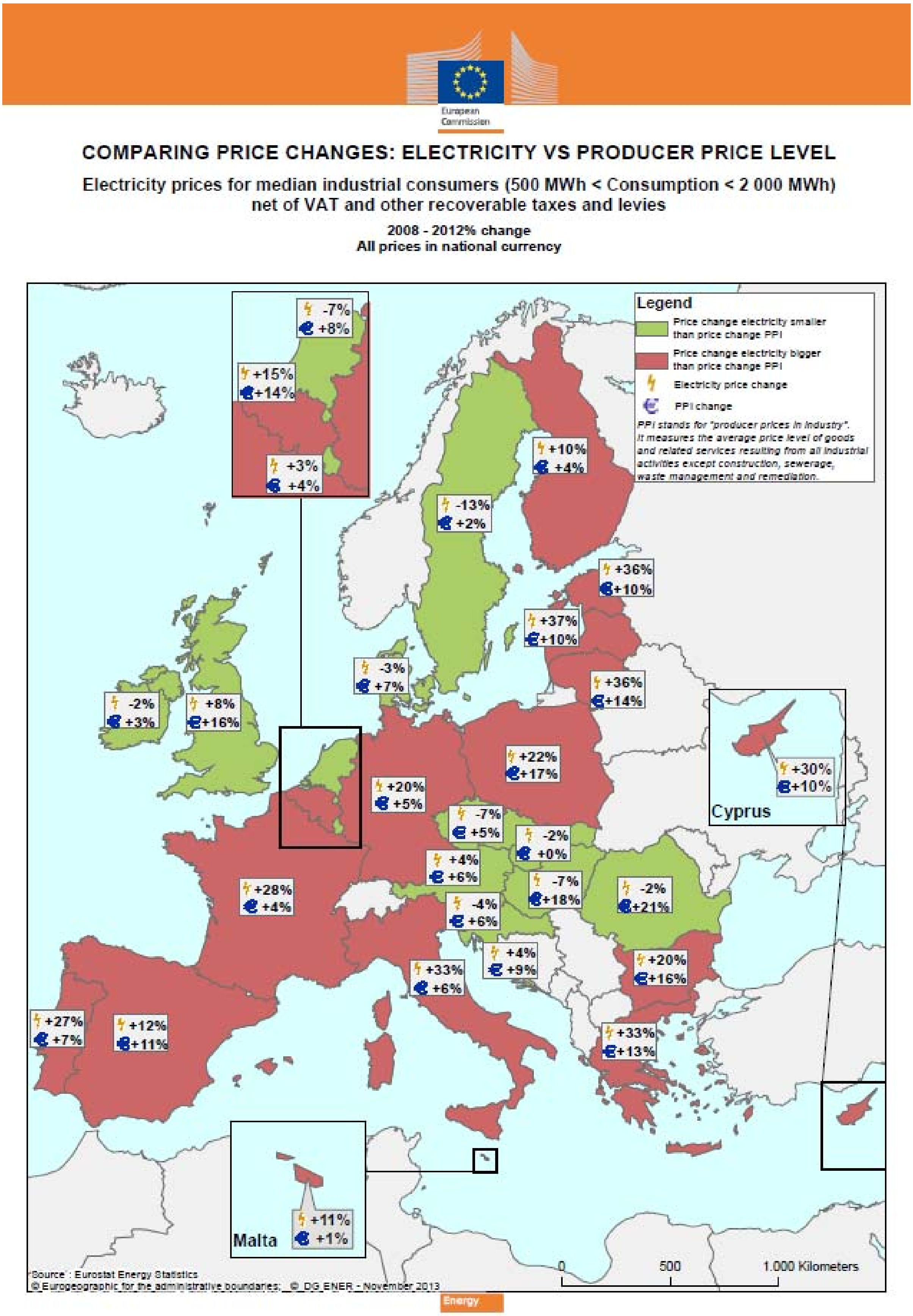




Map 1 Household electricity prices vs. inflation (HICP)



Map 2. Industrial electricity prices vs. inflation (PPI)



Comparing electricity price changes to inflation levels

The maps compare the increase in electricity prices against the increase of the general price level in each Member State.

As indicated by **Map 1**, in 19 out of 28 Member States the median household consumer bands experienced a price increase in electricity which was higher than the increase in the general price level[13] as measured by the harmonized index of consumer prices (HICP). Belgium, Denmark, Italy, Luxembourg, Hungary, the Netherlands, Romania, Sweden and the UK were the exceptions to that rule.

The combination of actual changes in electricity and general price levels between 2008 and 2012 was unique for each Member State and the map colours illustrate only the relative position of those changes. In Estonia, Spain, Cyprus, Latvia, Lithuania and Portugal electricity prices, inclusive of all taxes, increased by more than 30% between 2008 and 2012. For the same period, inflation increased by 10% or more in Bulgaria, Estonia, Greece, Cyprus, Lithuania, Luxembourg, Hungary, Malta, Poland, Romania, Slovakia, Finland and the UK.

Turning to industrial consumers and comparing the price rise in electricity (excluding VAT and other recoverable taxes and levies) and the general industrial price level, as measured by the Producer Price Index (**Map 2**), Member States were split by half. As a rule, electricity price changes were smaller than those for domestic consumers and in several countries (the Czech Republic, Denmark, Ireland, Hungary, the Netherlands, Romania, Slovenia, Slovakia and Sweden) electricity prices actually decreased.

Comparing electricity price changes to exchange rate variations

During the 2008 – 2012 period, the Romanian, Polish and Hungarian currencies depreciated by 21%, 19% and 15% respectively. Thus, while median retail prices for Romanian households were registering a modest decrease when measured in Euro cents per kWh (- 2.45%), those same prices increased by 20% when measured in Lei per kWh. Similar trends were observed for the other countries with notable currency depreciation.

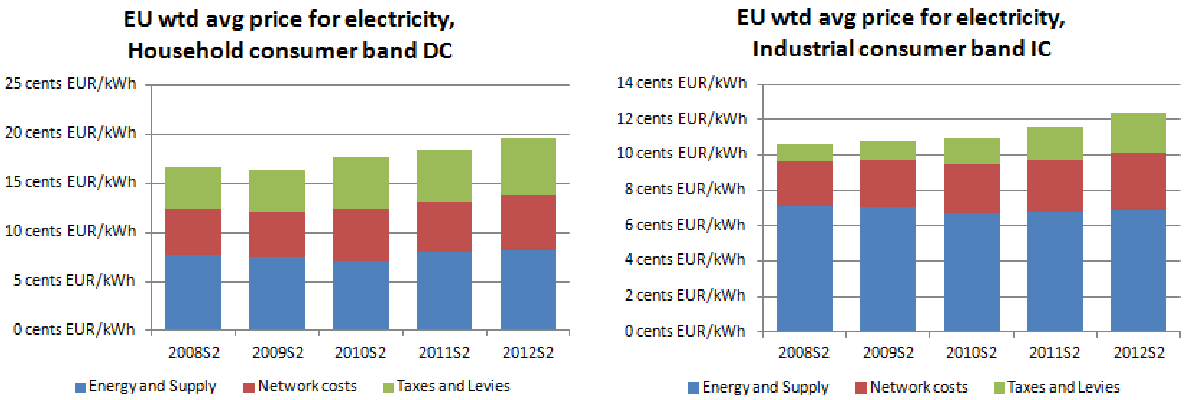
Sweden was the only Member State that witnessed the opposite evolution as the Krona appreciated by 10% in 4 years relative to the Euro. As a result, whereas electricity prices for domestic consumers registered moderate increases when measured in the national currency, more pronounced changes were recorded in Euros. In the case of median industrial consumers, a decrease in price measured in Kronor actually translated into an increase when converted into Euros.

[13] Second round effects in the interaction of retail electricity prices and inflation (the electricity price being a component of the HICP) are not discussed in this report.

1.1.1. Electricity retail price developments by components

Figure 5 illustrates the aggregate EU numbers weighted by electricity consumption respectively for households and industrial users.

Figure 5. Evolution of EU28 electricity retail price by components: levels, selected household and industrial bands



Source: Eurostat Energy Statistics

Note: Prices include all taxes in the case of households. Prices exclude VAT and other recoverable taxes in the case of industry, as well as industry exemptions (data not available).

Based on available data from the most recent 5-year period, the European retail prices (nominal) for electricity increased on average by 3 Euro cents per kWh. Whereas the energy component remained the most important element in the end consumer bill, its relative share registered significant decreases (more than 10 % for industrial consumers and about half as much for households). As the relative share of network costs remained relatively stable, representing about a third of the bill, it was the taxation component that filled the gap left by the supply of energy component.

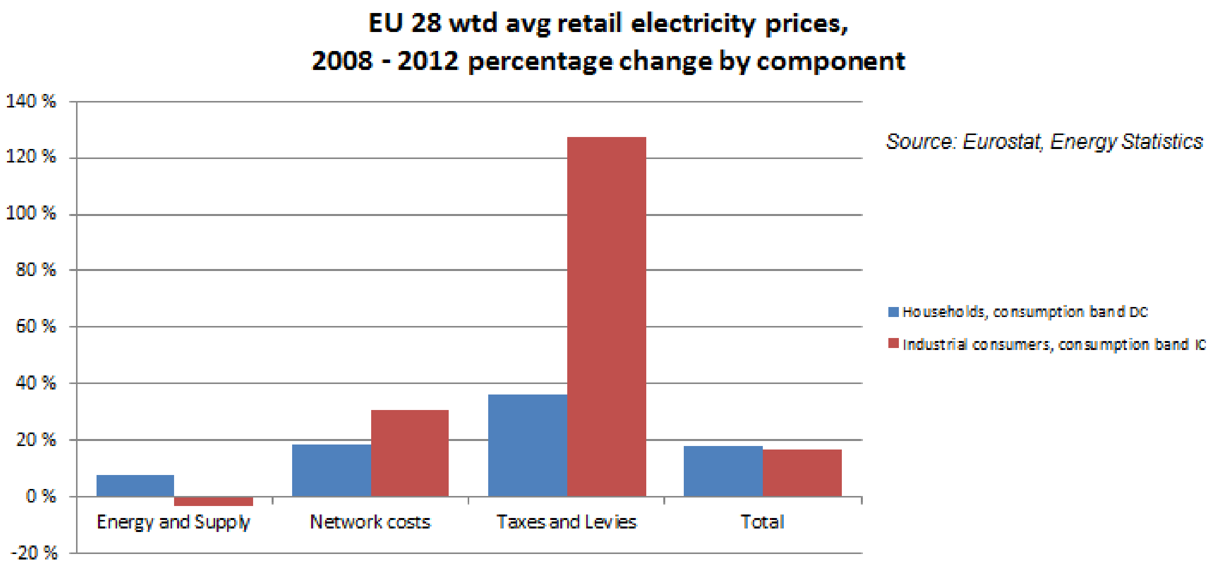
The next chart illustrates these evolutions. Taxes and levies went up by the most, especially for industry. In the case of the EU weighted average price it increased by 127%. The chart includes only non-recoverable taxes for industry (e.g. excluding VAT and other recoverable taxes) and exemptions are not reported. For the large majority of Member States the share of taxes and levies is still below 10% of ex-VAT prices, even though for Germany, Italy and Austria it exceeds 20%[14]

In the case of households, the taxes and levies component of the EU weighted average price went up by 36.5% and its share accounts on average for 30% of the final price (up from 26% in 2008).

Network costs went up by 30% for industrial consumers and by 18.5% for households. While this increase is smaller than in the case of taxes and levies, network charges constitute a much more important element of final prices, reaching 50% in the case of households (CZ) and 56% in the case of industrial consumers (LT).

[14] These countries may give exemptions that are not uniform and hence report certain levies as non-recoverable, whereas they are indeed recoverable for certain categories of consumers.

Figure 6. Evolution of EU28 electricity retail price by components: percentage change, selected household and industrial bands



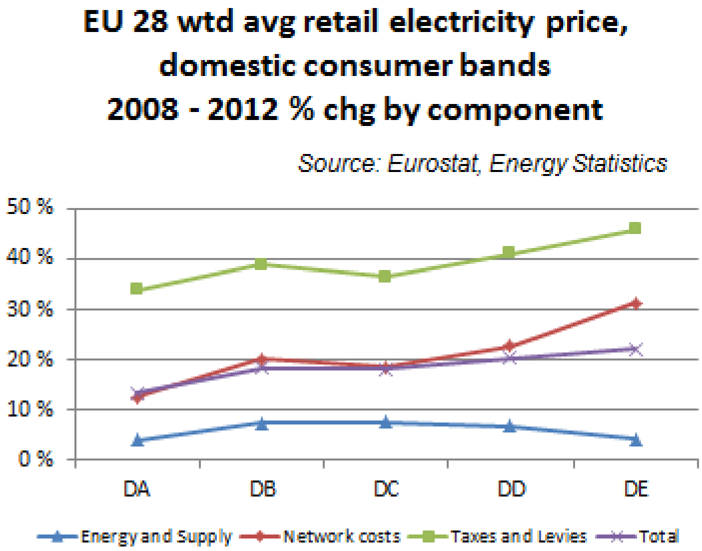
Note: Prices include all taxes in the case of households. Prices exclude VAT and other recoverable taxes in the case of industry, as well as industry exemptions (data not available).

The energy element went up only slightly in the case of households and indeed went down in the case of industrial consumers.

With these general findings it is important to point out that part of the increase in the taxes and levies includes financing for energy supply costs and that "network" costs can include other charging elements (e.g. for RES or other financing needs). Member State reporting is inconsistent in this regard and needs to be improved.

The next two charts illustrate that the developments observed for the median consumers were quite representative for the remaining consumer bands as well. As a rule, the taxation element registered the highest increases across all bands, followed by increases in the network components of half that magnitude, whereas the costs related to the supply of energy remained stable.

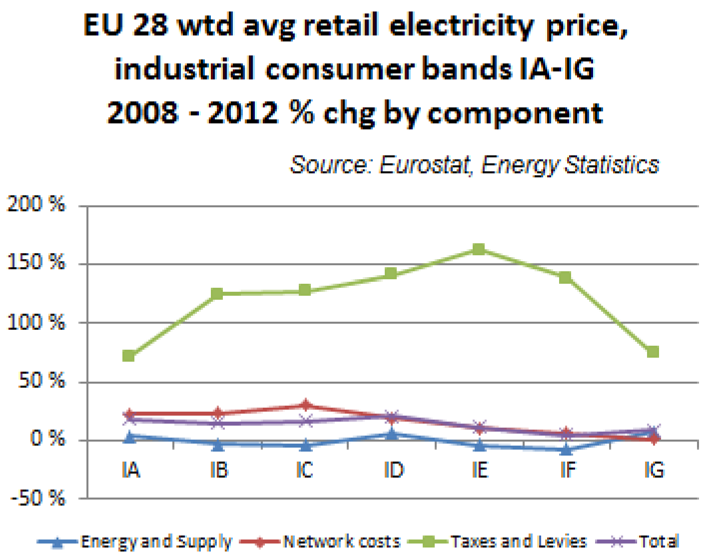
Figure 7. Evolution of EU 28 electricity retail price by components, all household consumer bands



DA	Consumption < 1 000 kWh
DB	1 000 kWh < Consumption < 2 500 kWh
DC	2 500 kWh < Consumption < 5 000 kWh
DD	5 000 kWh < Consumption < 15 000 kWh
DE	Consumption > 15 000 kWh

The increase in the non-recoverable taxation element was significantly higher for industrial consumers. The network and energy elements were stable, even slightly negative for the larger consumer bands. As the relative share of non-recoverable taxes currently represents a small portion of the final bill, network costs were among the most likely price drivers.

Figure 8. Evolution of EU 28 electricity retail price by components, all industrial consumer bands

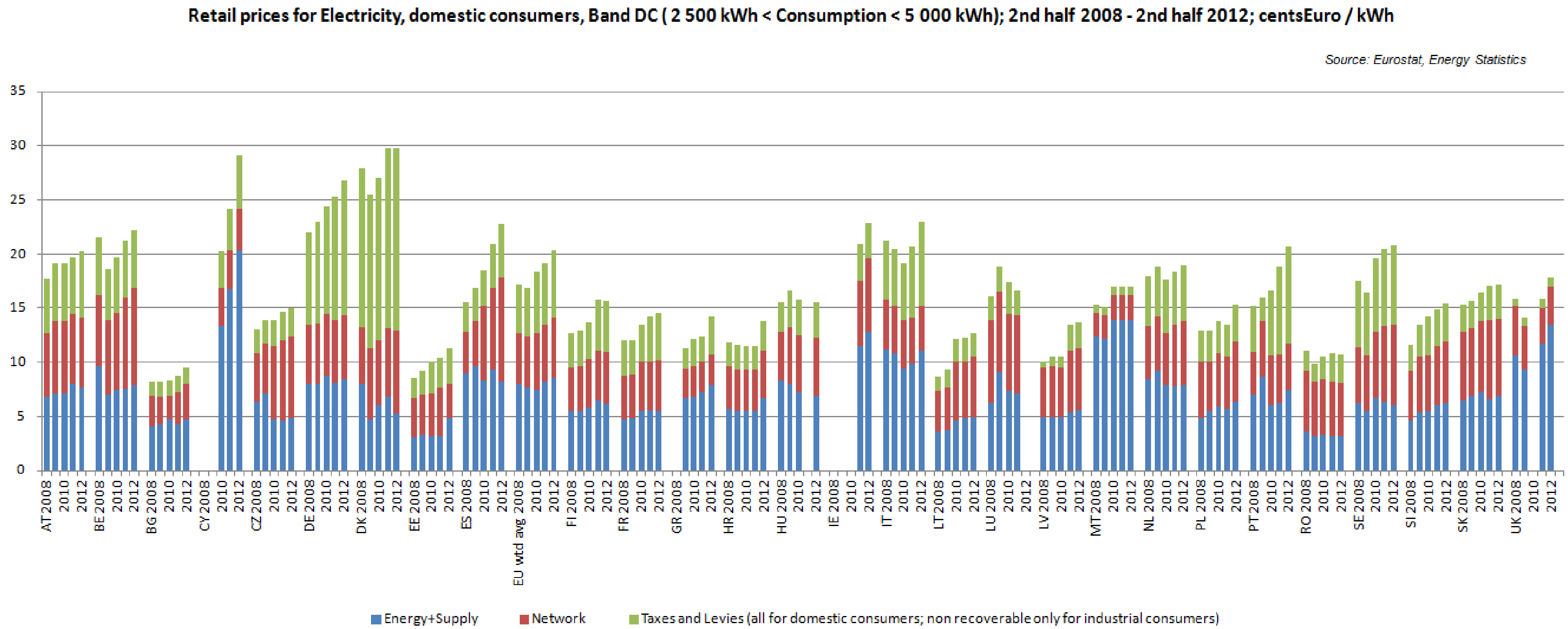


DA	Consumption < 1 000 kWh
DB	1 000 kWh < Consumption < 2 500 kWh
DC	2 500 kWh < Consumption < 5 000 kWh
DD	5 000 kWh < Consumption < 15 000 kWh
DE	Consumption > 15 000 kWh
IA	Consumption < 20 MWh
IB	20 MWh < Consumption < 500 MWh
IC	500 MWh < Consumption < 2 000 MWh
ID	2 000 MWh < Consumption < 20 000 MWh
IE	20 000 MWh < Consumption < 70 000 MWh
IF	70 000 MWh < Consumption < 150 000 MWh
IG	Consumption > 150 000 MWh

Components at national level

The weighted average EU numbers conceal a great deal of variety between Member States. The chart on the next pages illustrates the evolution of the energy, supply, network and taxation components for each Member State and for the median household consumer band in 2008 – 2012.

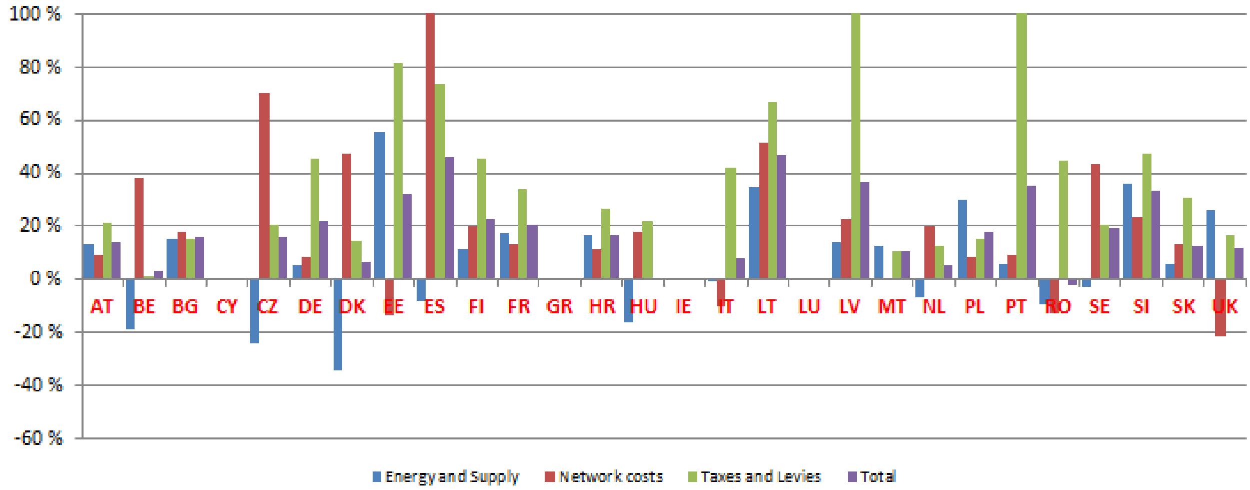
Figure 9. 2008-2012 evolution of the retail price of electricity, median households by component



Note: Prices include all taxes.

The percentage change of the level of the energy component of **household electricity prices** varied in a range of -34% in Denmark and +55% in Estonia over the period 2008-2012. During the same period the network costs of households decreased in the UK (-21%) and more than doubled in Spain (+152%[15]). The largest growth in taxes and levies on electricity prices for households was in Portugal, where the component level went up by more than 100%[16] and in Latvia where it increased by almost 400%[17].

Figure 10. Retail electricity prices, Household consumer band DC; 2008 – 2012 percentage change by component

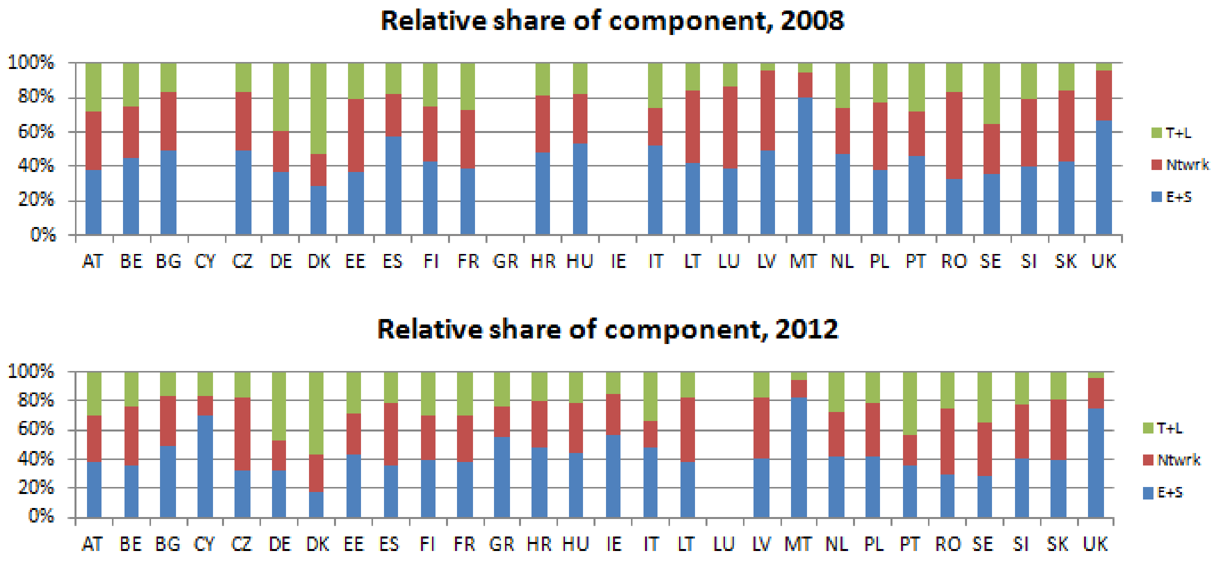


Source: Eurostat, energy statistics

In 2008 taxes and levies represented on average 26% of the bill, being as low as 5% for Malta, the UK and Lithuania and accounting for more than half of the bill in Denmark (52%). In 2012 the relative share of taxes reached 30% on average, ranging from 5% in the UK, to close to 30% in Austria, Estonia, Finland, France, Italy and Sweden and reaching 43%, 46% and 56 % respectively in Portugal, Germany and Denmark. The share of taxes decreased marginally in Belgium, Bulgaria, Malta in Poland while it grew by more than 10% in Latvia and Portugal.

[15] The Spanish data apparently includes significant other charges together with network costs
[16] A combination of an increase in VAT rate, concession fees, stranded costs and other taxes linked to the energy sector and a small decreases on RES and CHP levies and the compensation for isolated islands, according to the MS metadata (see footnote 62)..
[17] The RES tax doubled and the VAT rate increased more than 4 time, according to the MS metadata (see footnote 62).

Figure 11. Relative share of components, households

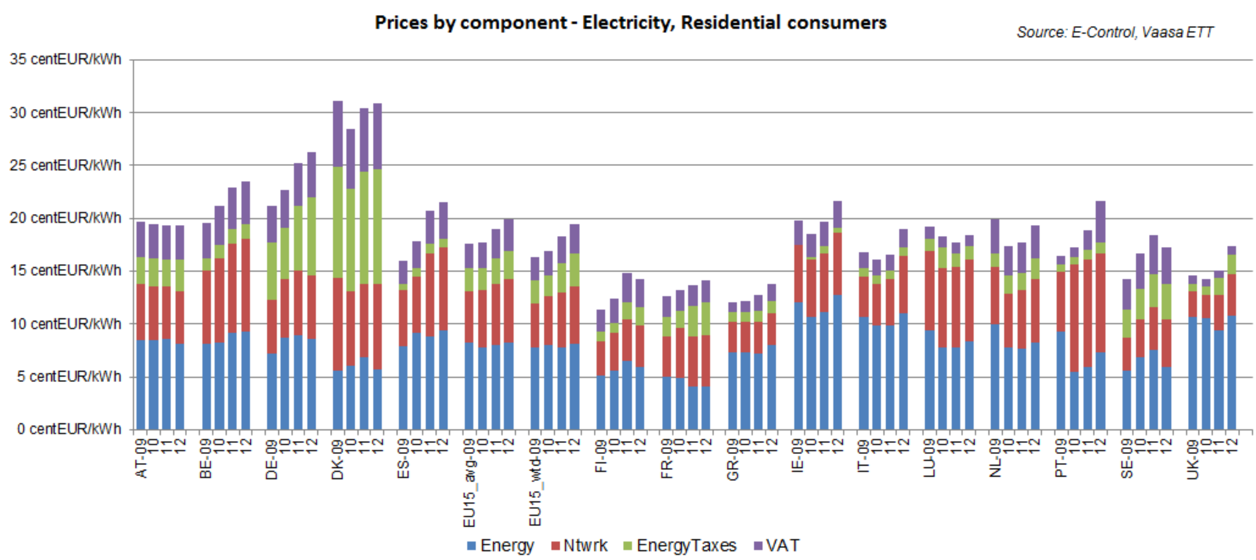


Source: Eurostat, energy statistics

Note: Prices include all taxes

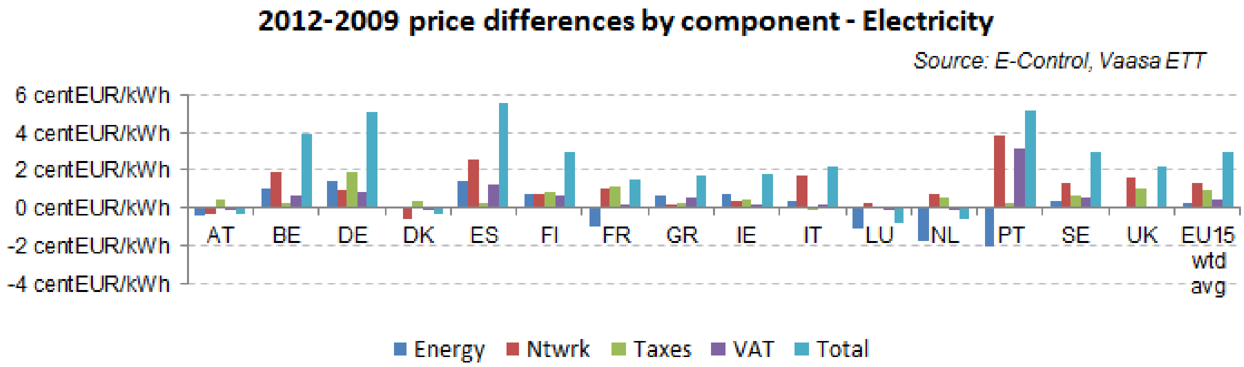
A further look into the different elements of the electricity bill of residential consumers is provided by the Household Energy Price Index (HEPI) from E-Control and VaasaETT[18]. Each month since January 2009, it has been reporting electricity prices paid by residential consumers in 15 capitals of the EU since 2009. It also provides an alternative breakdown of the taxation component into taxes related to energy policies and VAT and other recoverable taxation instruments.

Figure 12. EU15: electricity retail prices – residential consumers in capitals, 2009 – 2012 evolution



[18] http://www.energypriceindex.com/

Figure 13. EU15: electricity retail prices – residential consumers in capitals; 2009-2012 differences and percentage changes by component



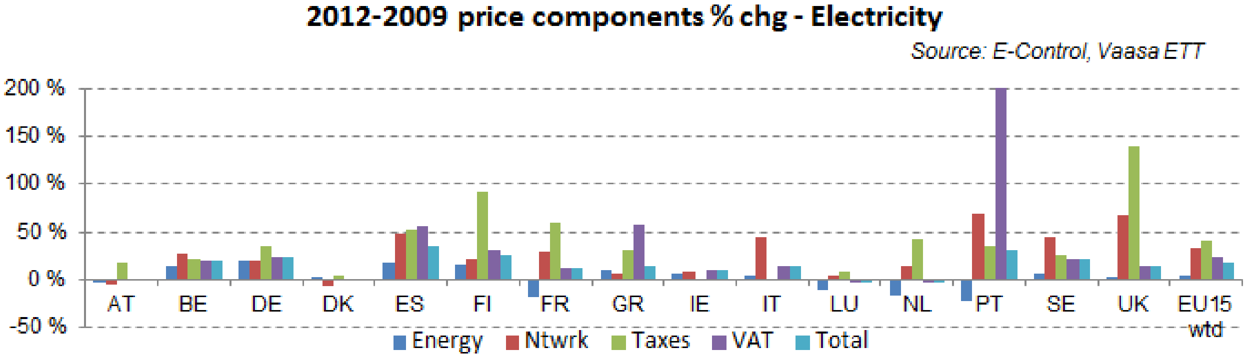
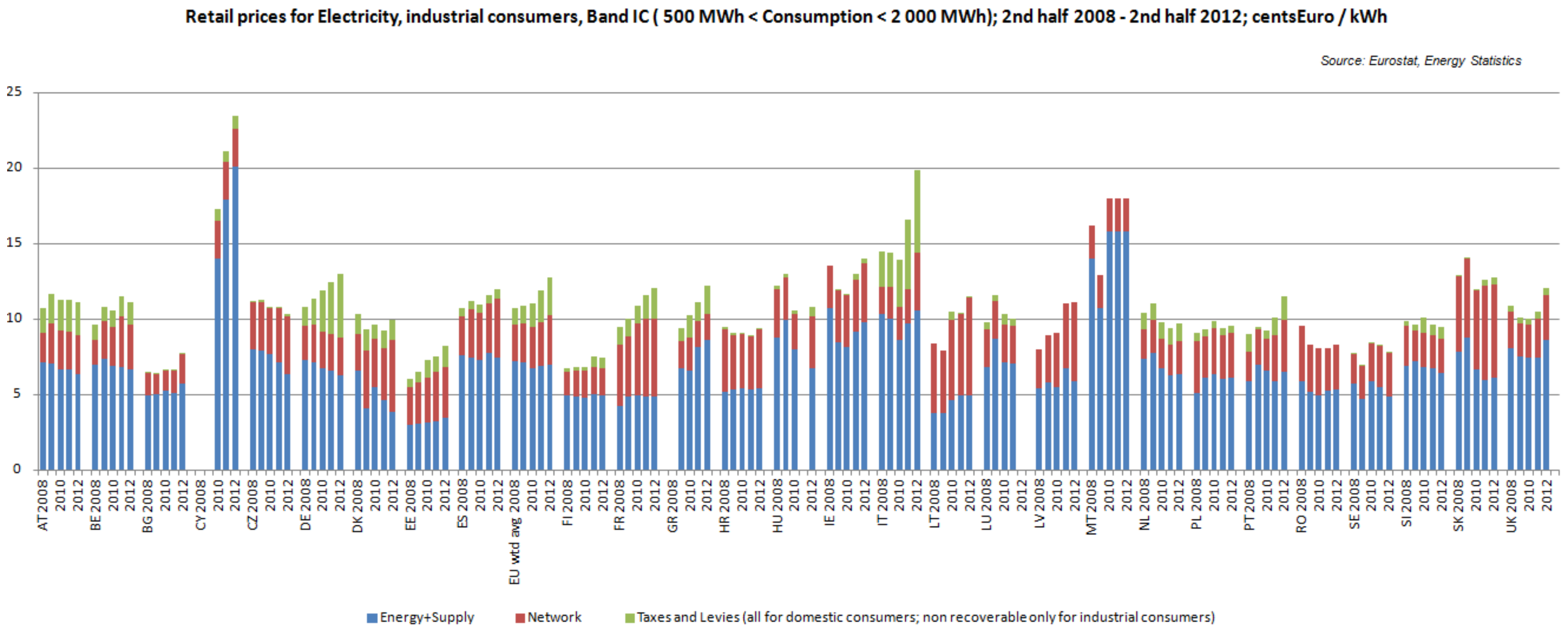


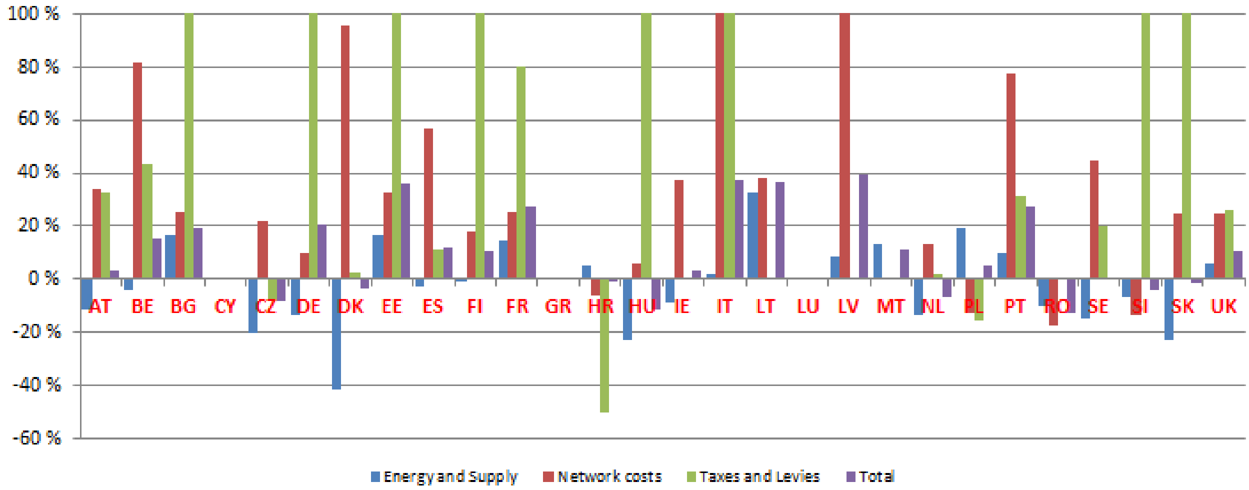
Figure 14. 2008-2012 evolution of the retail price of electricity, industrial consumers by component



Note: Prices exclude VAT and other recoverable taxes in the case of industry, as well as industry exemptions (data not available).

In the case of **industrial electricity prices**[19], between 2008 and 2012 the energy component went up by more than 30% in Lithuania, while it went down by 40% in Denmark. Network costs doubled in Latvia and Italy, but went down by 17% in Romania. Taxation increased many-fold in the following countries: Germany (RES levy and electricity tax), Estonia (RES tax and electricity excise tax), Finland (electricity excise tax), Hungary (increase in support for district heating, partly compensated by decreases in support for retirement schemes for electric industry employees and support for coal industry restructuring), Italy, Slovenia (contribution to provide security of supply by using domestic primary energy sources for electricity production, contribution to support the production of electricity in high efficiency cogeneration and from renewable resources, addition to fuel prices for the improvement of energy efficiency and an increase in excise tax) and Slovakia (increase of the excise tax and introduction of other taxes linked to the energy sector)[20]. The taxation component remains still a fairly minor part of industrial prices in most of these countries, except for Germany and Italy. More Member State specific information is available in **Annex 1**.

Figure 15. Retail electricity prices, Industrial consumer band IC; 2008 – 2012 percentage change by component



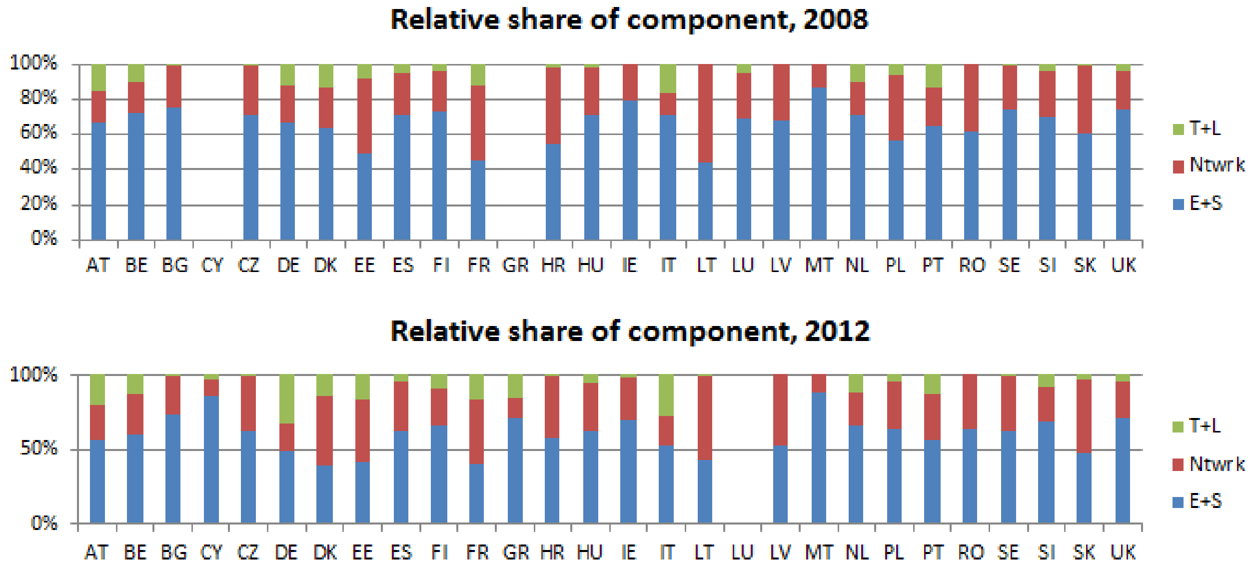
Source: Eurostat, energy statistics

Note: Prices exclude VAT and other recoverable taxes in the case of industry, as well as industry exemptions (data not available).

In 2008 taxes and levies represented on average 9% of the bill, being as low as 0.5% for Slovak consumers and reaching 16% in Italy. In 2012 taxes were counting still for less than 2% in Bulgaria, the Czech republic, Croatia, Lithuania and Sweden while they reached 32 in Germany; the average EU level reached 18%, well above the maximum level registered in 2008.

[19] The prices for the industrial consumer bands are net of VAT and other recoverable taxes and levies.
[20] Source: MS metadata (see footnote 62).

Figure 16. Relative share of components, industrial consumers



Source: Eurostat, energy statistics

Note: Prices exclude VAT and other recoverable taxes in the case of industry, as well as industry exemptions (data not available).

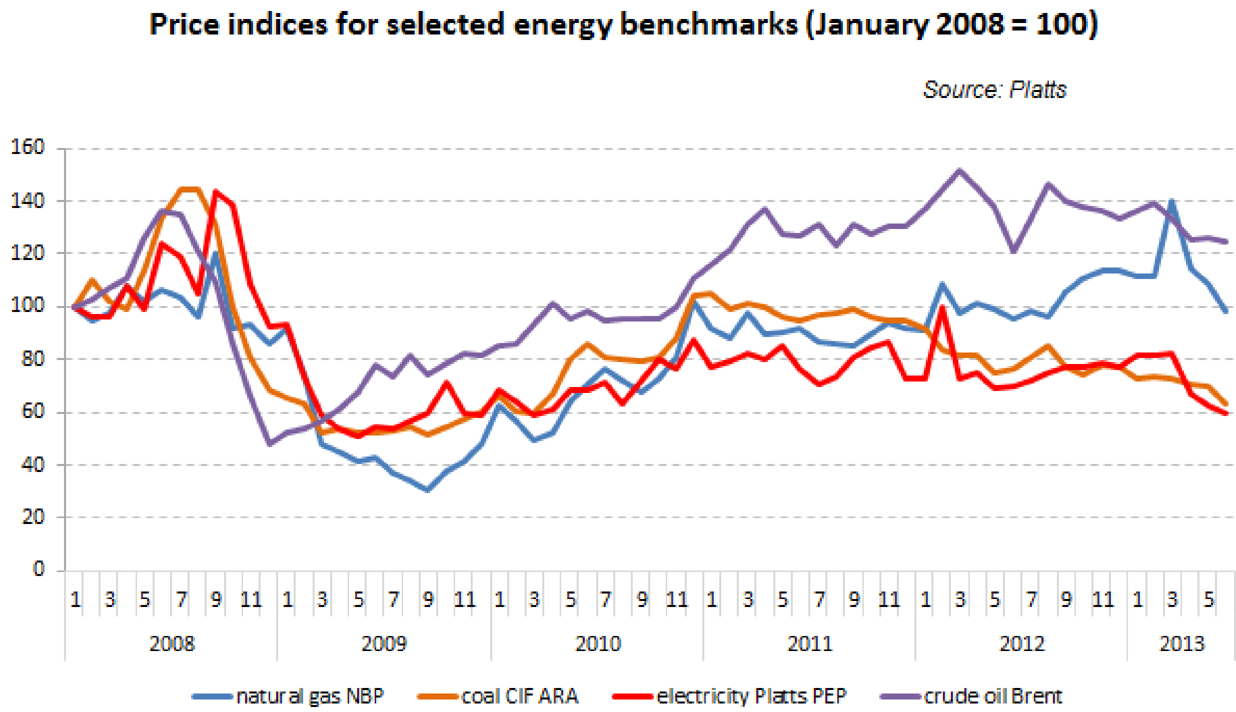
1.1.1.1. Costs related to energy and supply

In the case of **electricity prices paid by households**, in 2012 the energy component was between 3.2 Eurocent/kWh (Romania) and 20.4 Eurocent/kWh (Cyprus) and accounted for between 18% (Denmark) and 82% (Malta) of the household electricity price (see Figure 14 on p. 21). Median **industrial consumers** paid between 3.4 Eurocent/kWh (Estonia) and 20.1 Eurocent/kWh (Cyprus) for the energy component in 2012, its share in the final bill[21] ranging between 39% (Denmark) and 88% (Malta).

The wholesale market developments have influenced the energy – related component of the end consumer bill. As an asset class, energy commodities followed the market turmoil triggered by the financial crisis and the recession fears in most of the world's leading economies throughout the second half of 2008. Prices for crude oil, coal, natural gas and electricity experienced similar price corrections, as illustrated by Figure 17. Since then European electricity prices evolved within a range of EUR 40 / MWh – EUR 60 / MWh, representing 60%-70% of the price levels of January 2008. Fossil fuel prices were more volatile.

[21] Excluding VAT and other recoverable taxes

Figure 17. Evolution of European average wholesale electricity prices vis-à-vis coal and gas prices



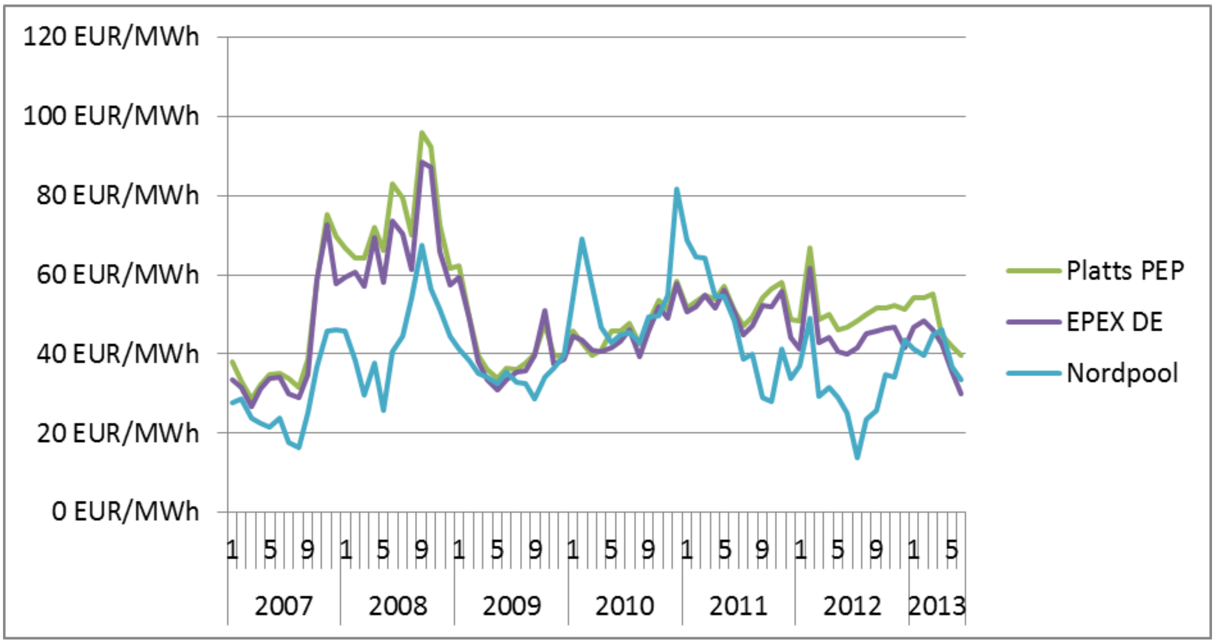
Notes: Platts PEP: Pan European Power Index (in €/MWh), Coal CIF ARA: Principal coal import price benchmark in North Western Europe (in €/Mt), Natural gas NBP: price for natural gas delivered at the national balancing point, a virtual trading location for sale and purchases of gas at the UK gas grid

The EU's main electricity markets have followed a similar trend, reflecting seasonal and regional specificities of the different price areas, as indicated in Figure 18 which illustrates the price evolution for the leading day-ahead indices[22]. In spite of some significant increases experienced over the period examined, subsequent decreases have resulted in wholesale electricity prices by the end of the period (June 2013) reaching levels close to those at the beginning of 2007 and well below peaks in 2008.

During the observed period (H2 2008 – H2 2012) **the prices of the major European wholesale electricity benchmarks decreased by 35 – 45 %** as markets remained well supplied. This is in clear contrast to the trend in retail prices.

[22] These indices are a proxy for the spot price; they are also used to build derivative products on the forward curve. Finally, they serve as a reference point for the over-the-counter trade (cleared and non-cleared).

Figure 18. Selected European benchmarks, wholesale electricity prices



Source: Platts

Prospex Research[23] estimates that the total electricity trading volumes in the mature EU markets, including exchanges and over-the-counter trades (OTC), stood at 8 500 TWh in 2012. This compares to a gross inland consumption for electricity in EU27 in the range of 3 000 – 3 200 TWh. The traded volumes recorded a second consecutive year of decrease, mostly linked to a reduction of trading activity of a number of banks and major utilities such as EDF, E.ON and RWE.

The German and Nordic markets remained the European leaders by a wide margin in terms of both total trading volumes and market development. The churn factors[24] of these markets have been estimated respectively at 7.1 and 5.

With regards of market sectors, OTC remained the favoured choice of trading, representing about 2/3 of total volumes. Yet, compared to previous years, OTC volumes declined significantly. The larger part of OTC is non-cleared on exchanges.

Despite the difficult conditions, the exchange spot trading remained the only segment to register steady increases of volumes. About 1 200 TWh were exchanged in 2012, reaching 14%, which is an increase compared to the year before. Among the factors shaping the evolution described above were the recession and slow economic recovery thereafter that affected energy demand, especially from industry, coupled with new electricity generation assets coming on-stream.

The frequency of occurrence of negative price episodes[25] rose in the last part of the observed period as the costs of ramping up or down of some conventional plants are significant.

Some of the new generation plants (wind, solar) impacted directly the supply curve[26] of the day-ahead market as their low marginal generation costs allowed them to outbid conventional electricity generators. As such, the RES units contributed to keeping the wholesale price in

[23] "European power trading 2013", Prospex Research, www.prospex.co.uk

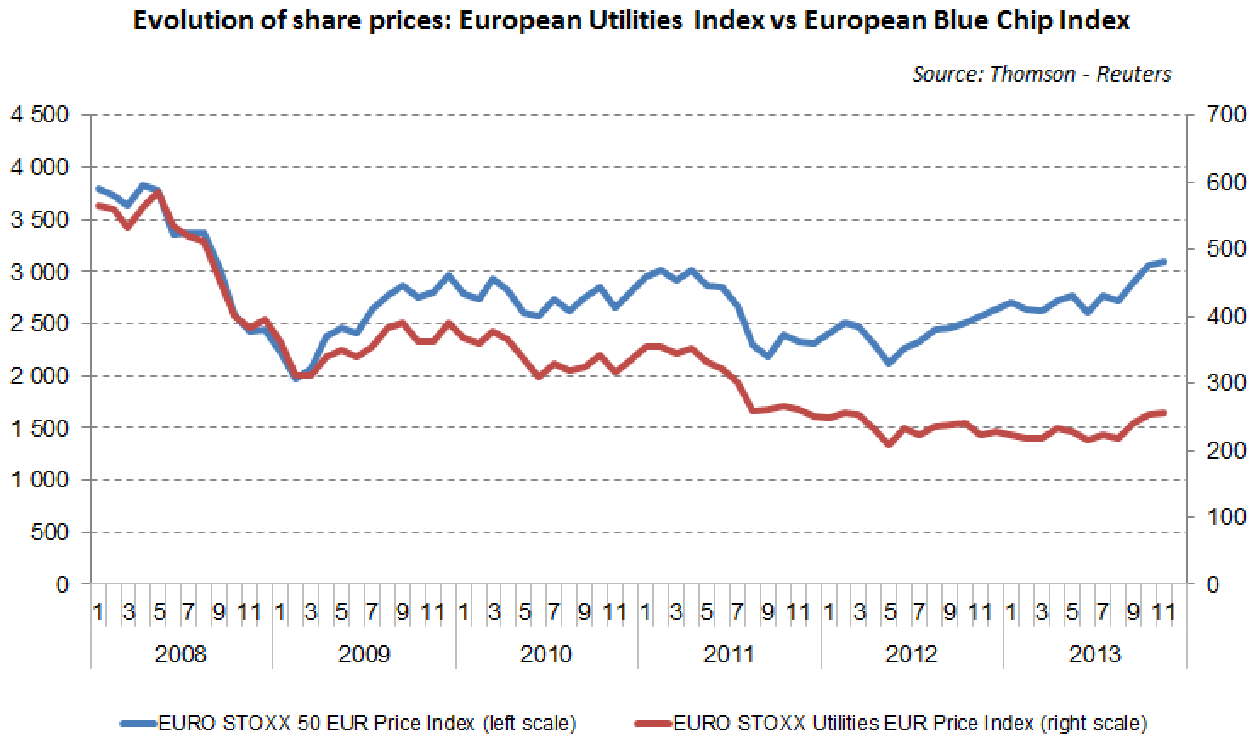
[24] The churn facto is defined as the ratio of traded volume to physical consumption. It informs about the liquidity of the market place and the quality of the pricing signal that is discovered on that market.

[25] Negative prices occur when, with excess supply of electricity, utilities with inflexible generation capacity prefer to pay to sell the generated electricity, rather than ramp down or close their power stations

[26] The ranking of electricity generation assets by their marginal cost of production sets up the supply curve, also known as the merit order.

check through **the merit order effect,** as explained in **Annex 3**. In a normally functioning energy market, the decreased wholesale prices *should* pass through to final consumers in the form of lower cost of the energy supply component.

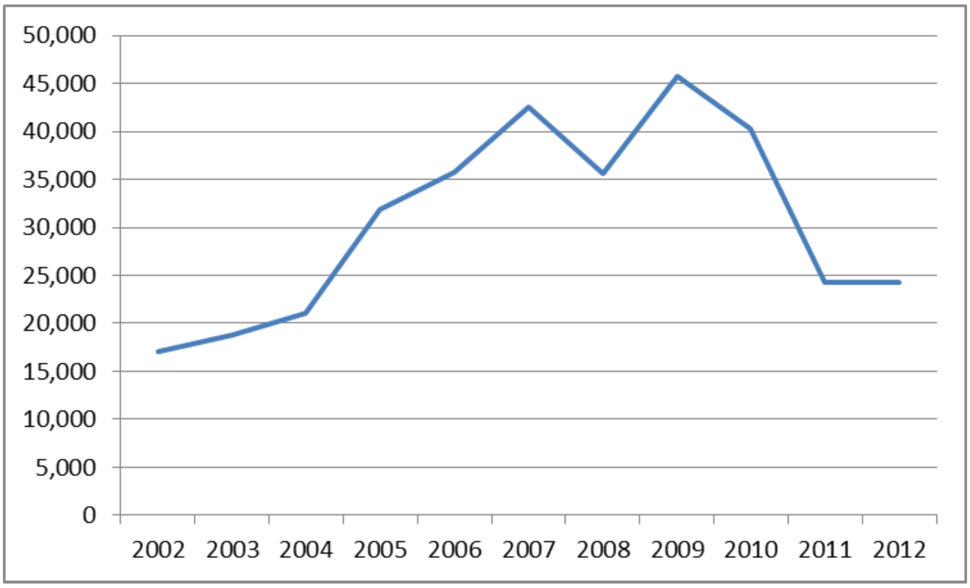
Figure 19 Evolution of share price indices: European Utilities vs. European Blue Chips



At the same time, policy support measures (including renewables and energy efficiency support and other energy subsidies) increase the levy element of retail prices or the transmission charges, while the costs of network development and ancillary services increased the network element. Thus overall, retail prices rose.

The combination of weak demand, stable wholesale electricity prices (when hydrocarbon prices were on the rise) has put pressure on conventional assets (at times resulting in companies adopting faster depreciation rates). In many cases both the profit margins from the generation business and company share prices were negatively affected, (as can be seen from the evolution of the Euro Stoxx Utilities index on Figure 19), and access to finance has been more difficult.

Figure 20 Reported Net Income for the Bloomberg EU Power Generation Top Index in € millions (2002-2012)



Source: Bloomberg

Reported net income for European electricity generation utilities demonstrates this negative trend in profits, as illustrated in Figure 20. Whereas fortunes had been rising throughout the first decade of the millennium, profits rapidly declined after a peak in 2009 before reaching a plateau in 2011. Earnings have not, however, stabilized across Europe, as European utilities are not equally exposed to the new risks facing the industry. Firms with large shares of coal generation have a different short-term outlook than those with large shares of gas generation due to low ETS credit prices and cheap coal prices resulting from increased American exports. Moreover, Central European utilities (E.ON, GDF Suez, RWE, PGE and CEZ) have been particularly hit due to their exposure to electricity prices. However, electricity generation utilities have fared poorly in other regions as well (Endesa, PGE).

As a rule, the EU utilities have tried to adapt to this new business environment by focusing more on downstream services, including decentralized generation and energy efficiency and by gradually divesting their conventional electricity generation assets.

In an open and competitive retail market the energy component of the end consumer price (Figure 1) for electricity would reflect generation costs, as represented by an efficiently functioning wholesale market[27] and the quality of services provided by the energy supplier; the network component would reflect the costs of the efficient operation and balancing of the transmission and distribution grids, including the demand side response, and the taxation component would be set in such a way, so as to achieve taxation and energy policy objectives with the least burden on consumers.

In addition, pricing signals should provide a strong link between the retail and wholesale segments, ensuring a completeness and coherence of the market structure. A strong and relatively quick **pass-through** of any persistent, long term change of the wholesale benchmark to the energy component in the retail price would indicate a good / normal

[27] The part of the consumer bill related to the supply of energy is in fact the only component where suppliers can actually compete.

operation of the IEM. The final consumers would then be able to adapt their economic decisions in line with the supply and demand fundamentals.

These conditions are rarely met in today's retail markets in the EU. The normal operation of the market is often restrained by a variety of factors and barriers that limit competition. Measuring barriers to entry is difficult in the case of electricity and natural gas markets, not least because harmonised methodologies to support data collection of relevant retail market indicators are still missing.

Elements that may slow down the interaction between retail and wholesale sections include but are not limited to: consumers' low ability and propensity to switch behaviour, sticky retail prices and non-market based price regulation.

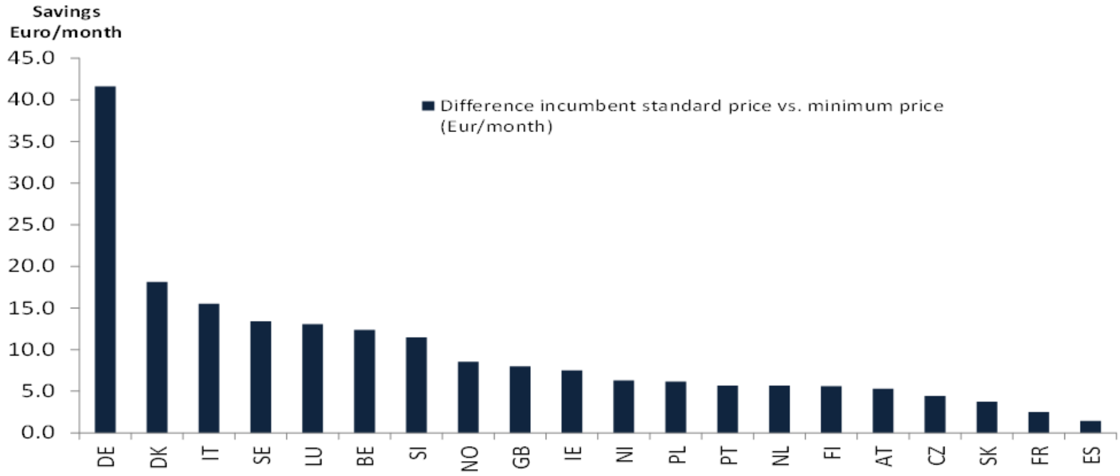
In a competitive retail market the empowered and price-sensitive energy consumers have a wide range of options when it comes to finding attractive price offers. Switching across offers of the current supplier, or switching the supplier, is just one of those options, yet to be fully used in the case of EU retail electricity and natural gas markets.

Understanding consumer behaviour is in general a complex exercise which is further compounded for the case of electricity and natural gas. As a rule, the price elasticity of these commodities is low, implying that end consumers have to be incentivised by a significant price variation to consider changing behaviour. This may explain in part why switching rates tend to be low.

Figure 21, coming from the latest market monitoring report from ACER and CEER (2012)[28], illustrates this for the case of electricity: it shows that the expected profits from switching (coming in the form of savings on the bill) have to be substantial to incentivise consumer switching. In some cases the prospect of saving more than 10 Euros per month, just by switching to an existing offer in the market, may not be enough to prompt actions from consumers.

[28] The report is available here: http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf

Figure 21. Average monthly saving potential (household consumers, 4000 kWh of annual consumption) from switching from the incumbent standard offer to the lowest priced offer in the market – capital city – December 2012 (euro/month)



Source: ACER retail database (December 2013)

Non-market related justifications – such as loyalty to a supplier or a perception of protection by staying under the administered offer – may not be enough to explain such behaviour. The complexity of supply offers, the lack of transparency and user-friendly tools for comparing offers, even ignorance or lack of interest may be at play as well.

Commission's 2010 in-depth market study on retail electricity market found that current market conditions (limited transparency and comparability of tariffs and offers, limited access to information as well as complicated switching procedures) make it very difficult for EU consumers to compare the different offers and choose the best deal, or to subsequently switch providers. The study estimated that 62% of consumers could switch to a cheaper tariff, representing a potential average annual saving of EUR 13 billion EU-wide.[29]

For a large group of consumers, the retail prices also tend to be **sticky**: such consumers would sign contracts where prices and consumed amounts are set ex-ante and where metering and ex-post bill settlement takes place on regular intervals (matching real and estimated prices and consumed volumes). Demand-side participation on the wholesale market is thus discouraged and so is the transmission of pricing signals between the retail and wholesale segments.

As indicated by the ACER-CEER report, Member States continue to administer retail prices for electricity over vast portions of household and industrial consumers: "***in 2008, 130 million out of 229 million of household consumers in Europe were supplied under regulated prices, i.e. 57%. This share decreased only to 51% four years later****. Whilst in several MSs regulated and non-regulated prices co-exist, the tendency for household consumers to switch from regulated to non-regulated prices is rather low*".

It should be noted that several Member States have committed themselves to timetables to phase out retail price regulation and other Member States are considering such a phase out. In a few other Member States, isolated wholesale markets would not for the time being allowing competition to keep prices at check in the retail markets. Retail price regulation might in these instances not have a major distortive impact.

[29] *The functioning of retail electricity markets for consumers in the European Union*, Study on behalf of the European Commission, Directorate-General for Health and Consumers, 2010 – http://ec.europa.eu/consumers/consumer_research/market_studies/docs/retail_electricity_full_study_en.pdf.

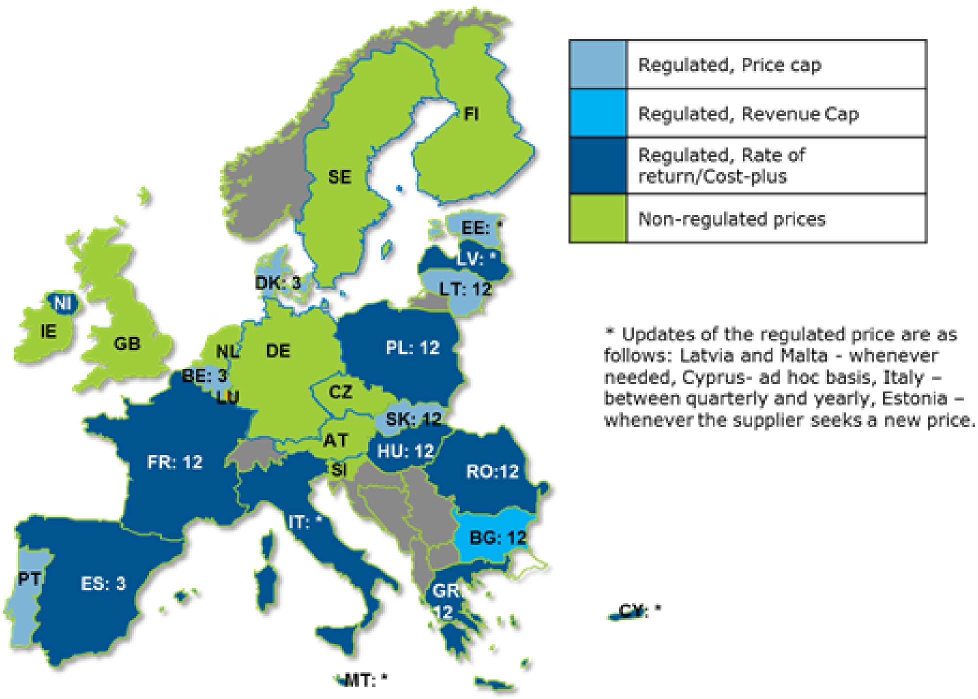
Non-market based regulated prices tends to distort the normal operation of retail markets; service quality and innovation tends to be lower than it would otherwise be. Moreover, the implementation of smart demand response solutions, which allows consumers to take advantage of fluctuating just-in-time prices, and which depend on flexible pricing formulas, risks being hampered by retail price regulation.

Moreover, in these cases incentives for energy efficiency are greatly reduced and an additional financial burden is placed on consumers in their capacity of taxpayers in order to finance the non-covered costs

A recent European Commission service report found out that price regulation also leads to cross-subsidisation among consumer groups[30]. When prices are set below costs, tariff deficits may accumulate in the balance sheet of companies that are present on the market. Profit margins of companies deteriorate and the related uncertainty might have a negative impact on the cost of capital, which impacts in turn investment decisions. Switching behaviour would be further discouraged as consumers would not see any need to look for competitive offers and new entrants would stay away from the market.

A regulation setting prices above costs can also distort retail markets and act as a deterrent to new entry. It clusters offers around the regulated level and discourages switching; it also creates unnecessary burden for National Regulating Agencies as the definition of the regulation methodology may become a contested topic in the political debate and thus subject to frequent modifications.

Map 3 Method of price regulation (electricity) and update frequency in months in Europe - 2012



Source: The CEER national indicators database and ACER questionnaire on regulated prices (2013)

[30] DG ECFIN. Energy Economic Development in Europe

Whereas the drive to regulate prices may be prompted by legitimate concerns as the protection of certain vulnerable consumer groups, regional policies, secure supplies, etc. these concerns can be better addressed through policies which are less distortive on the retail markets, in particular focussed financial support of vulnerable consumers that enable these customers to source energy at competitive market prices.

Map 3, again from the ACER-CEER report, illustrates that 18 Member States continued to regulate prices in 2012. Price regulation methods for the energy component of the retail price for electricity are specific for each Member State. As mentioned, "*11 out of 18 Member States with regulated electricity prices apply rate of return/ cost plus regulation (i.e. Cyprus, France, Greece, Hungary, Italy, Latvia, Malta, Northern Ireland, Poland, Romania and Spain). Price cap is applied in five out of 18 MSs (i.e. Denmark, Estonia, Lithuania, Portugal and Slovakia). Bulgaria regulates end-user prices by applying the revenue cap regulation for end suppliers and distribution companies*".

The factors slowing down the completion of the retail segment of the internal market are also contributing to the generally negative perception of consumers with regards to the quality of the service provided. As consistently shown by the Commission's Consumer Markets Scoreboards[31], the electricity and natural gas sectors are rather poorly assessed by consumers. In 2013, the electricity market ranked 28th out of 31 services markets, with market performance significantly differing from one country to another and particularly low scores in Southern European countries[32]. The market has particularly poor scores on the choice of suppliers available in the market, comparability of offers and trust in suppliers to respect consumer protection rules (2nd, 4th and 5th lowest among all services markets, respectively). In addition, only 4% of consumers have switched products or services with their existing provider and 7% switched supplier during the past 12 months (4th lowest among the 14 'switching services' markets) and the switching process is perceived as relatively difficult. All this suggests that consumers do not yet have the conditions to make full use of the saving opportunities created by market liberalisation[33].

According to Commission services' empirical estimate on electricity price drivers[34], market opening plays a downward effect on end user prices. Policies, such as unbundling of the electricity activities benefited end users by lowering the retail prices through higher competition among suppliers and more efficient monitoring of network costs. At the same time, fossil fuels are still important drivers and countries that have access to low marginal cost plants, such as nuclear and coal plants, face lower wholesale prices compare to countries that depend on high marginal cost, such as open cycle natural gas and oil plants. Finally, the RES penetration at times contributes to increasing the retail prices through the levy's component, as the cost of the supporting schemes may outweigh the benefit of lower wholesale prices resulted by renewables (see Annex 3. The merit order effect). However in many countries, the cost of RES supporting schemes is increased unevenly among consumer groups (particularly households) due to the government's protection of energy intensive industries. Industries.

As some industries are exempt from RES-related levies, the majority of the costs brought about by investments are to be borne by household consumers in some Member States (e.g.

[31] The Consumer Markets Scoreboard ranks over 50 consumer markets based on how well they are functioning for consumers in terms of trust, comparability, problems and complaints and overall consumer satisfaction. In addition, for the relevant markets, the Scoreboard also monitors switching suppliers and tariffs and consumer choice of providers. See http://ec.europa.eu/consumers/consumer_research/cms_en.htm.

[32] There is a 33 point difference (on a scale for up to 100 points) between the top ranked country (Germany) and the bottom ranked country (Bulgaria).

[33] Consumer Market Monitoring Survey 2013 commissioned by DG SANCO, to be used in the forthcoming 10th Consumer Markets Scoreboard.

[34] See Energy Economic Development in Europe, DG ECFIN.

Germany). However in other Member States the situation appears to be different and lessons are to be learned from different national experiences

1.1.1.2. Costs related to networks

In 2012 median households paid in the range of 2.2 Eurocent/kWh (Malta) to 9.6 Eurocent/kWh (Spain) for the network component and its share represented between 13% (Cyprus and Malta) and 50% (Czech Republic) of the total bill. For industry, network costs represented between 11% (Cyprus) and 56% (Lithuania) of the end price and consumers paid between 1.66 Eurocent/kWh (GR) and 6.46 Eurocent/kWh (Lithuania).

The proceeds collected from the network component of the end consumer bill are intended to cover capacity and operating expenses related to the transmission and distribution grids. Both businesses are run as regulated activities and the expenses can be schematically broken down into infrastructure costs (maintenance and grid expansion), system services (costs by use or by availability), network losses and other charges such as (but not limited to) stranded costs, public service obligations, policy support to certain technologies, etc.

Direct comparison of unit tariffs should be done with caution due to differences between countries in areas such as quality of service, market arrangements, main technical characteristics, topological and environmental aspects of the networks, e.g. consumption density, generation location, that influence the level of such charges. On the transmission side these relate to costs of infrastructure, energy losses, ancillary services, system balancing and re-dispatching.

Figure 22 presents a breakdown of the network costs into transmission and distribution components starting from the total network values reported by Eurostat. These values are only indicative as they may include elements which are not directly related to the operation of the transmission and distribution grid. Such is the case for a number of Member States estimated to be on the high end of network costs. More elements are needed to conduct a thorough analysis on the drivers affecting network costs. What emerges is that, barring few exceptions, distribution costs are by far the larger part of this component.

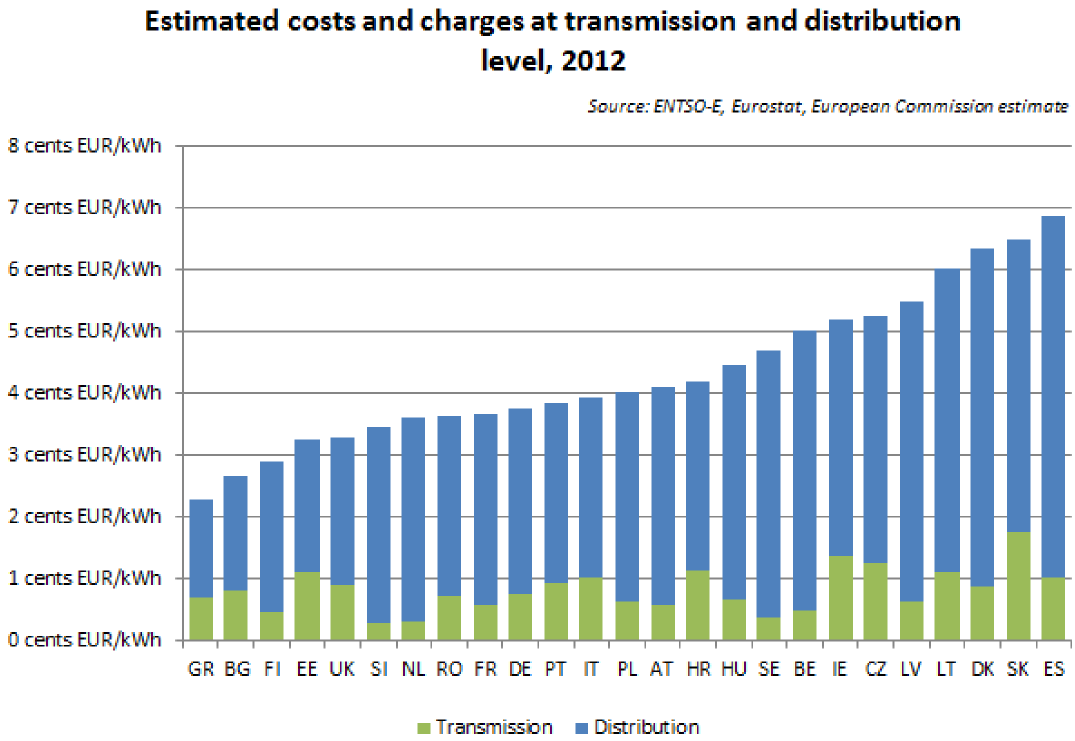
The split of electricity transmission and distribution costs within network costs also varies significantly across Member States – Spain, Denmark, Lithuania, Latvia and Slovakia have rather high distribution costs. Transmission costs are relatively high in Slovakia, Ireland, the Czech Republic, Croatia, Lithuania and Spain.

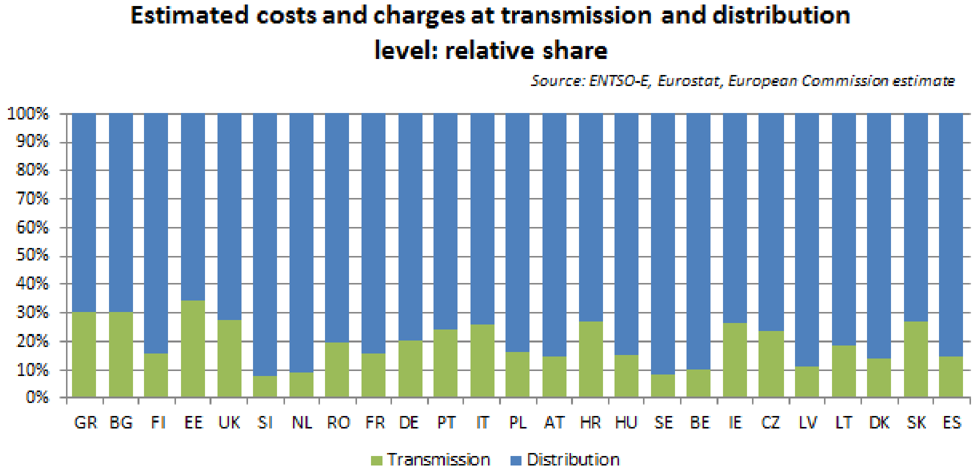
Detailed and harmonized information on the distribution grids of the EU is in general scarce. For the majority of the distribution grids, not much is known even on basic data such as total length and age of operation by component[35]. It is also not clear if national regulators are applying similar accounting rules and methodologies to determine the level of the distribution and, to a lesser extent, the transmission tariff.

The observed differences in network charges may result not only from differing underlying transmission and distribution costs, but also from different regulatory cost assessment methodologies in use by NRAs at TSO and/or DSO level (asset eligibility, asset valuation and asset remuneration for instance). Figure 23 provides data on some basic elements of the transmission grid.

[35] A first estimation of the total length is provided by Eurelectric, "Power distribution in Europe: facts and figures": http://www.eurelectric.org/media/113155/dso_report-web_final-2013-030-0764-01-e.pdf

Figure 22. Breakdown of network costs into transmission and distribution (levels + shares)

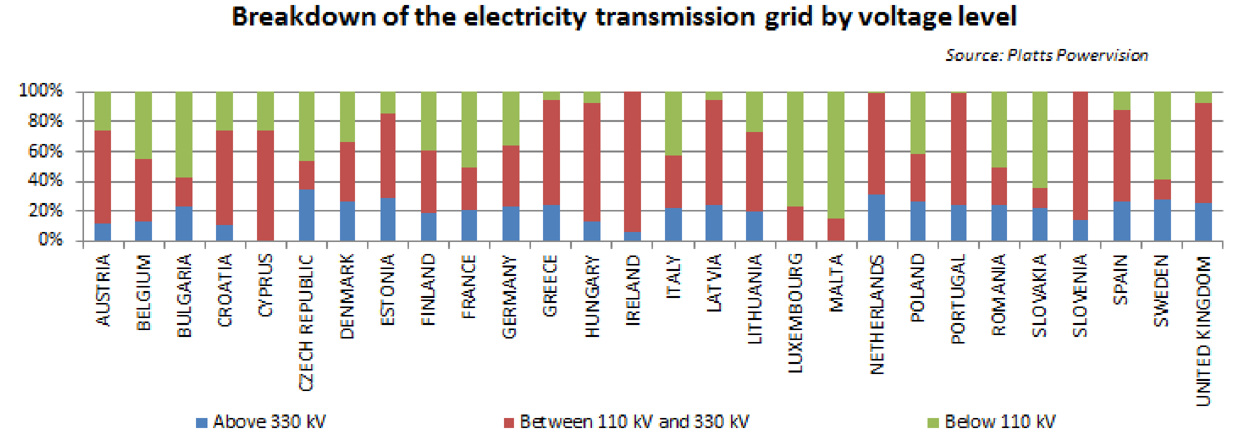




Note: certain Member States add non network costs to network charges, which are not distinguished in the data. For example, Spanish data reported to Eurostat includes capacity payment (*pagos por capacidad*) and premium payments for RES and CHP (*Prima Régimen especial*) under network costs. Similarly, Danish data reported to Eurostat classifies Public Service Obligations under network costs.
The total network costs are calculated as a weighted average of network costs for household and industrial consumers (consumer bands DC and IC), as reported by Eurostat. Transmission costs are those reported by ENTSO-E. Distribution costs are estimated as the difference of total network and transmission costs. Data limitations do not allow splitting network costs in Luxembourg, Cyprus and Malta.
ENTSO-E calculates the unit transmission tariff taking into account the whole of the tariff: adding the invoices applied to the load and to the generation (if applicable), and assuming they produce and consume the energy they had in their programs (without individual deviations). ENTSO-E makes the following assumptions: 5000 h utilization time that includes day hours of working days, typical load considered is eligible and has a maximum power demand of 40 MW when it is connected at EHV and a maximum power demand of 10 MW when it is connected at HV, for countries with tariff rates that are differentiated by location an average value has been taken.

Figure 23 Length and relative share of Member States electricity transmission grids by voltage level

	< 110 kV (km)	110-330 kV (km)	> 330 kV (km)	Total (km)
AUSTRIA	1808	9199	3929	14936
BELGIUM	1447	4483	4781	10712
BULGARIA	3323	2828	8274	14425
CROATIA	982	5943	2446	9371
CYPRUS	0	968	328	1297
CZECH REPUBLIC	3950	2206	5369	11525
DENMARK	2514	3761	3149	9424
ESTONIA	2118	4131	1077	7325
FINLAND	4282	10061	9193	23536
FRANCE	21562	28605	51186	101353
GERMANY	20057	34824	30354	85234
GREECE	4353	12223	1010	17586
HUNGARY	2612	15535	1419	19566
IRELAND	435	6485	3	6923
ITALY	11986	19103	23581	54670
LATVIA	1378	3929	310	5617
LITHUANIA	1544	4186	2050	7779
LUXEMBOURG	0	167	538	704
MALTA	0	34	190	225
NETHERLANDS	3289	6958	133	10380
POLAND	6348	7625	9835	23808
PORTUGAL	1813	5592	67	7472
ROMANIA	4474	4444	9334	18252
SLOVAKIA	1647	978	4776	7401
SLOVENIA	396	2410	1	2807
SPAIN	16911	37901	7896	62709
SWEDEN	11852	5638	24625	42116
UNITED KINGDOM	12459	33995	3535	49989

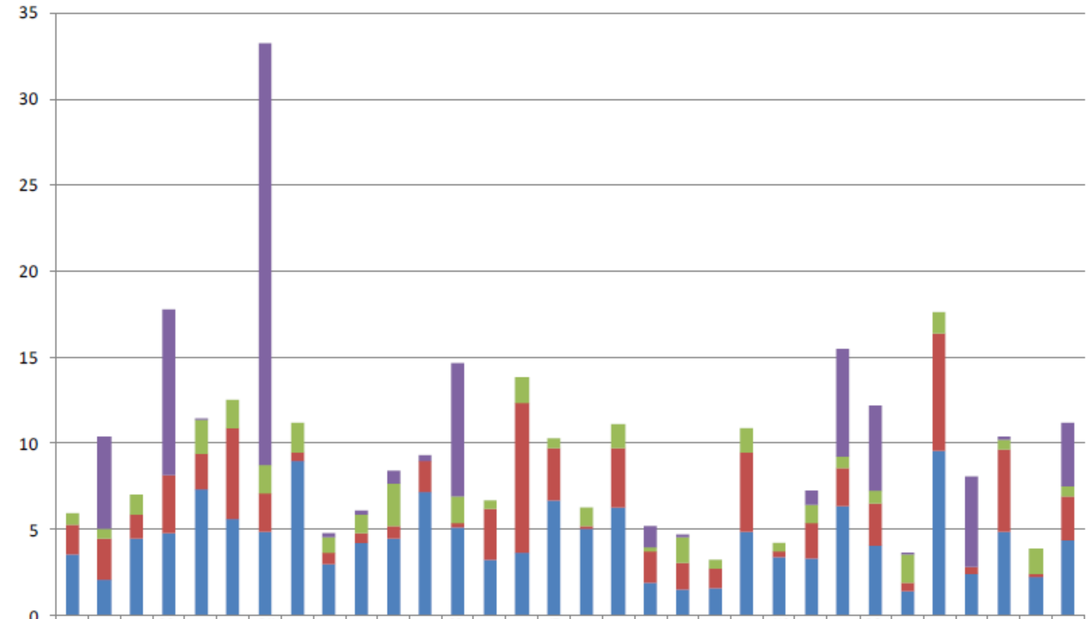


The work of TSOs within ENTSO-E may prove to be a good example to follow in bringing transparency on the operation of distribution networks. As more and more generation assets are connected to the low voltage level the need to reinforce the grid at that level increases. Grid expansion financed only by public investments may be difficult. So ensuring adequate financial framework to attract potential investors, may be necessary.

The next chart presents the components of the transmission tariffs, as represented by the latest ENTSO-E overview[36].

Infrastructure costs are in the 0.2 – 1 Eurocent / kWh range; system services including balancing are more variable with the ratio between the lowest to highest per Member State exceeding 1 to 10. Losses are globally comparable. The other regulatory charges are not directly related to TSO activities and include elements such as: stranded costs, public interest contribution, renewable energy and other. A detailed description by country is provided in Annex 5 of the above-mentioned publication.

Figure 24. Components of transmission tariffs, EUR/MWh



	AT	BE	BH	BG	HR	CZ	DK	EE	FI	FR	DE	GB	GR	HU	IE	IT
Other regulatory charges	0,00	5,33	0,00	9,60	0,01	0,00	24,51	0,00	0,19	0,18	0,75	0,29	7,69	0,00	0,00	0,00
Losses	0,61	0,60	1,16		2,01	1,58	1,66	1,70	0,90	1,10	2,49	0,00	1,57	0,51	1,45	0,524
System Services	1,79	2,37	1,39	3,34	1,99	5,26	2,18	0,50	0,71	0,61	0,75	1,85	0,20	2,98	8,78	3,05
Infrastructure	3,52	2,06	4,44	4,81	7,36	5,63	4,89	9,00	2,95	4,17	4,41	7,14	5,14	3,19	3,60	6,68

	LV	LT	LU	MK	NL	NI	NO	PL	PT	RO	RS	SK	SI	ES	SE	CH
Other regulatory charges	0,00	0,00	1,25	0,21	0,00	0,00	0,00	0,83	6,24	4,91	0,02	0,00	5,28	0,12	0,00	3,73
Losses	1,07	1,38	0,24	1,49	0,53	1,39	0,52	1,06	0,69	0,76	1,59	1,26	0,00	0,57	1,47	0,58
System Services	0,19	3,44	1,82	1,56	1,11	4,59	0,32	2,04	2,23	2,46	0,50	6,85	0,42	4,77	0,18	2,57
Infrastructure	5,03	6,28	1,90	1,47	1,58	4,89	3,38	3,32	6,32	4,02	1,42	9,53	2,37	4,87	2,20	4,34

Source: ENTSO-E Overview of transmission tariffs in Europe: Synthesis 2013

[36] https://www.entsoe.eu/fileadmin/user_upload/_library/Market/Transmission_Tariffs/Synthesis_2013_FINAL_04072013.pdf

1.1.1.3. Costs related to taxation

In 2012 median EU households paid between 0.85 Eurocent/kWh (UK) and 16.8 Eurocent/kWh (Denmark) for the taxation component which accounted for between 5% (UK, Malta) and 56% (Denmark) of the total bill.

The share of the taxation component (net of VAT and other recoverable taxes and levies) for industrial consumers varied in the range of 0% (Romania, Lithuania, Latvia, Malta) to 32% (Germany) of industrial electricity prices (excluding recoverable taxes) with levels of up to 5.5 Eurocent/kWh (Italy).

In general, taxes on energy can be divided into broad consumption taxes (such as Value Added Tax, VAT) and specific taxes (such as excise duties, energy and carbon taxes). VAT is a general tax that applies, in principle, to all commercial activities involving the production and distribution of goods and the provision of services. VAT is a consumption tax borne ultimately by the final consumer as a percentage of price. In contrast, excise duties are indirect and specific taxes on the consumption or the use of certain products, which are expressed as a monetary amount per quantity of the product.

Where carbon taxes are in place, they are generally designed to complement rather than overlap with the ETS, and ensure a similar burden share between ETS and non-ETS sectors. This is the case in Denmark and Sweden, for example. The UK has in place a Carbon Price Floor, which acts to "top up" the price of carbon allowances in the ETS.

The overall effect of high energy taxation depends on the use of tax revenues. The IEA points out that while taxes on the sale of energy to industry can affect the sector's international competitiveness, this effect can be offset – to some degree – by government interventions designed to improve industrial competitiveness, such as government measures and programmes aimed at improvements to infrastructure, support for investments.

Tax Rates - VAT and excise duties

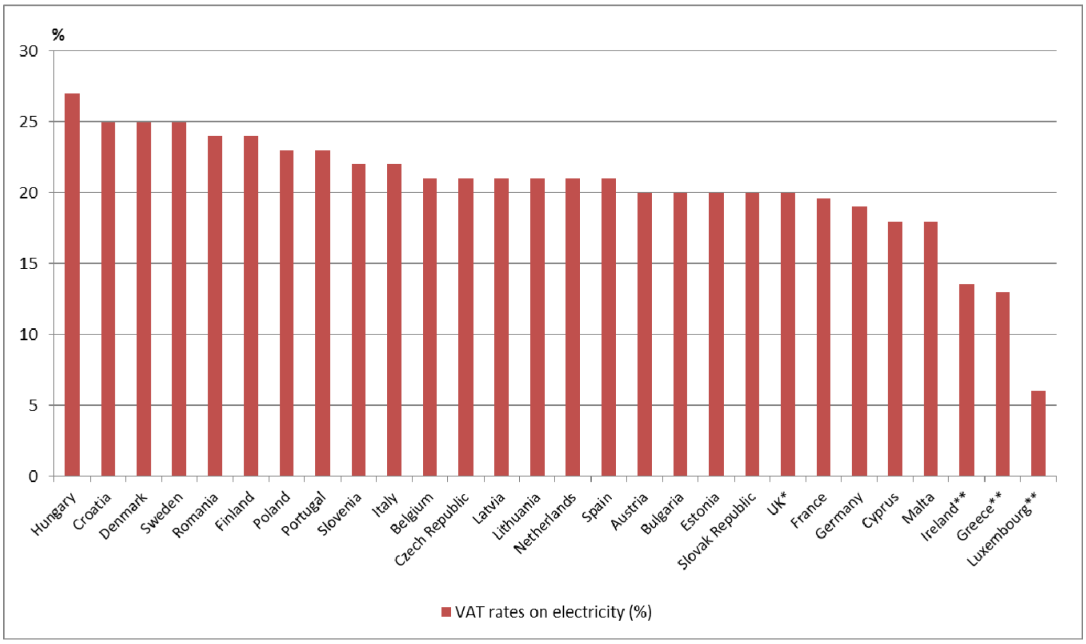
The VAT Directive[37] provides a legal framework for the application of VAT rates, establishing a standard rate of at least 15% and allowing for Member States to apply one or two reduced rates of not less than 5% to goods and services enumerated in a restricted list. In the case of electricity, VAT rates do not differ considerably across Member States. Since 2009, many MSs have raised VAT rates, in general affecting both commercial and non-commercial consumers. Standard VAT levels vary between 15% and 27% across Member States, with a range of 19-21% most commonly observed.

Some Member States apply reduced VAT rates on electricity consumption: for example, the United Kingdom charges a reduced VAT rate of 5% on electricity in the case of households, while Luxembourg, Ireland and Greece charge reduced VAT rates of 6%, 13.5% and 13%, respectively, on electricity consumption for both business and non-business use. VAT rate on electricity in Croatia, Sweden and Denmark is at 25% and in Hungary at 27%.

Reduced VAT-rates on energy products may reduce the incentives for energy efficiency efforts for household consumers.

[37] 2006/112/EC

Figure 25. VAT rates on electricity



Source: European Commission

Note: *Reduced VAT rate of 5% for electricity non-business use in the UK.

**Reduced VAT rates for electricity (business and non-business users) in Ireland, Greece and Luxembourg.

In the EU the general framework for energy taxation is set by the Energy Tax Directive, which set minimum levels of **excise duty** for a wide range of energy sources and fuels, plus electricity, while recognising that "*certain exemptions or reductions … may prove necessary … because of the risks of a loss of international competitiveness or because of social or environmental considerations*". According to the Energy Tax Directive the minimum levels of excise duty for electricity amount to 0.5 Euro/MWh and 1 Euro/MWh for business and non-business use respectively.

The levels of excise duty which Member States charge in addition to the minimum rates set by the Directive vary significantly by country. About half of the Member States enforce rates either at or slightly above the minimum (typically up to 1.5 Euro/MWh). On the other hand, significantly higher rates of taxation are found in Northern European and Nordic Member States. In the case of non-business use, Germany imposes a tax rate of up to 20 Euro/MWh, Sweden of up to 34 Euro/MWh and Denmark of over 109 Euro/MWh[38].

Excise duties are frequently applied unevenly across sectors; many Member States set lower rates for commercial, industrial or domestic use. Member States enforcing lower rates of excise duty for electricity use by business sectors (in comparison with non-business use) include Denmark, Germany, Greece, Finland, Italy, Lithuania, Romania and Sweden. The

[38] Includes CO_2 tax in the case of Denmark, as reported for the compilation of the Excise Duty Tables published by the European Commission and available at http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_ii_energy_products_en.pdf

scale of the disparity between sectors varies by country: in Germany, business versus non-business rates stand at 15.37 Euro/MWh to 20.57 Euro/MWh; for Finland, this was 7.03 Euro/MWh to 17.03 Euro/MWh; for Romania 0.5-1 Euro/MWh and for Lithuania 0.52 to 1.01 Euro/MWh.

Countries that impose lower effective tax rates on industrial use may be seeking to address competiveness concerns, particularly in relation to energy-intensive industries that are subject to strong international competition. On the other hand, in EU countries, the lower rates may to some extent reflect the fact that many large industrial emitters are subject to the EU emission trading system. Countries that impose lower rates on residential fuel use may place greater weight on affordability and vulnerability concerns.

The precise distribution of exemptions from excise duties also varies by Member State. In Sweden this applies to manufacturing industry as well as agriculture, horticulture, fisheries and forestry. In Finland, the reduced rates apply to industry and greenhouse cultivation. In Greece, the exemptions apply to consumers of high voltage electricity, while other business use is taxed at the normal rate.

In Slovakia, Greece and Bulgaria, domestic electricity consumption is exempt from excise duty. In the UK, the Climate Change Levy, the main tax on electricity and energy use, is paid only on business and public sector consumption.

Table 2. Excise duties levied on electricity, 2013

Electricity, EUR/MWh	Non-business use	Business use
Belgium (1)	1,91	0
Bulgaria	1,00	1,00
Croatia	1,01	0,51
Czech Republic	1,14	1,138
Denmark (2)	109,99	54,42
Germany	20,50	15,37
Estonia	4,47	4,47
Greece	2,20	2,5
Spain	1,00	0,50
France	1,5	0,5
Ireland	1,00	0,50
Italy	22,70	12,50
Cyprus	0	0
Latvia	1,00	1,00
Lithuania	1,01	0,52
Luxembourg	1,00	0,50
Hungary	1,00	1,00
Malta	1,5	1,5
Netherlands (3)	114	114
Austria	15 ,00	15 ,00
Poland	4,56	4,56
Portugal	1,00	1,00
Romania	1	0,5
Slovenia	3,05	3,05
Slovakia (4)		1,32
Finland	17,03	7,03
Sweden	31,66	0,55
UK	0	0

Source: European Commission Excise Duty Tables.
Notes : (1) In Belgium, a federal contribution of EUR 2.98 / MWh is collected; there are number of reductions and exemptions for energy intensive business; (2) Includes CO_2 tax ; (3) Depending on consumption level, the exemptions range from EUR 0.5 / MWh to EUR 116.5 / MWh; (4) Non-business use is exempted;

Other levies

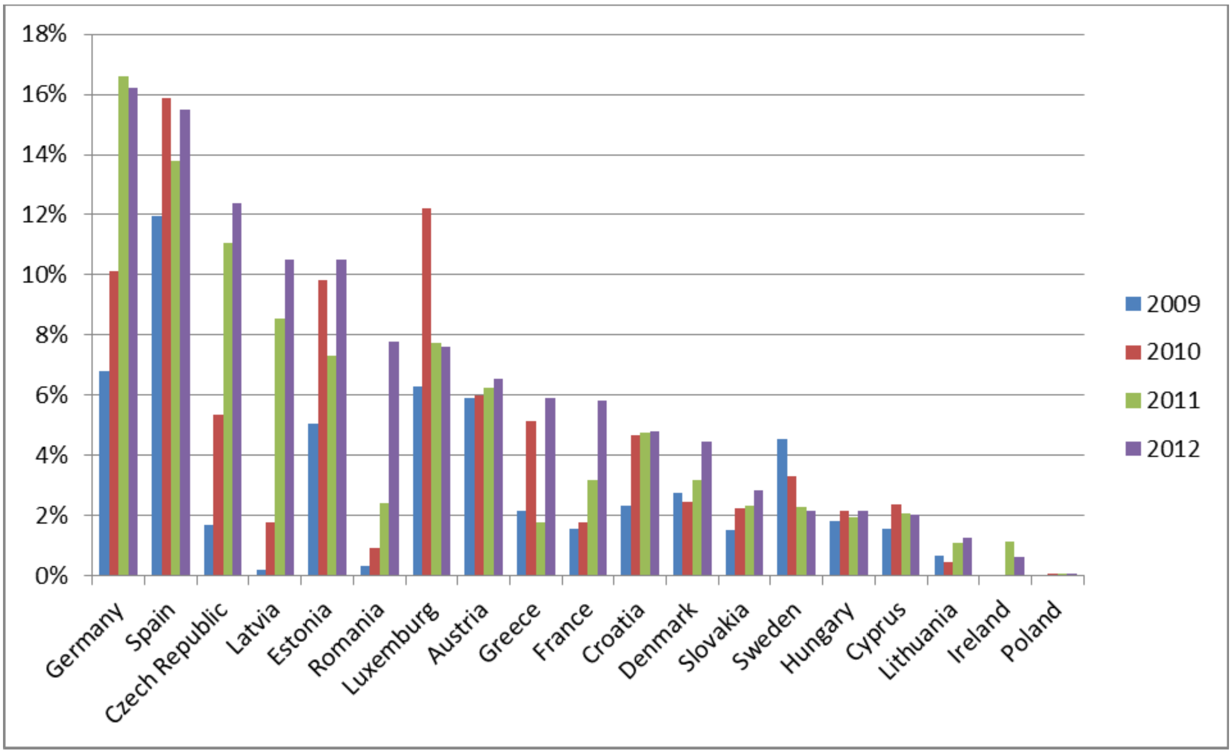
Other government policies may also be financed through additional energy or carbon-related taxes, as well as through levies and charges on energy bills, the composition of which is very different between Member States. Emissions trading schemes, renewable energy policies, energy efficiency policies and investment in infrastructure may all have an impact on electricity bills; in some Member States financing related to these policy priorities is done though taxes or levies, whereas in others they are instead considered as a factor in the production cost of energy or in network costs.

Costs related to the EU ETS are incorporated in the energy component of prices and current state of knowledge is that the impact on electricity prices has been relatively modest, if any. A recent study by DG ECFIN covering data until 2011 did not find any significant impact of ETS carbon prices on electricity retail prices neither for industry, nor for households.

In the period 2009-2012 the share of levies and charges used to support electricity generated from renewable energy sources has increased, rather abruptly in some Member States.

In 5 Member States support for renewable electricity generation in 2012 accounts for more than 10% of household electricity price, excluding VAT. The steep increase in the level and the relative share of renewable electricity charges paid by households in some Member States cannot be disconnected from the fact that large industrial consumers are often exempt from paying these (see discussion below).

Figure 26. Evolution of the share of RES-E levies in the electricity price for households in selected EU countries (2009-2012)

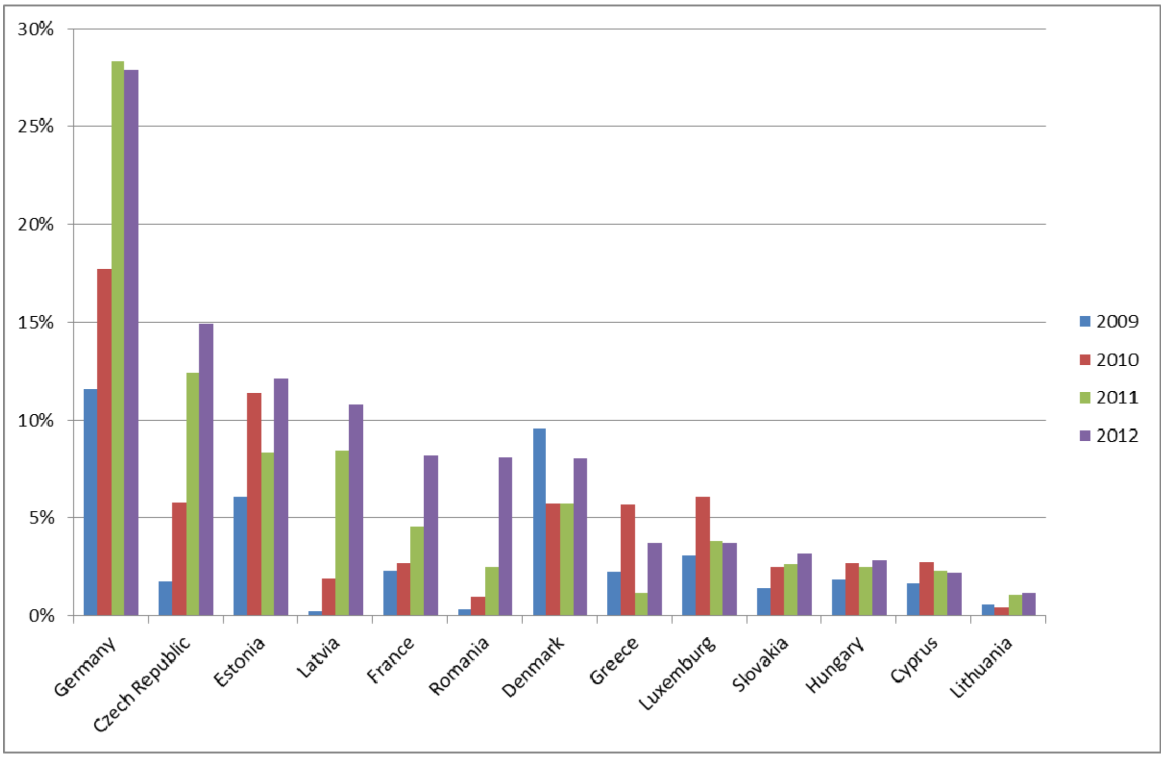


Note: Only states with data for all the years in the period 2009-2012 included. Calculated as % of price for consumers with annual consumption between 2500 and 5000 kWh (Eurostat consumption band DC), excluding VAT.

Source: Commission services calculations based on Eurostat and Member State data

Between 2009 and 2012 industrial consumers in Germany, the Czech Republic, Estonia, Latvia, France and Romania saw a steep increase in the share of RES-E-related levies in final price of electricity (excluding VAT and other recoverable taxes), though from a very low starting level in the cases of the Czech Republic, Latvia, France and Romania.

Figure 27. Evolution of the share of RES-E levies in the electricity price for industrial consumers in selected EU countries (2009-2012)



Note: Only states with data for all the years in the period 2009-2012 included. Calculated as % of price for consumers with annual consumption between 500 and 2000 MWh (Eurostat consumption band IC), excluding VAT and other recoverable taxes.

Source: Commission services calculations based on Eurostat and Member State data

Tax exemptions

The effect of energy taxes upon different industrial sectors is however complicated by reimbursements and exemptions which may be available in some countries to specific sectors. This section provides examples of exemptions provided to certain categories of consumers in some EU countries that generally tend to tax energy consumption more heavily. It is beyond the scope of this review to provide a comprehensive legal and economic analysis of all exemptions and preferential tax treatments in the EU: comprehensive data on re-imbursements and exemptions across all Member States are scarce, meaning it is difficult to build a systematic picture of these exemptions across the EU. It is nevertheless possible to point to specific examples.

A 2011 study carried out by ICF International for the UK government looked at the impact of energy and climate change policies on energy intensive industries[39] in a select group of EU countries[40]. This concluded that in the EU Member States examined "*energy taxes for energy intensive industries… are generally low due to significant re-imbursements that are possible*

[39] The study examined the following sectors: iron and steel; aluminium; cement; chemicals, in particular chlor alkali, fertiliser and industrial gases.

[40] Denmark, France, Germany, Italy and the UK,

… re-imbursements to EIIs appear most significant for Germany, Denmark and Italy, and are also relatively high for France".

In **Germany**, certain energy intensive sectors pay a rate on electricity consumption below the rates for businesses. Similarly for natural gas, heating use by businesses is taxed at a lower rate than by non-businesses (EUR 1.14 per gigajoule compared with EUR 1.53 per gigajoule) and a refund is applied to natural gas used in industry and agriculture[41]. Under the electricity tax law of 1999 (amended in 2011), the majority of EII sectors[42] qualify for a complete reimbursement of energy taxes.

In addition to these discounts, German renewables law protects EIIs from the added costs of electricity owing to preferential grid access for renewables. These costs are distributed among all electric consumers as an additional levy, with the exceptions of EIIs meeting certain conditions with regards to electro-intensity[43]. The case studies in section 1.1.2 confirm that the plants in the German sample paid about 5% of the full RES-levy size (see Table 5).

In the **United Kingdom**, the Climate Change Levy is a tax imposed on consumption by business and the public sector of electricity, natural gas and other fuel sources. Energy intensive industries[44] qualify for a reduction of 80% on this levy, on condition of meeting certain energy-saving targets set out in a Climate Change Agreement. Under this scheme, an energy intensive industrial user would pay GBP 1.018 per MWh, as opposed to GBP 5.09 per MWh paid by a regular industrial consumer.

In **Denmark**, under the Green Tax Package scheme, EIIs are completely exempt from energy taxes, and almost completely exempt from carbon taxes.[45] Processes which participate in Voluntary Agreements, committing them to energy efficiency improvements, are eligible for a rebate of 100% on their energy tax and 97% on their carbon tax.

In **France**, electricity consumed by large industrial consumers is taxed at a reduced rate slightly below that faced by residential users.[46] The tax rate applied to industrial users depends on the user's scale and is lower for larger consumers. The tax rate applied to residential and commercial users is set at an intermediate level between the rates of for the two types of industrial users.

In the **Netherlands**, taxes on natural gas and electricity consumption are based on a bracket system, which sets marginal rates based on the amount of use. The rates decrease with increased use, and different rate schedules apply for industrial, residential and agricultural use. Business use of electricity greater than 10 million KWh pa is exempted if the consumer has agreed to obligations for improving energy efficiency.[47] The average tax rates on electricity consumption for industry (calculated by the OECD) are below those for other sectors (e.g., for electricity, 0.006 Euro/kWh versus 0.113 Euro/kWh for residential use).

---

[41] OECD. 2013. Taxing Energy Use: A Graphical Analysis.

[42] The law covers: electrolysis, glass, ceramics, cement, lime, metals, fertilizers and chemical reduction methods. The industrial gas sector qualifies for a reimbursement of 90%.

[43] Exemptions are granted to EIIs meeting the following conditions: (a) the ratio of the electricity costs to gross value added exceeds 15% and electricity demand exceeds 10 GWh/year at a certain delivery point; in which case the added costs to the client cannot exceed €0.05 cents per kilowatt-hour; (b) the ratio of the electricity costs to gross value added is below 20% and the electricity demand is below 100 gigawatt-hours the limitation of the added cost will only apply to 90% of the electricity purchased in the previous year.

[44] Qualifying sectors must meet the following criteria: (a) energy intensity (EI) must be 3% or more (i.e. energy costs must be 3% or more of the production value for the sector); (b) the industry import penetration ratio must be 50% or more - this ratio is calculated for the sector as a whole to determine its exposure to international competition. Sectors that do not meet the international competitiveness criteria must have an EI of 10% or more. Source: https://www.gov.uk/climate-change-agreements

[45] ICF International. 2012. An international comparison of energy and climate change policies impacting energy intensive industries in selected countries.

[46] OECD, ibid

[47] OECD, ibid

In **Belgium**, EIIs with an environmental agreement are entitled to a 100% exemption on the excise tax on fuels they use, as well as on electricity consumption.[48]

[48] OECD ibid

1.1.2. Electricity price developments in selected industries

This section looks into retail electricity price developments for several energy intensive industries, based on samples compiled from a study analysing data at company and plant level[49]. Based on the methodology described in Annex 2, the results of several case studies for selected energy-intensive industries are presented below with regard to electricity prices. The results are not representative of either the entire industrial branches in each Member State or region, or of the EU as a whole.

The purpose of the case studies is to complement the statistical analysis with data from real installations, while acknowledging the limits in terms of interpretation and generalisation of the results and conclusions beyond the sampled plants. Annex 2 provides details on coverage and selection criteria; details on sampling for each industrial sector are provided in the text.

Cross-sectoral analysis

Before introducing the detailed results of the case studies, this section presents and compares the variation of data for each of the seven sectors assessed.

In particular, for each sector and the related EU-wide sample (no split into regions) the average electricity prices paid by the surveyed plants and the standard deviation of price are presented. The applicable consumption ranges are presented using the median and box plots[50].

The number of questionnaires used for each sector and each of the two energy inputs is reported below. The questionnaires that form the basis of this cross-sectoral section come from a total of 21 Member States. The coverage differs by sector. The results may not be necessarily representative of the situation of the respective industrial branches in each Member State or region.

Table 3 Number of questionnaires used in cross-sectoral analysis

(sub)sector	N. of questionnaires Electricity
Bricks and roof tiles	16
Wall and floor tiles	20
Float glass	10
Ammonia	10
Chlorine	9
Steel	15
Aluminium	9
Total	**89**

Note: Based on the number and type of respondents in each sector as well as the respective Member State of origin, the criteria used in the sample definition (see Annex 2) have different weights. This implied that, for some sectors, not all questionnaires received could be fully used.

As shown in the following graphs, for the installations sampled, the electricity consumption level increases when moving from the sector of bricks to the sector of aluminium while increasing consumption levels are associated to decreasing electricity prices.

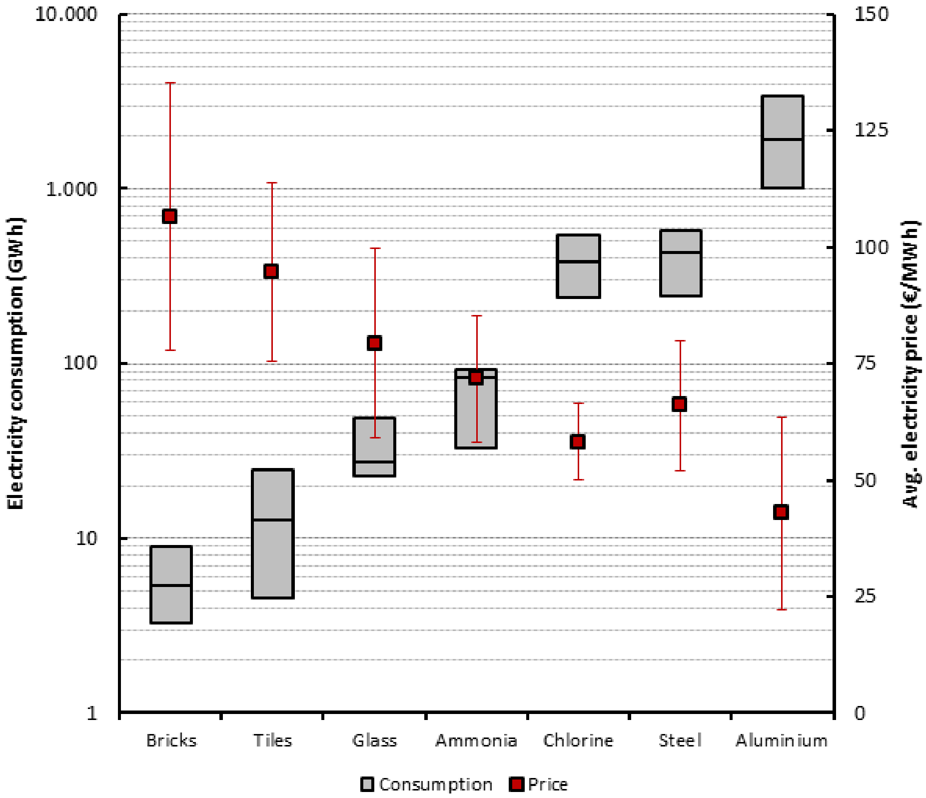
[49] "Composition and drivers of energy prices and costs in energy intensive industries" Specific contract No SI2.6575586 with the Centre for European Policy Studies.

[50] The median refers to the value which splits the sample in half; the box plot indicates the range of values between which 50% of the data sample lay.

The median electricity consumption in the aluminium sector, as seen from the 9 installations sampled, is indeed more than 360 times higher than this in the 16 installations sampled in the bricks sector, whereas an average aluminium producer responding to the questionnaire pays 42.9 €/MWh that is 63.7 €/MWh less than an average bricks producer responding to the questionnaire.

The finding is not surprising as possible explanations for decreasing price levels associated to higher consumption volumes include more favourable supply contracts (including long-term contracts); discounts for large-scale consumers; different levels of levies and taxes (incl. exemptions for large-scale consumers). It is worth noting that these average prices represent the values aggregating the plants surveyed in multiple countries with different price levels and different legislative frameworks.

Figure 28 Electricity consumption range and price variations grouped by sector (89 plants)



Source: CEPS, calculations based on questionnaires

Table 4 Average electricity prices and median consumption in various sectors (89 plants)

	Bricks	Tiles	Glass	Amm.	Chlorine	Steel	Alum.
Average price (€/MWh)	106.5	94.7	79.3	71.7	58.2	66.1	42.9
Median consumption (GWh)	5.3	12.7	27.4	83.2	384.8	436.0	1,915.0

Source: CEPS, calculations based on questionnaires

In addition to EU averages data, a specific assessment has also been conducted for four Member States - Germany, Italy, Poland and Spain – using answers to industry questionnaires collected across all sectors. This assessment builds on case study-based results that cannot be extrapolated to the entire sectors in each of these Member States and are meant to give insight about a sample of plants across the EU. Due to data limitations and the need to ensure the anonymity of plants, the country-specific analysis could be conducted only with regard to electricity prices and price components.

First, data shows a high variation of electricity prices paid by certain operators in the four Member States. It shows a general increase in prices in the 28 plants surveyed in Italy and Spain, a stable price level in Poland and a decrease in Germany.

Amongst the four selected countries and the 28 facilities in the industrial branches sampled, the 5 producers located in Italy face the highest price. Despite the fact that the selected plants in Italy have an average consumption similar to that of plants in Spain (23 vs. 14 GWh/year) Italian producers still paid about 20 €/MWh more than Spanish producers. A major part of this difference is due to higher impact of the energy component in Italy.

In contrast to the other countries analysed, the 10 Spanish electricity consumers in the present sample do not directly pay the costs for RES support through levies[51].

RES levies appear to have an impact also in the plants surveyed in Poland, where they represent about 10% of the final price paid the sampled plants. However, compared to the 15 plants in Italy and Spain, the 5 plants in Poland face lower or considerably lower grid fees. The latter are even lower in Germany, where they account for only about 6% of final electricity price in 2012 for the 8 installations sampled. Among possible explanations of lower grid fees in both Poland and Germany, there is also the possibility that some of the sampled plants are connected to the high-voltage grid.

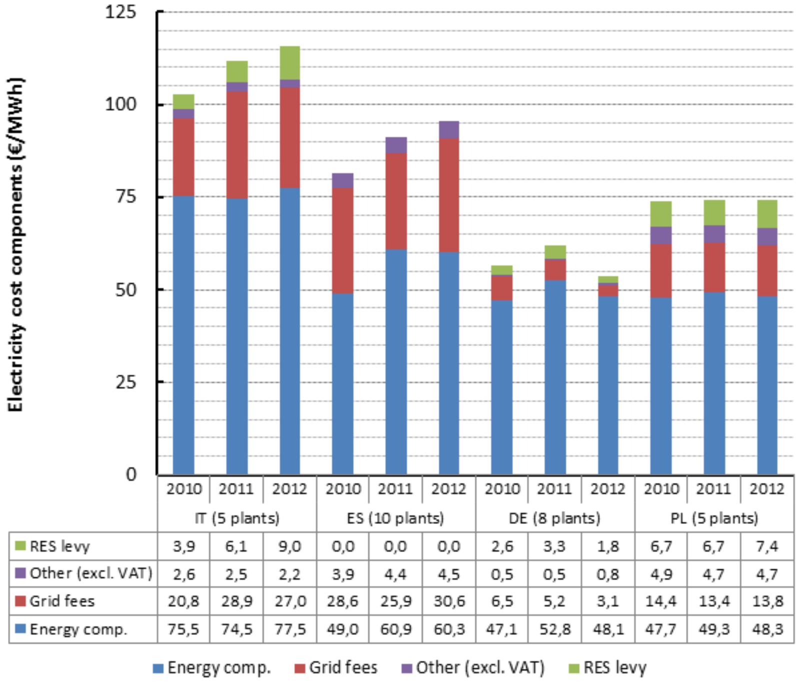
For the 8 German plants surveyed, the average price decreased from 2011 to 2012. This was associated with the decrease of three out of the four components assessed, namely grid fees, RES levies and energy component. However, it is worth noting that a certain share of grid fees is charged in the country in relation to the connection power of the consumer (i.e. euro per watt peak) and is not related to annual consumption. Therefore, increasing the annual consumption would decrease the grid fees when expressed in EUR/MWh, as reported in the graph below. Admittedly, it is still probable that one or more plants in Germany have benefited from lower grid fees starting in 2012. Atypical and energy intensive electricity consumers were exempt from grid fees in the order of 340 million Euro[52]. Decreasing RES levies are associated to new exemptions granted in that year, reversing the previous increasing trend.

[51] The Spanish government sets a so-called access fee (“peaje de acceso”) to cover all costs that are not related to (conventional) production and commercialisation. Costs for RES support are therefore supposedly included in the other components but may also partly be covered by the public budget.

[52] See Federal Ministry of Economics and Technology (BMWi), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU: First monitoring report "Energy of the future", Berlin 2012.

At the same time, the reasons behind the slight decrease in the energy component may be related to the falling wholesale market prices in Germany driven significantly by the strong growth in wind and solar electricity production.

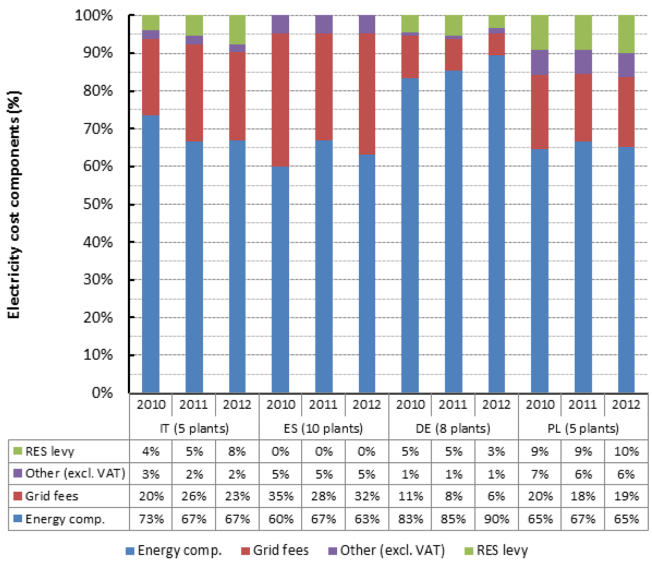
Figure 29 Structure of electricity costs in Italy, Spain, Germany and Poland in absolute terms (28 plants) (€/MWh)



	IT (5 plants) 2010	IT 2011	IT 2012	ES (10 plants) 2010	ES 2011	ES 2012	DE (8 plants) 2010	DE 2011	DE 2012	PL (5 plants) 2010	PL 2011	PL 2012
RES levy	3,9	6,1	9,0	0,0	0,0	0,0	2,6	3,3	1,8	6,7	6,7	7,4
Other (excl. VAT)	2,6	2,5	2,2	3,9	4,4	4,5	0,5	0,5	0,8	4,9	4,7	4,7
Grid fees	20,8	28,9	27,0	28,6	25,9	30,6	6,5	5,2	3,1	14,4	13,4	13,8
Energy comp.	75,5	74,5	77,5	49,0	60,9	60,3	47,1	52,8	48,1	47,7	49,3	48,3

Source: CEPS, calculations based on questionnaires.

Figure 30 Structure of electricity costs in Italy, Spain, Germany and Poland in relative terms (28 plants) (%)



	IT (5 plants) 2010	IT 2011	IT 2012	ES (10 plants) 2010	ES 2011	ES 2012	DE (8 plants) 2010	DE 2011	DE 2012	PL (5 plants) 2010	PL 2011	PL 2012
RES levy	4%	5%	8%	0%	0%	0%	5%	5%	3%	9%	9%	10%
Other (excl. VAT)	3%	2%	2%	5%	5%	5%	1%	1%	1%	7%	6%	6%
Grid fees	20%	26%	23%	35%	28%	32%	11%	8%	6%	20%	18%	19%
Energy comp.	73%	67%	67%	60%	67%	63%	83%	85%	90%	65%	67%	65%

Source: CEPS, calculations based on questionnaires.

As indicated above in the methodological section (Annex 2), all prices presented are net of possible exemptions from taxes, levies or transmission costs. In Table 5, the full size of the RES levies are compared with the average values paid by the sampled plants. The figures

show that the sampled German plants received – on average – a 93% reduction in the year 2012.

Table 5– RES levies in Germany – regular vs. average values paid by sampled plants (€/MWh)

	2010	2011	2012
RES levy (regular, full size)	20.47	35.30	35.92
RES levy (average sampled plants)	2.6	3.3	1.8

Source: CEPS, calculations based on questionnaires

1.1.2.1. Bricks and roof tiles

The results of the case study for bricks and roof tiles presented below are based on the answers provided by a sample of 13 plants to a questionnaire and to each sections of it, as reported in the table below. The share of the sampled plants in EU production is unknown. Production volumes are reported using different units due to homogeneity of products.

Table 6 – Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison
23	13	13	13	8	6

Average electricity prices for the sample of bricks and roof tiles producers have increased by about 13% between 2010 and 2012, from 90.4 to 102.4 €/MWh. The spread between the lowest and the highest price in the sample has also increased by 40%, going from 91.4 to 128 €/MWh, indicating an increased variability across sampled operators. In particular, the gap has been widening because of the sustained increase of the maximum price recorded (+30%). Very different price dynamics can be observed across regions.

Table 7 Descriptive statistics for electricity prices paid by the 13 sampled brick and roof tile producers in the EU (€/MWh)

Electricity price (€/MWh) €c/kWh	2010	2011	2012	% change 2010-2012
EU average	90,4	93,4	102,4	13,3
EU minimum	52,7	54,1	58,7	11,4
EU maximum	144,1	146,1	186,7	29,6
Northern Europe (average)	89,9	91,3	95,0	5,7
Central Europe (average)	95,4	99,3	103,4	8,4
Southern Europe (average)	87,1	89,2	105,0	20,6

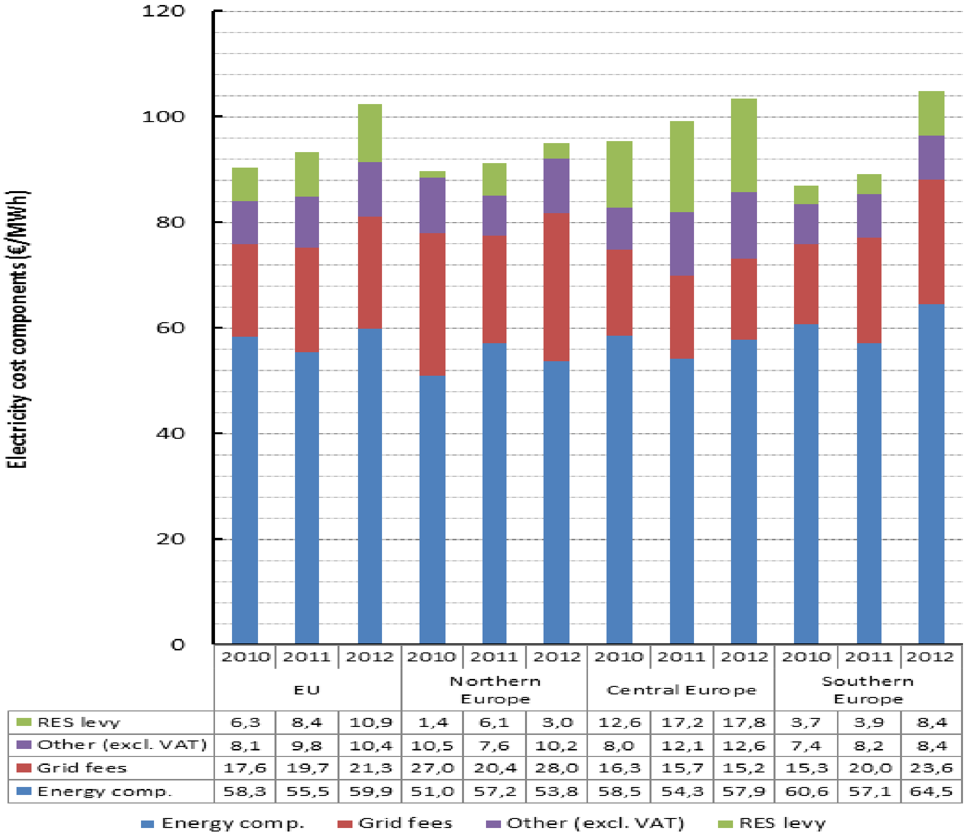
Northern Europe includes 5 plants: IE, UK, BE, LU, NL, DK, SE, NO, LT, LV, FI, EE
Central Europe includes 3 plants: DE, PL, CZ, SK, AT, HU
Southern Europe includes 5 plants: FR, PT, ES, IT, SI, HR, BG, RO, EL, MT, CY
Note that sampled plants do not come from all the Member States in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires

In 2010 based on the sample of plants surveyed Southern Europe represented the region with lowest average price. Between 2010 and 2012 the 5 plants in Southern Europe saw a sustained increase in electricity prices of more than 20%. As a result of this, in 2012 Southern Europe was the region with the highest average electricity price (105 €/MWh compared to 103.4 and 95 €/MWh for Central and Northern Europe, respectively).

In terms of electricity price components, energy still represents the most significant one in the 13 sampled plants. However, despite a slight increase between 2010 and 2012 - from 58.3 €/MWh to 59.9 €/MWh – its share of the total price has decreased from 65% to 58%. This development is related to the stronger increase in other components.

This is due to the significant increase in all other components, with grid fees going up by 21% in the plants surveyed (from 17.6 to 21.3 €/MWh), other non-recoverable taxes and levies increasing by 28.4% (from 8.1 to 10.4 €/MWh) and RES levy by 73.0% (from 6.3 to 10.9 €/MWh). Between 20120 and 2012, the share of components other than energy in the total average electricity price went up from 35% to 42%.

Figure 31 Components of the electricity bills paid by the 13 sampled bricks and roof tiles producers in Europe (€/MWh)



	EU 2010	EU 2011	EU 2012	Northern Europe 2010	Northern Europe 2011	Northern Europe 2012	Central Europe 2010	Central Europe 2011	Central Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
RES levy	6,3	8,4	10,9	1,4	6,1	3,0	12,6	17,2	17,8	3,7	3,9	8,4
Other (excl. VAT)	8,1	9,8	10,4	10,5	7,6	10,2	8,0	12,1	12,6	7,4	8,2	8,4
Grid fees	17,6	19,7	21,3	27,0	20,4	28,0	16,3	15,7	15,2	15,3	20,0	23,6
Energy comp.	58,3	55,5	59,9	51,0	57,2	53,8	58,5	54,3	57,9	60,6	57,1	64,5

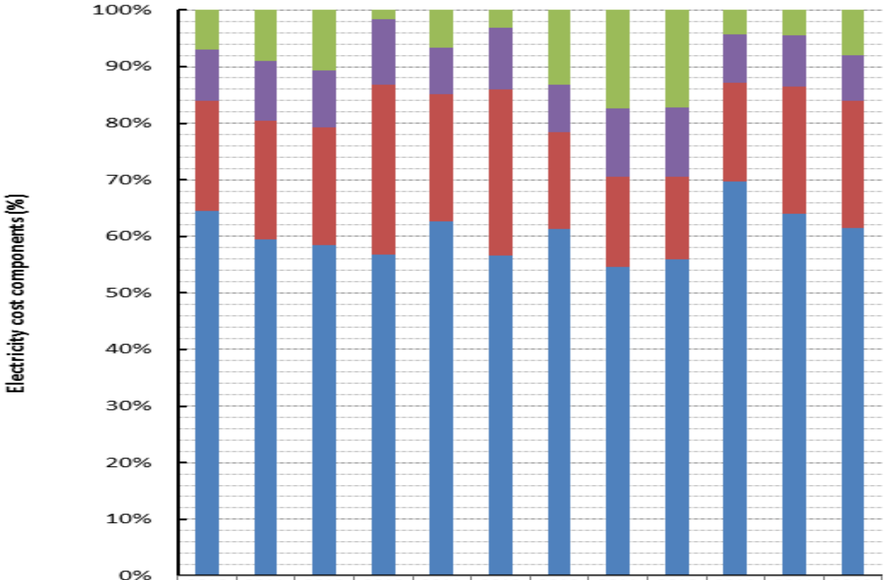
Source: CEPS, calculations based on questionnaires.

Looking at the trend in the plants surveyed in different regions, RES levies registered a much higher increase in the plants surveyed both in Southern and in Northern Europe compared to Central Europe (127%, 114% and 41% respectively). Despite the different dynamics, however, the impact of RES levies on final price remained greater in the Central Europe where they represented 17% of the total.

The non-recoverable tax component increased considerably in the plants surveyed in Central Europe (+57%) while only slightly increasing (+13%) or remaining stable in the plants in Southern and Northern Europe, respectively.

Finally, grid fees went up by 54% in the plants surveyed in Southern Europe compared to slight decrease or increase elsewhere, therefore, pushing up the EU average.

Figure 32 Components of the electricity bills paid by the 13 sampled bricks and roof tiles producers in Europe (€/MWh)



	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
	EU			Northern Europe			Central Europe			Southern Europe		
RES levy	7%	9%	11%	2%	7%	3%	13%	17%	17%	4%	4%	8%
Other (excl. VAT)	9%	11%	10%	12%	8%	11%	8%	12%	12%	9%	9%	8%
Grid fees	19%	21%	21%	30%	22%	29%	17%	16%	15%	18%	22%	22%
Energy comp.	65%	59%	58%	57%	63%	57%	61%	55%	56%	70%	64%	61%

Energy comp. Grid fees Other (excl. VAT) RES levy

Source: CEPS, calculations based on questionnaires.

1.1.2.2. Wall and floor tiles

The results of the case study for wall and floor tiles presented below are based on the answers provided by a sample of 12 plants to a questionnaire and to each sections of it, as reported in the table below. The share of the sampled plants in EU production could not be calculated. Production volumes are reported using different units due to homogeneity of products.

Table 8 – Number of questionnaires used in the wall and floor tiles case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and margins
24	12	12	12	6	6	9

The average electricity price paid by the sample of 12 wall and floor tiles producers has increased by more than 20% between 2010 and 2012, from 80.8 to 97.6 €/MWh. The spread between the lowest and the highest price has also increased by about 37%, going from 63.5 to 86.8 €/MWh, indicating an increased variability across operators.

Table 9 Descriptive statistics for electricity prices paid by the 12 sampled EU wall and floor tile producers (€/MWh)

Electricity price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	80,8	88,8	97,6	20,8
EU minimum	64,1	71,4	76,9	20,0
EU maximum	127,6	130,3	163,7	28,3
Central and Northern Europe (average)	74,4	86,3	92,0	23,7
South-Western Europe (average)	85,3	89,5	92,9	8,9
South-Eastern Europe (average)	99,5	103,6	120,1	20,7

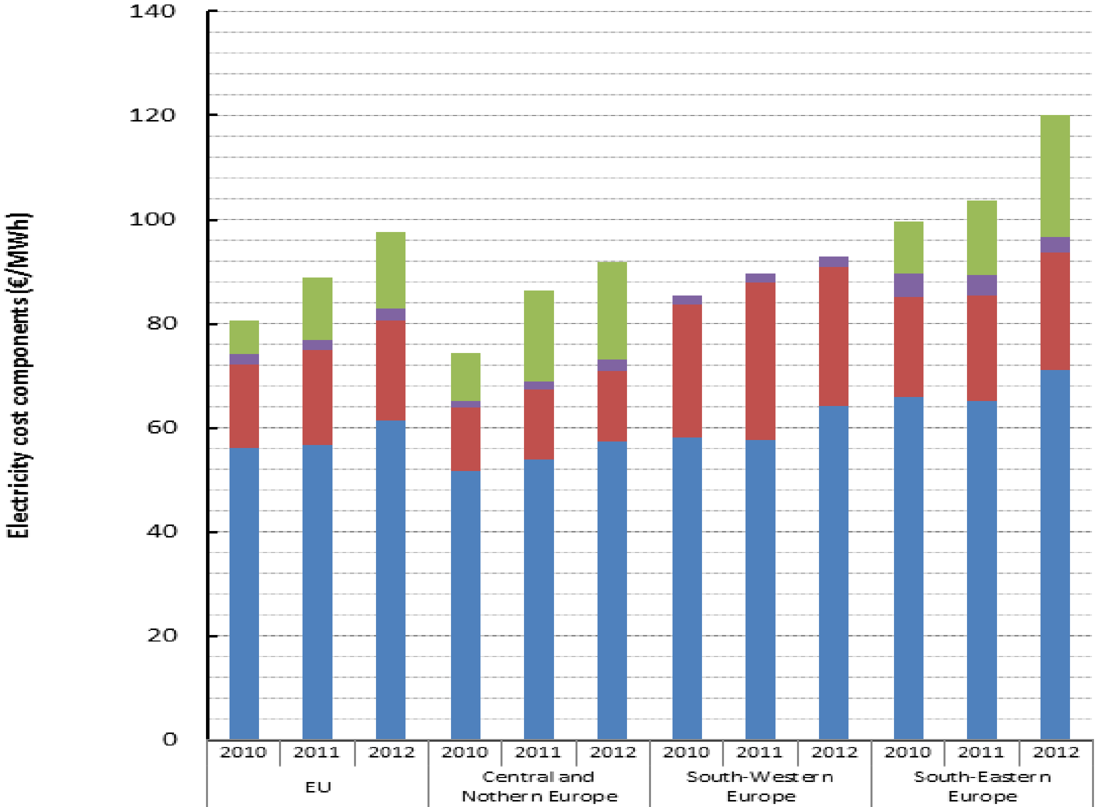
Central and Northern Europe includes 3 plants: IE, UK, BE, LU, NL, DK, DE, PL CZ, LV, LT, EE, SE, FI
South-Western Europe includes 5 plants: ES, PT, FR
South-Eastern Europe includes 4 plants: IT, SI, AT, HU, SK, HR, BU, RO, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires

With regard to the regions assessed, the strongest increase in electricity price was registered in the 3 plants based in Central and Northern Europe (23.7%), which led to an average price in 2012 in line with the price paid by 5 plants in South-Western Europe. However, in each of the years observed, the highest price of electricity is paid by operators in South-Eastern Europe, which paid 120 €/MWh in 2012 (up by 21% compared two 2010).

With regard to the electricity price components in the 12 sampled plants, energy still represents the most significant one although, despite an increase in absolute terms of about 9%, its relative weight for the whole sample decreased from 70% in 2010 to 63% two years later. The result is mainly the consequence of the strong increase of the RES levy component, which more than doubled over the period, going from 6.7 €/MWh in 2010 to 14.7 €/MWh in 2012 (+119%). The other components, namely grid fees and other non-recoverable taxes also

increased but at a lower pace (about 20%), resulting in a rather stable share over the total price.

Figure 33 Components of the electricity bills paid by the 12 sampled wall and floor tiles producers in Europe (€/MWh)



	EU 2010	EU 2011	EU 2012	Central and Nothern Europe 2010	Central and Nothern Europe 2011	Central and Nothern Europe 2012	South-Western Europe 2010	South-Western Europe 2011	South-Western Europe 2012	South-Eastern Europe 2010	South-Eastern Europe 2011	South-Eastern Europe 2012
RES levy	6,7	11,9	14,7	9,4	17,4	18,9	0,0	0,0	0,0	9,8	14,3	23,6
Other (excl. VAT)	1,8	1,9	2,2	1,3	1,4	2,3	1,7	1,7	1,9	4,4	4,0	2,9
Grid fees	16,1	18,4	19,4	12,2	13,5	13,3	25,4	30,1	26,7	19,3	20,2	22,4
Energy comp.	56,2	56,6	61,3	51,6	54,0	57,5	58,2	57,7	64,3	66,0	65,2	71,2

Energy comp. ■ Grid fees ■ Other (excl. VAT) ■ RES levy

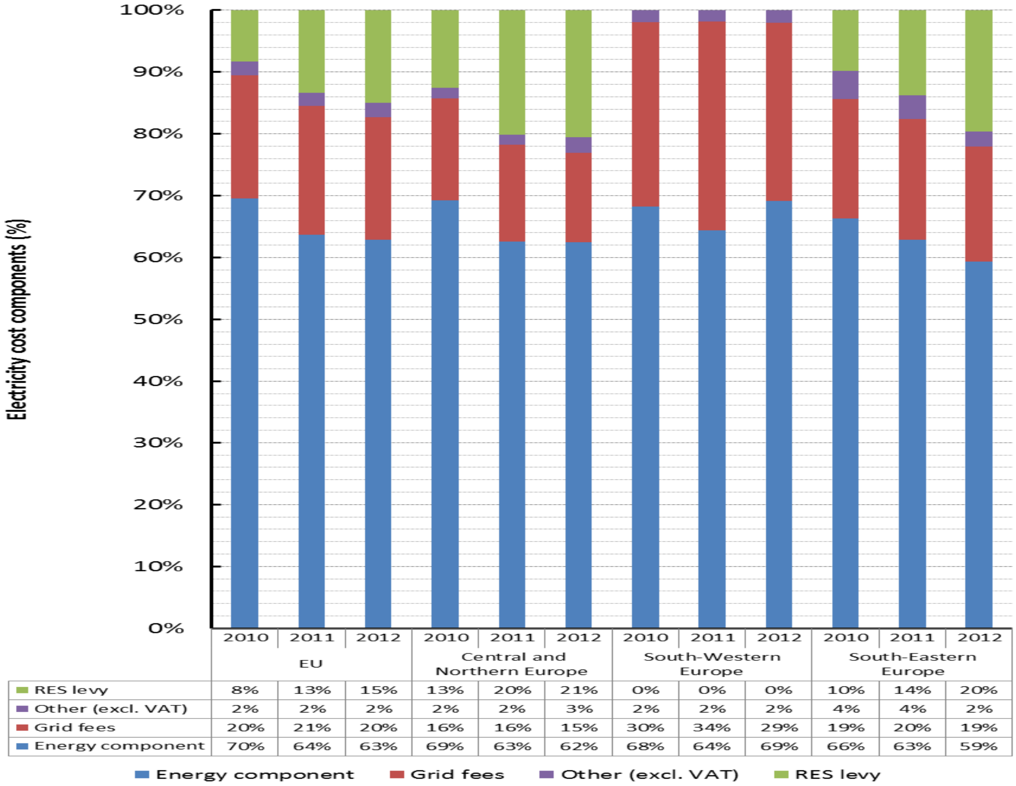
Source: CEPS, calculations based on questionnaires.

Looking at the trend in different regions, RES levies registered a very high increase in the plants surveyed in both Central and Northern Europe and in these based in South-Eastern Europe (101% and 141%, respectively). The relative weight of the RES component in the two regions therefore went up to about 20%.

However, in the sample of plants located in South-Eastern Europe a 34% decrease in other non-recoverable taxes is observed (from 4.4 €/MWh in 2010 to 2.9 €/MWh in 2012) while these increase in Central and Northern Europe and remained fairly stable in South-Western Europe. The size of RES contributions in South-West Europe could not be established based on the invoices provided by respondent plants.

Grid fees increased in all three regions, with the highest increase registered in South-Eastern Europe (about 16%).

Figure 34 Components of the electricity bills paid by the 12 sampled wall and floor tiles producers in Europe (€/MWh)



	EU			Central and Northern Europe			South-Western Europe			South-Eastern Europe		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
RES levy	8%	13%	15%	13%	20%	21%	0%	0%	0%	10%	14%	20%
Other (excl. VAT)	2%	2%	2%	2%	2%	3%	2%	2%	2%	4%	4%	2%
Grid fees	20%	21%	20%	16%	16%	15%	30%	34%	29%	19%	20%	19%
Energy component	70%	64%	63%	69%	63%	62%	68%	64%	69%	66%	63%	59%

Source: CEPS, calculations based on questionnaires.

1.1.2.3. Float glass

The results of the case study for float glass presented below are based on the answers provided by a sample of plants to a questionnaire and to each sections of it, as reported in the table below. The 10 plants in the sample represent about 19% of European production.

Table 10. Number of questionnaires used in the float glass case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs	Margins
10	10	10	7	10	7	4

Average electricity prices in the sampled plants were on the rise in the period 2010-2012. These increased by about 10% between 2010 and 2012, from 76.7 to 84.3 €/MWh. The spread between the lowest and the highest price is considerably high and has further increased, going from 60 to 82 €/MWh (+37%).

Different price dynamics can be observed across regions. In particular the increase is particularly evident for the 2 sampled operators in Southern Europe, which already paid the highest price in 2010 and in 2012 paid almost twice as much as the 2 plants in Eastern Europe.

Table 11 Descriptive statistics for electricity prices paid by the 10 sampled EU float glass producers (€/MWh)

Electricity price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	76,7	79,3	84,3	9,9
EU minimum	50,6	50,5	55,1	8,9
EU maximum	110,0	113,9	136,6	24,2
Western Europe (average)	78,3	80,4	83,9	7,2
Southern Europe (average)	93	96,7	110,3	18,6
Eastern Europe (average)	59,1	62,6	64,7	9,5

Western Europe includes 6 plants: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes 2 plants: BG, RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes 2 plants: IT, MT, CY, PT, ES, EL, SI
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires.

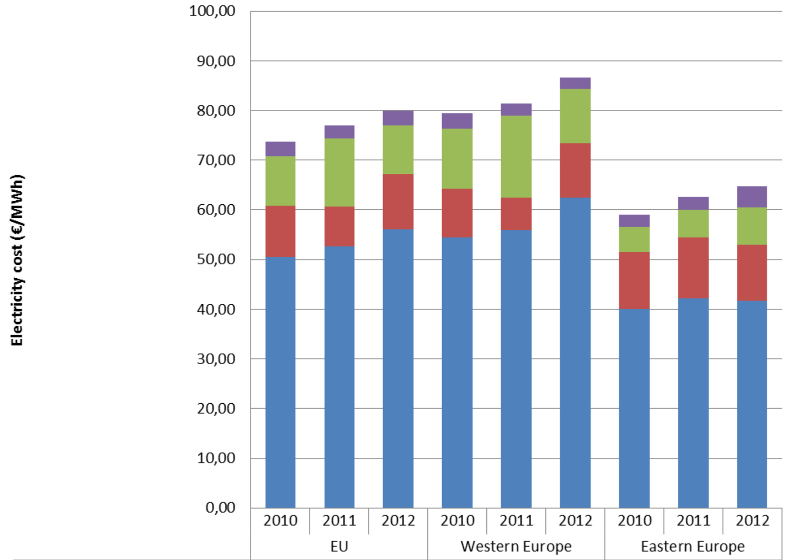
The energy component is the largest component, with a share of about 71% of the total. Based on the 10 sampled plants, between 2010 and 2012, the energy component has increased by 8%, from 52 €/MWh to 56.1 €/MWh. Over the same period different trends can be observed for the other price components. In particular, in the plants surveyed grid fees increased overall by 11% after a decline between 2010 and 2011. At the end of the period their share of total price results only slightly higher compared to the previous year but still in the range of 15%.

The average of RES levies increased by 37% between 2010 and 2011 but decreased afterwards and led to a slight reduction in the relative share of RES in the total price since 2010 (from 12% to 11%). In contrast, other non-recoverable taxes and levies decreased between 2010 and 2011 and then decreasing the following year, registered an overall decrease of about 3% at the end of the period.

Different trends can be observed across regions. In fact, while for the 6 plants in Western Europe the average RES levy and other non-recoverable taxes decreased both in absolute and relative terms, in the 2 plants in Eastern Europe the same components increased in absolute terms by 51% and 64%, respectively, therefore resulting in a higher weight on total price.

In 2012, components other than energy (production costs) in the 2 Eastern European plants accounted on average for about 35% of the total electricity price, compared to 30% in 2010.

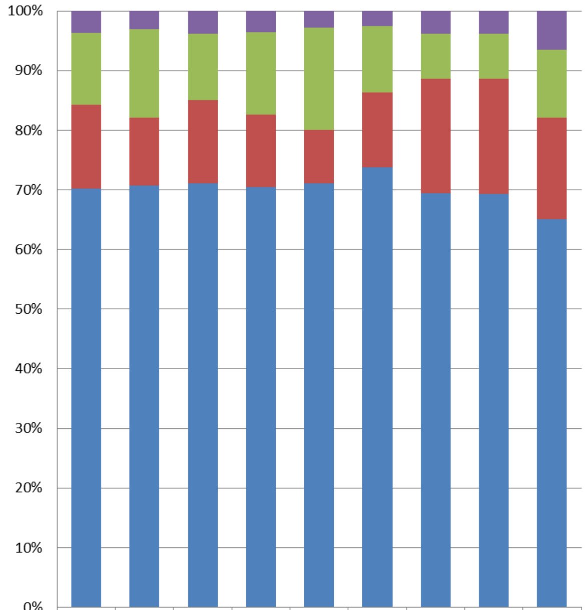
Figure 35 Components of the electricity bills paid by the sampled float glass producers in Europe (€/MWh)



	EU 2010	EU 2011	EU 2012	Western Europe 2010	Western Europe 2011	Western Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012
Other levies & taxes (excl. VAT)	2,93	2,60	2,84	3,11	2,57	2,26	2,5	2,7	4,1
RES levy	10,07	13,80	9,94	12,00	16,37	10,98	5,04	5,49	7,61
Grid fees	10,27	7,96	11,04	9,81	6,64	10,92	11,46	12,21	11,31
Energy component	50,47	52,66	56,07	54,45	55,87	62,45	40,09	42,26	41,65

Source: CEPS, calculations based on questionnaires.

Figure 36 Components of the electricity bills paid by the sampled float glass producers in Europe %)



	EU 2010	EU 2011	EU 2012	Western Europe 2010	Western Europe 2011	Western Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012
Other taxes and levies	3,66%	3,00%	3,76%	3,60%	2,75%	2,57%	3,82%	3,84%	6,45%
Levy for RES and other non-recoverable taxes	12,04%	14,94%	11,21%	13,78%	17,24%	11,08%	7,49%	7,50%	11,50%
Network cost	14,15%	11,36%	13,96%	12,18%	8,89%	12,61%	19,27%	19,32%	17,01%
Energy component	70,15%	70,70%	71,07%	70,44%	71,12%	73,74%	69,42%	69,34%	65,04%

Source: CEPS, calculations based on questionnaires.

1.1.2.4. Ammonia

The results of the case study for ammonia producers are based on the answers provided by a sample of plants to a questionnaire and to each section of it, as reported in the table below.

The 10 sampled plants represent in total about 26% of EU27 production. Considering that about 80% of the global ammonia production is used for the production of fertilisers, the case study focused on ammonia plants that in the vast majority of cases are integrated in large installations that subsequently produce fertilisers. The sample includes 2 small, 4 medium and 4 large-sized plants. The 10 plants are located in 10 different member states.

Table 12 Number of questionnaires used in the ammonia case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs
10	10	10	10	10	7

Natural gas is the predominant fuel used by the sampled plants, accounting for about 90-94% of their total energy costs. Electricity accounts for about 4-8% of total energy costs of the sampled plants.

Data collected show that the average price of electricity paid by the sampled producers of ammonia has increased by 11% between 2010 and 2012, from 63.9 to 71.1 €/MWh. The gap of prices paid by sampled producers has also increased.

From the 10 sampled plants, similar price increases can be observed in all the geographical regions defined, in line with the EU average. Nevertheless, the surveyed plants in Southern Europe witnessed the highest price throughout the 3-year period assessed.

Table 13 Descriptive statistics for electricity prices paid by 10 sampled ammonia EU producers (€/MWh)

Electricity price (€/MWh)	2010	2011	2012	% change 2010-2012
EU (average)	63.9	72.5	71.1	11.3
Western-Northern Europe (average)	54.0	62.4	61.0	13.0
Southern Europe (average)	86.3	95.5	96.0	11.2
Eastern Europe (average)	64.3	73.6	70.7	10.0

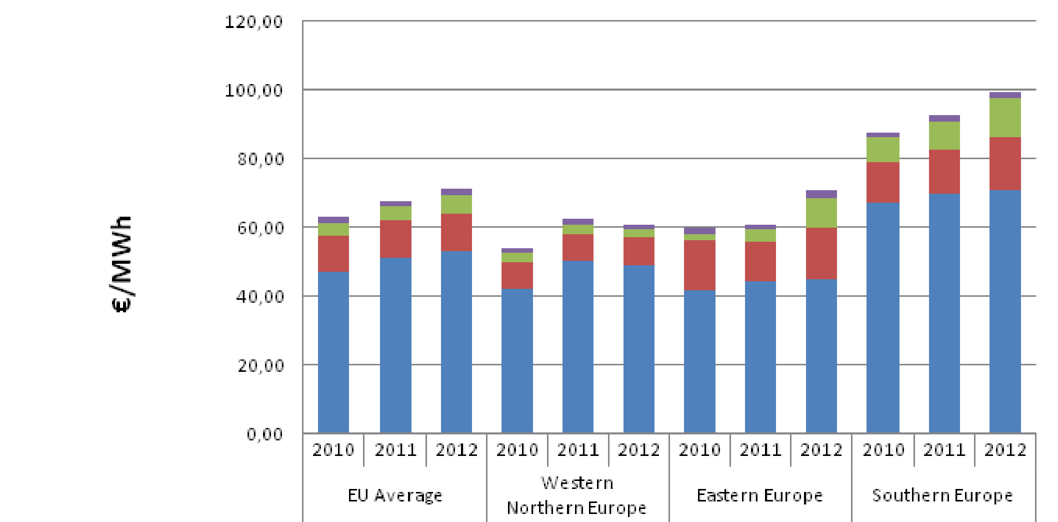
Western-Northern Europe includes: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes: RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes: IT, MT, CY, PT, ES, EL, SI, BG
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons. The number of sampled plants per region cannot be disclosed due to confidentiality.
Source: CEPS, calculations based on questionnaires.

With regard to the different price components, the energy part accounts for more than 60% of the total price. Between 2010 and 2012, the energy component increased on average for the whole sample by 12%, from 47.1 to 52.9 €/MWh

For the 10 sampled plants other non-recoverable taxes remained stable both in absolute terms (around 1.6-1.8 €/MWh) and as a share of total price (2.5%). The contribution of RES levies in the total bill has steadily increased from 5.6% in 2010 to 8% in 2012, reaching 5.7 €/MWh in absolute terms in 2012. As for the grid fees, their impact on the total bill decreased from 17.1% in 2010 to 15.5% in 2012. Their absolute value remained almost stable between 2010 and 2012 (around 11€/MWh).

Over the period, the plants in Southern Europe experienced the highest impact of RES levies on the total energy bill. In absolute terms, RES levies increased from 7.17 €/MWh in 2010 to 11.37 €/MWh (+59%) in 2012. The plants in Eastern Europe experienced the highest increase of RES levies, from 1.95 €/MWh in 2010 to 8.33 €/MWh in 2012, with their contribution to the bill increasing from 3.2% in 2010 to 11.8% in 2012.

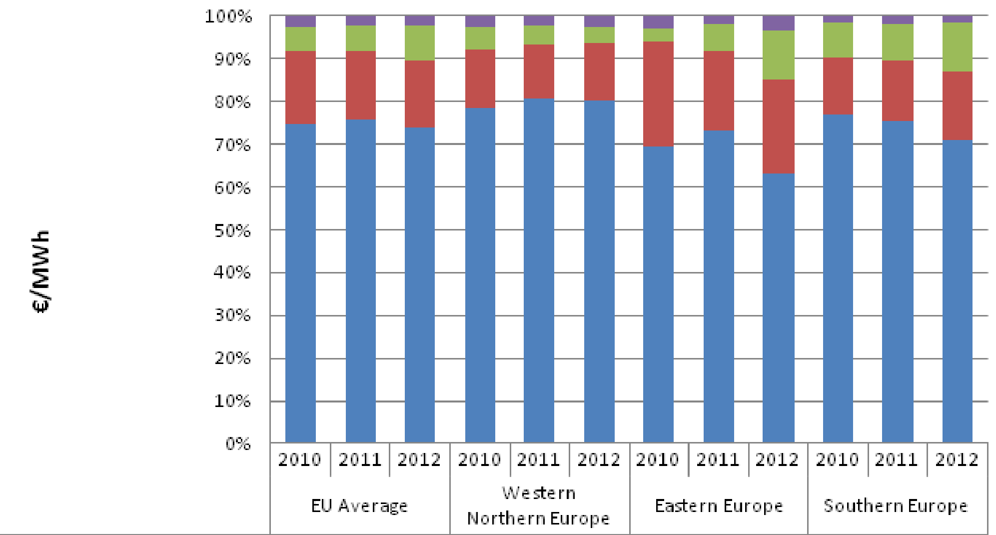
Figure 37 Components of the electricity bills paid by the 10 sampled ammonia producers in Europe (€/MWh)



	EU Average 2010	EU Average 2011	EU Average 2012	Western Northern Europe 2010	Western Northern Europe 2011	Western Northern Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other non-recoverable taxes	1,58	1,45	1,75	1,54	1,43	1,57	1,75	1,28	2,30	1,37	1,92	1,64
RES Levy	3,53	4,13	5,70	2,68	2,87	2,29	1,95	3,63	8,33	7,17	7,91	11,37
Grid Fees	10,78	10,84	11,05	7,44	7,80	8,29	14,51	11,32	15,38	11,83	12,87	15,82
Energy component	47,10	51,36	52,91	42,37	50,36	48,86	41,69	44,56	44,73	67,40	70,01	70,65

Source: CEPS, calculations based on questionnaires.

Figure 38 Components of the electricity bills paid by the 10 sampled ammonia producers in Europe (%)



	EU Average 2010	EU Average 2011	EU Average 2012	Western Northern Europe 2010	Western Northern Europe 2011	Western Northern Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other non-recoverable taxes	2,5%	2,1%	2,5%	2,9%	2,3%	2,6%	2,9%	2,1%	3,2%	1,6%	2,1%	1,7%
RES Levy	5,6%	6,1%	8,0%	5,0%	4,6%	3,8%	3,2%	6,0%	11,8%	8,2%	8,5%	11,4%
Grid Fees	17,1%	16,0%	15,5%	13,8%	12,5%	13,6%	24,2%	18,6%	21,7%	13,5%	13,9%	15,9%
Energy component	74,8%	75,8%	74,1%	78,4%	80,6%	80,1%	69,6%	73,3%	63,2%	76,8%	75,5%	71,0%

Source: CEPS, calculations based on questionnaires.

1.1.2.5. Chlorine

The results of the case study for chlorine producers presented below are based on the answers provided by a sample of plants to a questionnaire and to each sections of it, as reported in the table below. The 9 sampled plants represent about 12% of EU27 production. The membrane manufacturing technology represents 62% of the capacity of the plants in the sample, the mercury technology 32% and others 6%. The diaphragm technology is not represented in the sample.

Table 14 Number of questionnaires used in the chlorine case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs
11	9	9	9	9	5

Electricity is the predominant fuel of the 9 sampled plants and accounts for about 91% of total energy costs[53] and for 43-45% of total production costs[54] of the sampled plants. All sampled chlorine producers use electricity as a primary source of energy, while some use steam as a secondary energy carrier[55].

The average price of electricity paid by the sampled chlorine producers increased slightly between 2010 and 2011, and then decreased in 2012.Overall, between 2010 and 2012 the average electricity price fell by 5%, from 59.4 to 56.4 €/MWh. This result is a weighted average and strongly influenced by the trend registered in the 6 plants in Central-Northern Europe, which contains a higher share of the total sampled production capacity. The average price paid by the 6 operators in this region decreased by about 10% (from 60.3 to 54.1 €/MWh) while the price observed in the 3 sampled plants in Southern-Western Europe registered a very significant increase (40%) and in 2012 was 1.3 times higher than the average price in Central-Northern Europe.

With regard to the different price components, the energy part slightly decreased in absolute terms between 2010 and 2012, from 48.7 to 48.9 €/MWh, although its relative share of the total electricity price increased to almost 87%.

For the sampled plants grid fees and RES levy also decreased over the period assessed: grid fees from 6.9 to 5 €/MWh (-29%), RES levy from 2.5 to 1 €/MWh (-59%), which for both components is associated with a reduction in their relative share of the total price (from 11.7% in 2010 to 8.8% in 2012 for grid fees and from 4.2% in 2010 to 1.8% for RES).

[53] Average for the nine sampled plants.
[54] Average for the five plants that provided data on production costs.
[55] The number of data points was too low to allow for an analysis of steam as a secondary energy carrier. Natural gas is used by only one plant in the sample. For these reasons, the analysis is limited to electricity prices and costs (chapter 2).

Table 15 Descriptive statistics for electricity prices paid by the 9 sampled EU producers of chlorine (€/MWh)

Electricity price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	59.4	59.8	56.4	-5.1
Southern-Western Europe (average)	51.9	61.5	72.7	40,1
Central-Northern Europe (average)	60.3	59.5	54.1	-10.3

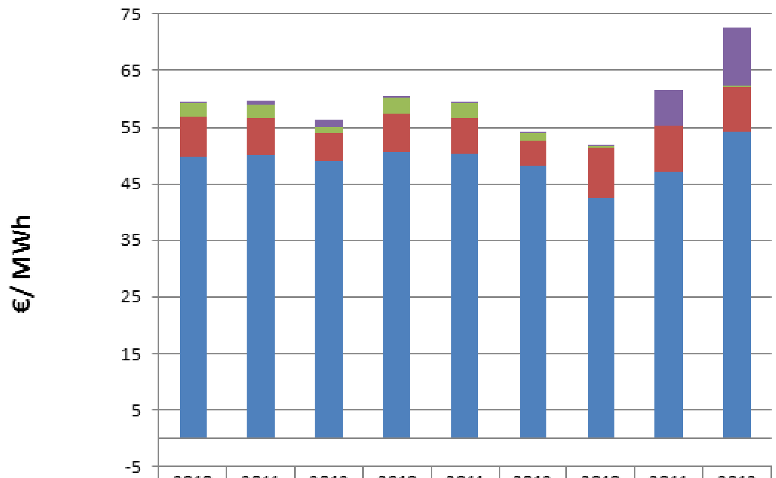
Central-Northern Europe includes 6 plants: IE, UK, BE, LU, NL, DE, PL, CZ, LV, LT, EE, DK, SE, FI
Southern-Western Europe includes 3 plants: ES, PT, FR
For remaining MS, no questionnaires were received and no averages could be calculated.
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires.

On the contrary, although still having a relatively small impact on total price (2.5% in 2012), other non-recoverable taxes registered a significant increase from 0.2 to 1.4 €/MWh.

Looking at regional averages, one can observe a 25 fold increase of non-recoverable taxes in the 3 Southern-Western European plants, from 0.44 to 10.5 €/MWh between 2010 and 2012. As a consequence, their weight on total electricity price paid by the sampled plants went up from less than 1% to more than 14%. In the same region, the energy component increased also substantially in absolute terms, from 42.5 to 54.2 €/MWh (+28%) while other components decreased both in absolute terms and as a share of total price.

As observed before, in the 6 plants in Central-Northern Europe the overall average electricity price decreased between 2010 and 2012. Looking at the different components, one can see that all components decreased except non-recoverable taxes, which remained stable and with a very limited share of total price.

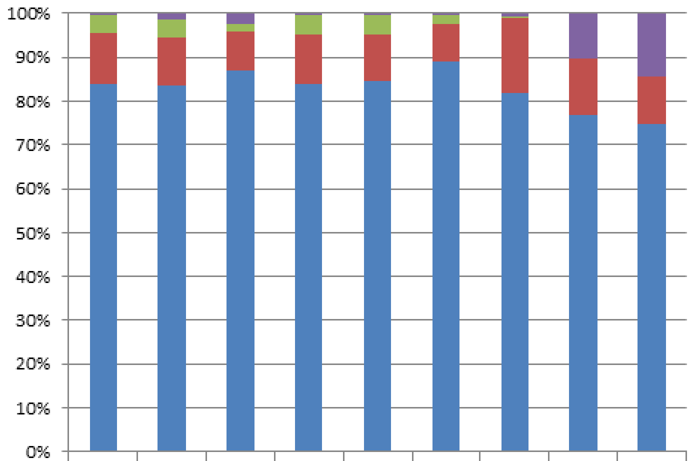
Figure 39 Components of the electricity bill paid by the 9 sampled chlorine producers in Europe (€/MWh)



	EU average			Central Northen Europe			Southern Western Europe		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Other non-recoverable taxes	0,20	0,87	1,41	0,17	0,17	0,20	0,44	6,24	10,47
RES levy	2,49	2,34	1,02	2,81	2,63	1,15	0,12	0,10	0,07
Grid fees	6,97	6,63	4,98	6,69	6,45	4,58	8,86	7,98	7,97
Energy component	49,76	49,96	48,94	50,66	50,22	48,14	42,49	47,22	54,20

Source: CEPS, calculations based on questionnaires.

Figure 40 Components of the electricity bill paid by the 9 sampled chlorine producers in Europe (%)



	EU average			Central Northen Europe			Southern Western Europe		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Other non-recoverable taxes	0,3%	1,4%	2,5%	0,3%	0,3%	0,4%	0,9%	10,1%	14,4%
RES levy	4,2%	3,9%	1,8%	4,7%	4,4%	2,1%	0,2%	0,2%	0,1%
Grid fees	11,7%	11,1%	8,8%	11,1%	10,8%	8,5%	17,1%	13,0%	11,0%
Energy component	83,7%	83,5%	86,8%	84,0%	84,4%	89,0%	81,9%	76,7%	74,5%

Source: CEPS, calculations based on questionnaires.

1.1.2.6. Steel

The results of the case study for steel producers are based on the answers provided by a sample of 17 plants, out of more than 500 steel plants in the EU. The sample installations were self-selected by the industrial sector.

Steel making plants can be broadly classified in two different groups, integrated plants and mini-mills. The former use Basic Oxygen Furnaces (BOFs) to transform iron ore and coke into steel. Mini-mills are plants comprising only steel furnaces and rolling and finishing facilities. Mini-mills generally use Electric Arc Furnaces (EAFs) to produce steel and mainly rely on scrap rather than raw iron, which is usually purchased as processed input. The results of the case study for steel producers are based on the answers provided by a sample of plants to a questionnaire and to each sections of it, as reported in the table below[56]. For each technology, sampled plants had different capacity in order to reflect a distribution similar to that of the steel making universe.

The 4 BOF plants included in the sample range from small to medium (up to 4.5 MMt), while very large BOF plants are not covered. The 9 EAF plants included are very diversified in terms of capacity, ranging from small (< 400 thousand tonnes) to large (> 1.3MMt). Consumption of electricity for steel making is very different between BOFs and EAFs. Electricity intensity of the BOF process is about one third of EAF; furthermore, BOF installations usually include a self-generation facility, where electricity is produced out of recycled waste gases from the furnaces. This means that on average sampled BOF producers procure electricity from external sources for about 60% of their total electricity consumption. Once these factors are accounted for, the sample points to the fact that much smaller EAF installation consumes as much electricity as larger BOF ones.

Consumption levels for the 9 EAF plants in the sample range between 150 and 600 GWh per year; as for the 4 BOF plants, the range is between 350 and 750 GWh per year. Given that the production process is standardised, the biggest determinant of electricity consumption is plant capacity, and the presence of hot or cold rolling facilities within the plant premises.

Table 16 Number of questionnaires used in the steel case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and Margins
17	17	15 (gas) 17 (electr.)	14 (gas) 17 (electr.)	11 (gas) 14 (electr.)	3	*

* Data available from the Cumulative cost Assessment Study (CEPS)

Compared to natural gas, both EU average and EU median electricity prices paid by the 17 sampled steel plants are more stable. EU sample price went up by 7% from 66.8 to 71.4 €/MWh.

[56] In the sample, both technologies are represented, as 4 BOF and 9 EAFs are included plus two national representative facilities mostly referring to EAF producers and two rolling mills. EAF plants, given their higher electricity intensity per tonne of steel and the fact that do not own self-generation facilities running on waste gases, are mostly exposed to the costs of energy.

Different geographical regions have all registered an increasing trend although of different intensity, as it can be seen from the table below:

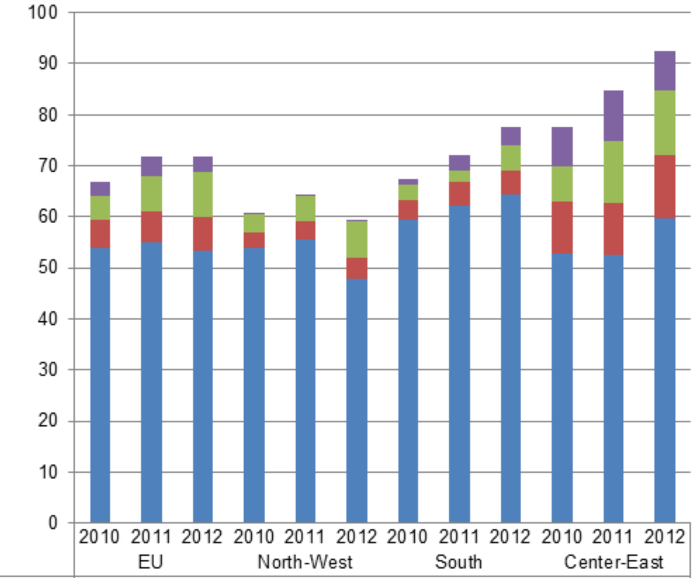
Table 17 Descriptive statistics for electricity prices paid by 17 sampled EU producers of steel (€/MWh)

Electricity price (€/MWh)	2010	2011	2012	% change 2010-2012
EU (average)	66,8	71,2	71,4	6,9
EU (minimum)	51,8	51,0	46,5	-10,2
EU (maximum)	89,6	93,5	104,4	16,5
Central and Eastern EU (average)	77,7	84,7	92,5	19,0
Southern EU (average)	67,7	68,8	74,2	9,6
North-Western EU (average)	60,7	64,3	59,4	-2,1
BOF Average	67,5	73,9	73,9	9,5
EAF Average	65,2	67,0	67,0	2,8

North-Western Europe includes 9 plants: FR, BE, LU, NL, IE, UK, DE, AT, DK, FI, SE
Central and Eastern Europe includes 3 plants: PL, SI, HU, RO, BG, CZ, SK, EE, LV, LT
Southern Europe includes 5 plants: IT, ES, PT, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires.

The energy component is the most significant component of the electricity price paid by the sampled production facilities in Europe. In 2010, the energy component of the electricity price paid by the 17 sampled plants amounted to 53.9 €/MWh (81% of price) and decreased to 53.3 €/MWh in 2012 (-0.1%). However, its share over the total costs shrank from 81% to 74% due to the increase of the other components, mostly RES levies. RES levies reached 8.8 €/MWh (+91%), and in 2012 they represented 12% of the final electricity bill. Network costs and other taxes and levies increased by 24% and 10%, respectively. Note that the steel industry is outside of the scope of the Energy Taxation Directive.

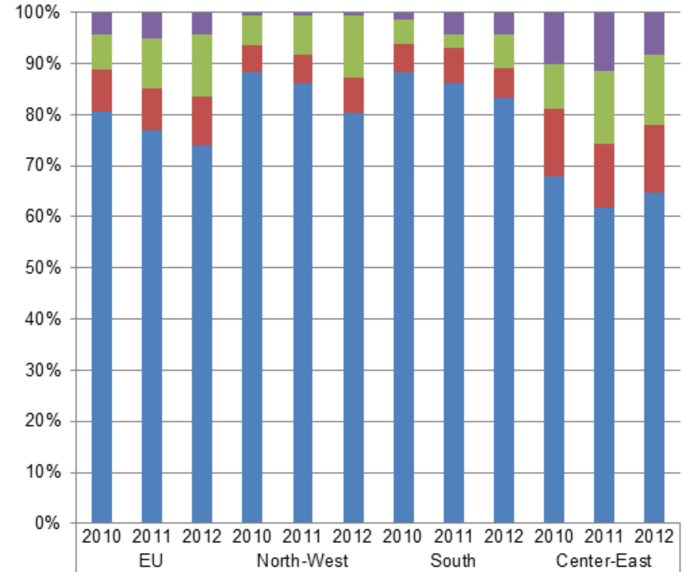
Figure 41 Components of the electricity bills paid by the 17 sampled steel producers in Europe (€/MWh)



	EU 2010	EU 2011	EU 2012	North-West 2010	North-West 2011	North-West 2012	South 2010	South 2011	South 2012	Center-East 2010	Center-East 2011	Center-East 2012
Other Taxes	2,8	3,7	3,1	0,4	0,4	0,4	0,9	3,1	3,4	7,9	9,7	7,6
RES Support	4,6	7,0	8,8	3,6	5,0	7,1	3,2	2,0	5,1	6,7	12,1	12,7
Network Costs	5,5	5,9	6,8	3,2	3,6	4,1	3,8	4,9	4,6	10,4	10,4	12,3
Energy Component	53,9	55,1	53,3	53,8	55,5	47,9	59,4	62,1	64,5	52,8	52,4	59,8

Source: CEPS, calculations based on questionnaires.

Figure 42 Components of the electricity bills paid by the 17 sampled steel producers in Europe (%)



	EU 2010	EU 2011	EU 2012	North-West 2010	North-West 2011	North-West 2012	South 2010	South 2011	South 2012	Center-East 2010	Center-East 2011	Center-East 2012
Other Taxes	4%	5%	4%	1%	1%	1%	1%	4%	4%	10%	11%	8%
RES Support	7%	10%	12%	6%	8%	12%	5%	3%	7%	9%	14%	14%
Network Costs	8%	8%	9%	5%	6%	7%	6%	7%	6%	13%	12%	13%
Energy Component	81%	77%	74%	88%	86%	80%	88%	86%	83%	68%	62%	65%

Source: CEPS, calculations based on questionnaires.

1.1.2.7. Primary aluminium

The evidence presented in the case study for aluminium is based on data collected via a questionnaire from a sample of 11 out of the 16 primary smelters in the EU, representing more than 60% of EU primary aluminium production in 2012. The data has been validated using the CRU database[57].

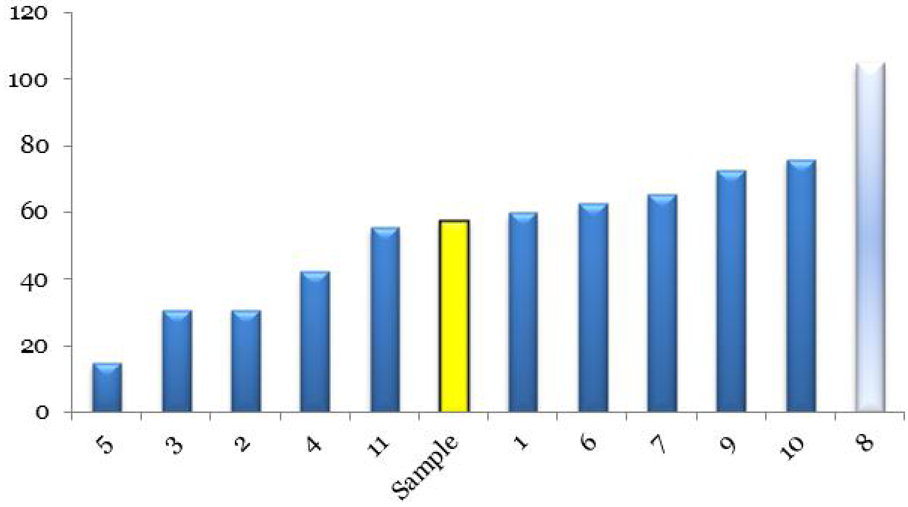
In contrast to other case studies in this report, no sampling by geographical region is presented. The averages calculated for the whole sample are compared to averages obtained for two subsamples which are of great importance for understanding the issue of energy costs impact on the sector. In particular, subsample 1 refers to 5 plants which procure electricity through long-term contracts or self-generation[58] while subsample 2 refers to 6 plants which procure electricity in the wholesale market.

In terms of price per MWh, the 2012 average price is 44.7 €/MWh[59]. A wide range of diversity is seen in the actual price paid by individual plants in the sample, which can be explained by considering the two main forms of procuring electricity. The average electricity cost for subsample 1 is 24.3 €/MWh while for subsample 2 it is 56 €/MWh, more than 2.3 times higher.

Smelters with low electricity prices (subsample 1) are mainly those which are in a long-term electricity contract or which have their own generation (the minority in subsample 1). These contracts are considered to be non-replicable. As soon as these contracts come to an end, these smelters are expected to move up the electricity price curve and reach the electricity price level of the smelters in subsample 2. Smelters in subsample 2 buy electricity on the market and are impacted by differences in terms of wholesale prices on different markets, national policies, energy mix, grid costs, or other tariffs.

[57] CRU Group in an independent, privately owned company providing business intelligence services on the global metals, mining and fertilizer industries.
[58] The case of long-term contracts is the most frequent.
[59] Average weighted by 2012 production. EUR/USD exchange rate: 1.2848. 2012 annual value, source ECB.

Figure 43 Prices of electricity for the 11 sampled aluminium smelters - 2012 ($/MWh, delivered at plant)

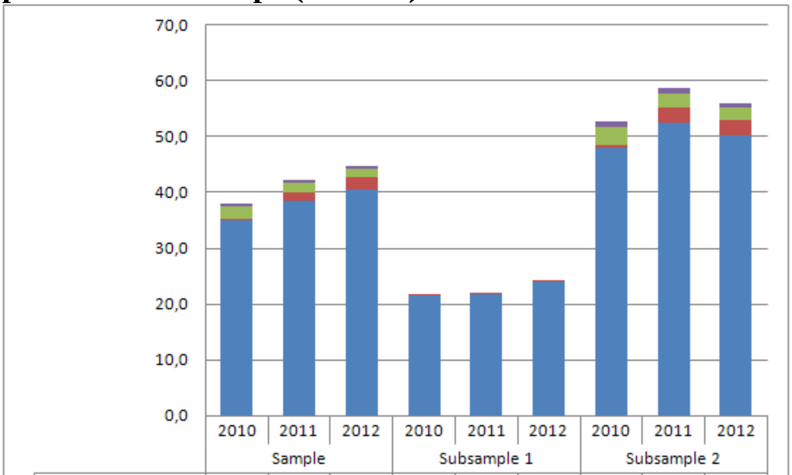


Source: CEPS, calculations based on questionnaires and CRU. Note: plant 8 is now closed.

Plants in subsample 1 are shielded from transmission costs and other taxes while the impact of RES levies is minimal, only slightly increasing from 0.7% to 1.5% of total price between 2010 and 2012.

For plants in the subsample 2, the sum of all components other than energy increased from 8.8% to 10.4% of the total price over the observed period. In particular, the increase is due to the upward trend registered for RES levies, which increased by more than 370% between 2010 and 2012 (from 0.6€/MWh to 2.9€/MWh). Transmission costs decreased by almost 30%, as a consequence of a decrease in two smelters; for all remaining smelters the component remained stable. Other taxes remained stable both in absolute terms as well as share of total price.

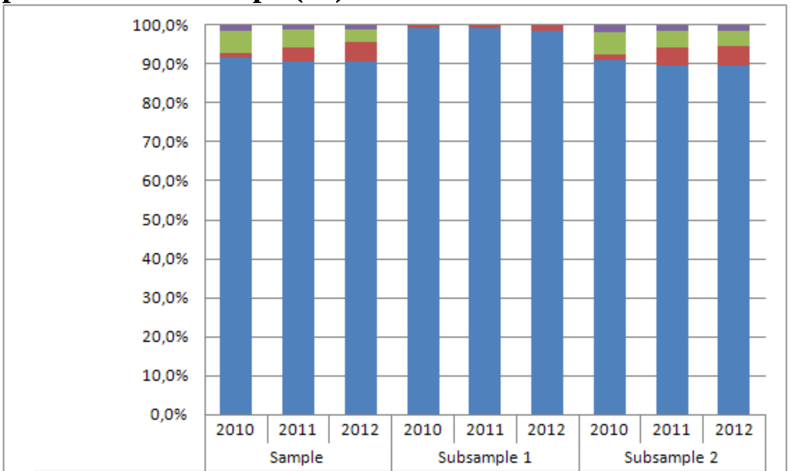
Figure 44 Components of the electricity bills paid by the 11 sampled aluminium producers in Europe (€/MWh)



	Sample 2010	Sample 2011	Sample 2012	Subsample 1 2010	Subsample 1 2011	Subsample 1 2012	Subsample 2 2010	Subsample 2 2011	Subsample 2 2012
Other taxes	0,6	0,6	0,5	0,0	0,0	0,0	0,9	0,8	0,8
Transmission Costs	2,1	1,8	1,4	0,0	0,0	0,0	3,1	2,6	2,2
RES Costs	0,4	1,5	2,2	0,2	0,2	0,4	0,6	2,7	2,9
Energy Component	34,9	38,4	40,6	21,6	21,8	23,9	48,0	52,4	50,2

Note: A certain degree of estimation is included because of the different possibility of singling out all components for all sampled plants.
Source: Calculations based on questionnaires

Figure 45 Components of the electricity bills paid by the 11 sampled aluminium producers in Europe (%)



	Sample 2010	Sample 2011	Sample 2012	Subsample 1 2010	Subsample 1 2011	Subsample 1 2012	Subsample 2 2010	Subsample 2 2011	Subsample 2 2012
Other taxes	1,6%	1,3%	1,2%	0,0%	0,0%	0,0%	1,7%	1,4%	1,4%
Transmission Costs	5,5%	4,3%	3,1%	0,0%	0,0%	0,0%	5,9%	4,5%	3,9%
RES Costs	1,0%	3,6%	4,9%	0,7%	0,8%	1,5%	1,2%	4,7%	5,2%
Energy Component	91,8%	90,8%	90,8%	99,3%	99,2%	98,5%	91,2%	89,4%	89,6%

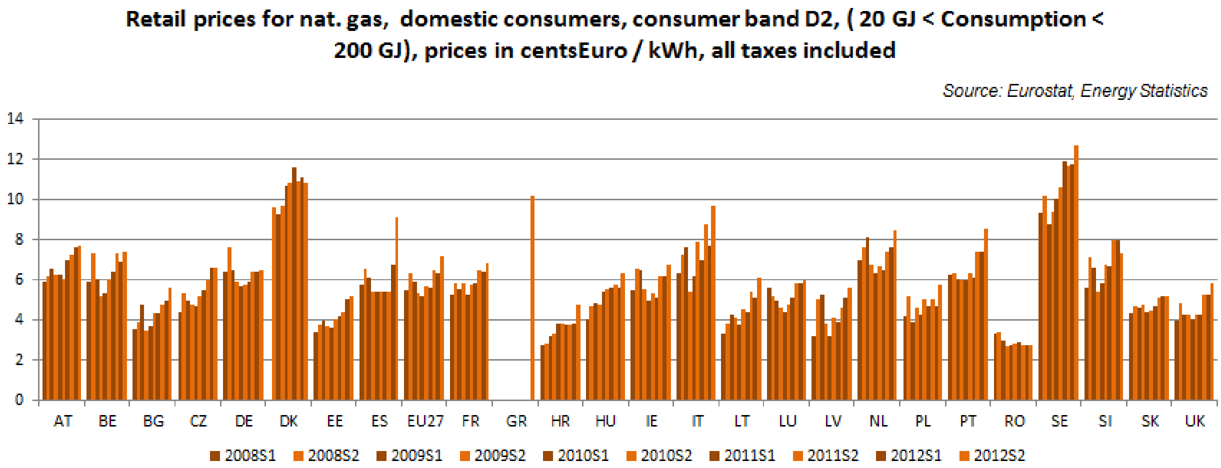
Note: A certain degree of estimation is included because of the different possibility of singling out all components for all sampled plants.
Source: Calculations based on questionnaires

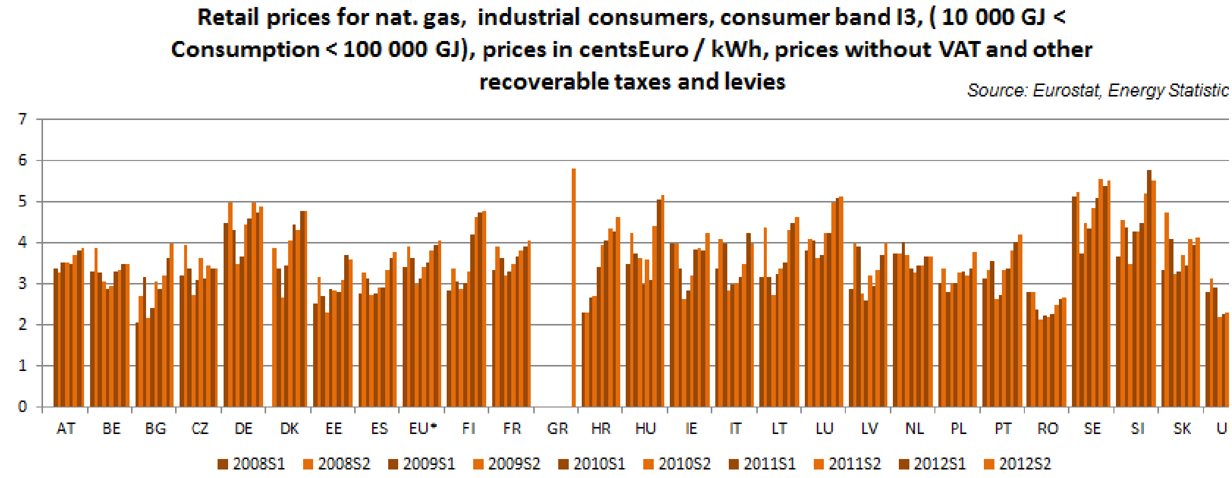
1.2. Developments in the retail markets for natural gas

Retail natural gas prices expressed in Euros

From 2008 until 2012, natural gas prices for household consumers increased in every country of the EU except for Germany and Romania. **Europe's gas prices have risen by more than 3% a year between 2008 and 2012**[60]. Bulgaria, Estonia and Spain registered annual price increases close to 10% and growth rates in Lithuania and Croatia were even higher, reaching more than 12% and 14% respectively.

Figure 46. Evolution of retail prices, natural gas, domestic and industrial consumers, centsEuro / kWh





During the observed period, industrial prices for natural gas (excluding VAT and other recoverable taxes and levies) were much more stable, with an average annual increase for the EU being less than 1%. In most Member States a similar trend was observed: prices would decrease in 2008 – 2009 and then they would pick up. Yet, the growth rates varied wildly across Member States.

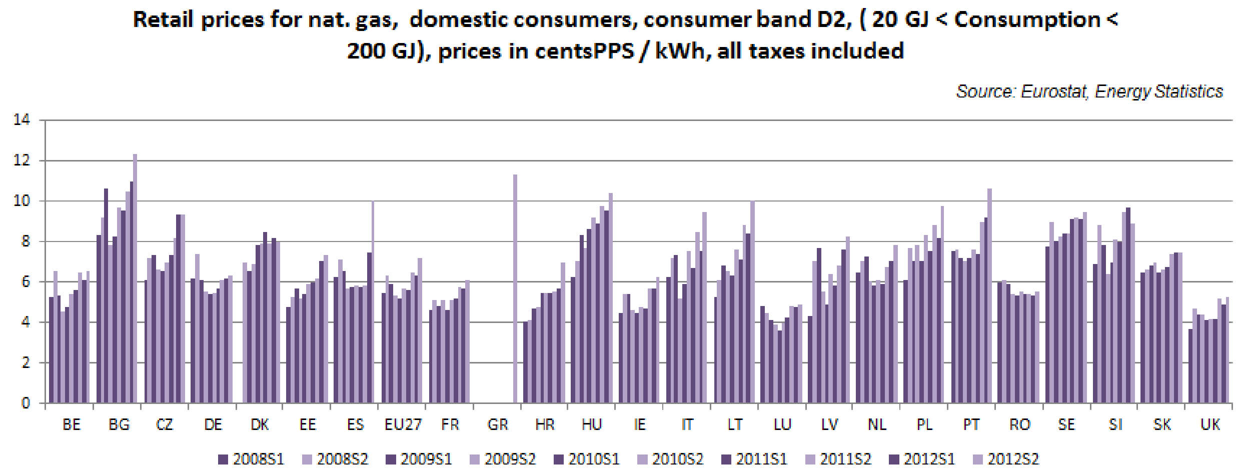
[60] Median household consumer band D2 with annual consumption between 5.56 and 55.56 MWh per year. Prices measured in cents EUR / kWh.

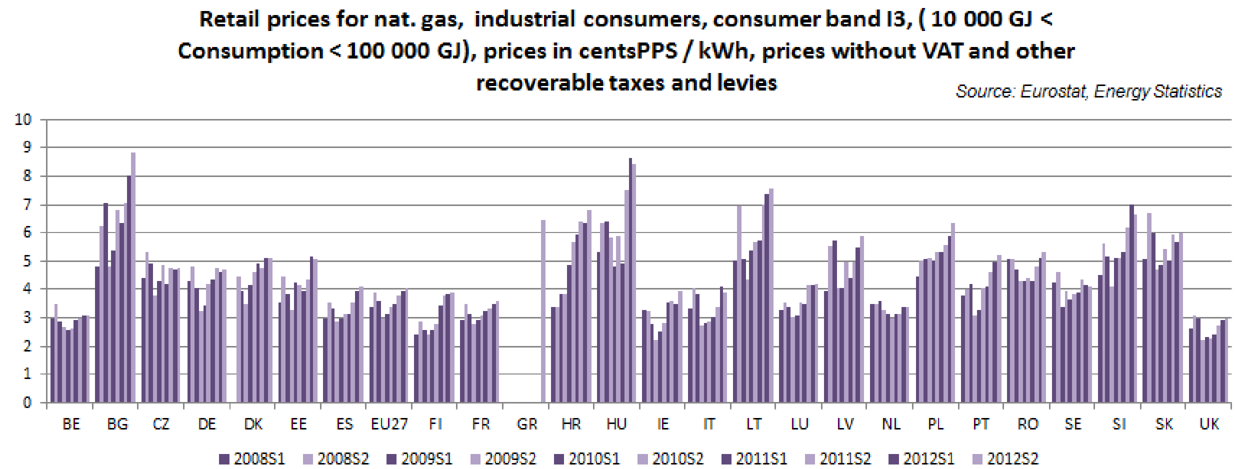
Over the whole period, natural gas prices (measured in Euro) fell for industrial consumers in Belgium, the Czech republic, Germany, Italy, the Netherlands, Romania and Slovakia whereas double digit annual growth rates were registered in Bulgaria and Croatia, even though from a relatively low basis.

__Retail natural gas prices expressed in purchasing power standards__

When the monetary measure is switched to purchasing power standards (PPS), the ranking of Member States is changed with countries from the Eastern part of the continent moving up in the ranking of countries with the highest prices. 7 out of the 10 Member States with the highest household prices are such countries with the average consumers from Bulgaria paying the highest price for natural gas.

Figure 47. Evolution of retail prices, natural gas, industrial consumers, cents PPS / kWh





The same observation applies for industrial consumers: the top 10 PPS rates are all paid by countries from the East. In the second half of 2012 industrial consumers from Hungary, Lithuania, Croatia, Slovenia, Greece, Poland, Slovakia, Latvia and Romania were paying on average higher gas prices than the countries from North West Europe; in Bulgaria industrial consumers were actually paying three times as much as in the UK.

These developments have clear negative implications for the competitiveness of the economies of the new Member States and point to the potential savings for final consumers if grids are integrated and the competitive play of supply and demand is allow to set the prices.

<u>Comparing natural gas price changes to inflation levels</u>

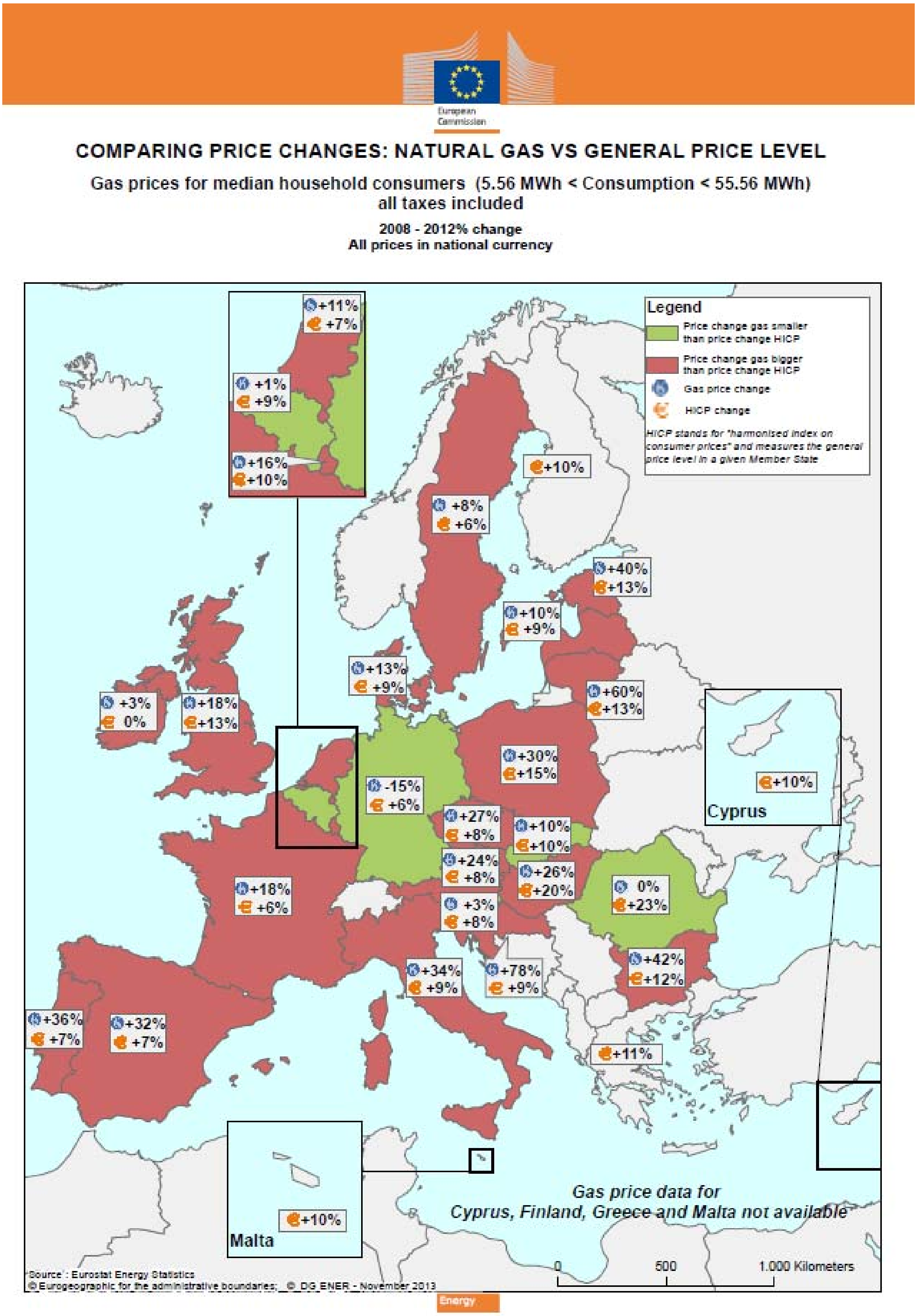
As shown on Map 4, during the observed period the increase of median household consumer prices for natural gas outpaced the increase of the general price level[61], as measured by the harmonized index of consumer prices (HICP). Belgium, Germany, Romania, Slovenia and Slovenia were the exception to that rule.

The actual changes of natural gas and general price levels in 2008 – 2012 were quite unique for each Member State and the map colours illustrate only the relative position of those changes. Natural gas prices, measured in national currencies, all taxes included, increased by more than 30% from 2008 to 2012 in Bulgaria, Estonia, Spain, Italy, Hungary and Portugal. In Lithuania and Croatia gas prices rose by 60% and 70% respectively. For the same period, inflation levels increased by more than 10% in Bulgaria, Estonia, Greece, Cyprus, Lithuania, Luxembourg, Hungary, Malta, Poland, Romania, Slovakia, Finland and the UK.

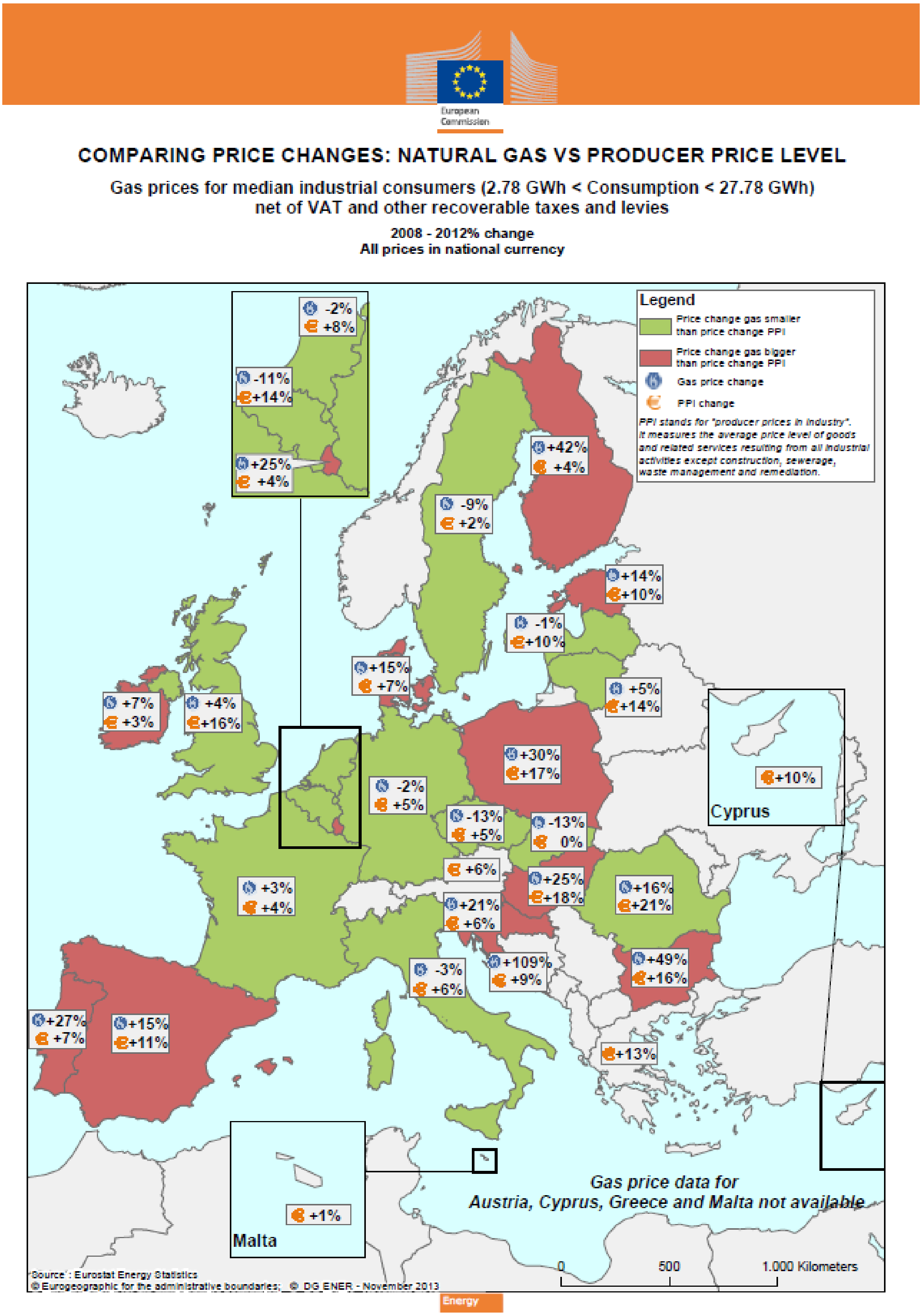
In the case of industrial consumers (**Map 5**), the situation was quite different. For the majority of Member States the price rise for gas was below the industrial price levels, as measured by the producer price index. The levels of producer price indices (PPI) and gas prices (excluding VAT and other recoverable taxes and levies) were specific for each Member State. Gas price changes varied in a broad range from a 10 – 15 % decrease (Belgium, Czech republic, Slovakia) to increases of up to 50% (Finland, Bulgaria) with an outlier of 100% (Croatia).

[61] Second round effects in the interaction of retail electricity prices and inflation (the electricity price being a component of the HICP) are not discussed in this report.

Map 4 Household gas prices vs. inflation (HICP)



Map 5 Industrial gas prices vs. inflation (PPI)



Comparing natural gas price changes to exchange rate variations

The exchange rate variations played similar effects to the ones observed in retail prices for electricity. From 2008 to 2012 the Romanian Lei depreciated by a fifth of its value (21%) with respect to the Euro and the natural gas price for households was kept stable in national currency; as a result, it appeared that prices measured in Euro decreased by 18%.

Polish and Hungarian currencies depreciated by 19% and 15% respectively in 2008 – 2012. Natural gas price increases in natural currencies were then stronger than those observed in Euro (12% and 36%).

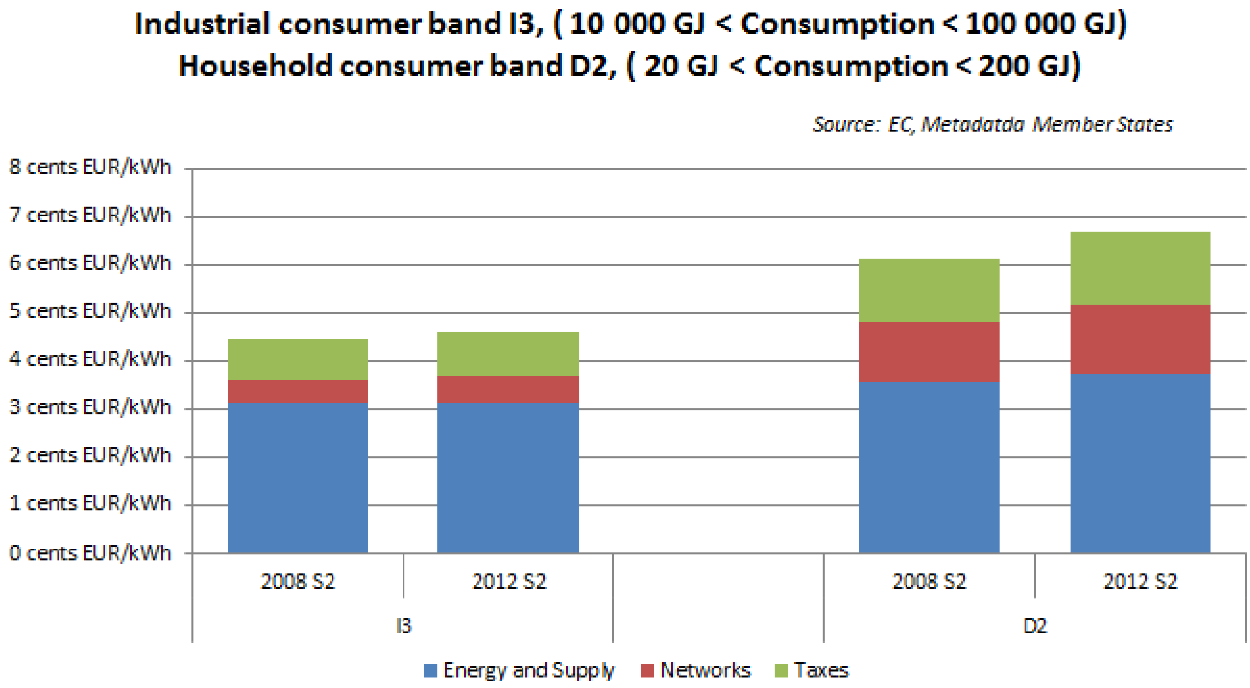
Swedish natural gas prices increased by 25 % in 5 years when measured in Euro; their rise was more gradual if measured in Swedish Kroners. The 9% appreciation of the national currency made the price rise appear bigger in Euros, with negative implications for the energy intensive export oriented companies.

1.2.1. Natural gas price developments by components

Components at the EU level

The next chart illustrates the evolution of the average EU retail prices for natural gas for industrial and household consumers weighted by the respective share of each Member State in both consumption categories.

Figure 48 Evolution of EU retail price for natural gas (wtd avg) by components: levels, selected household and industrial bands)



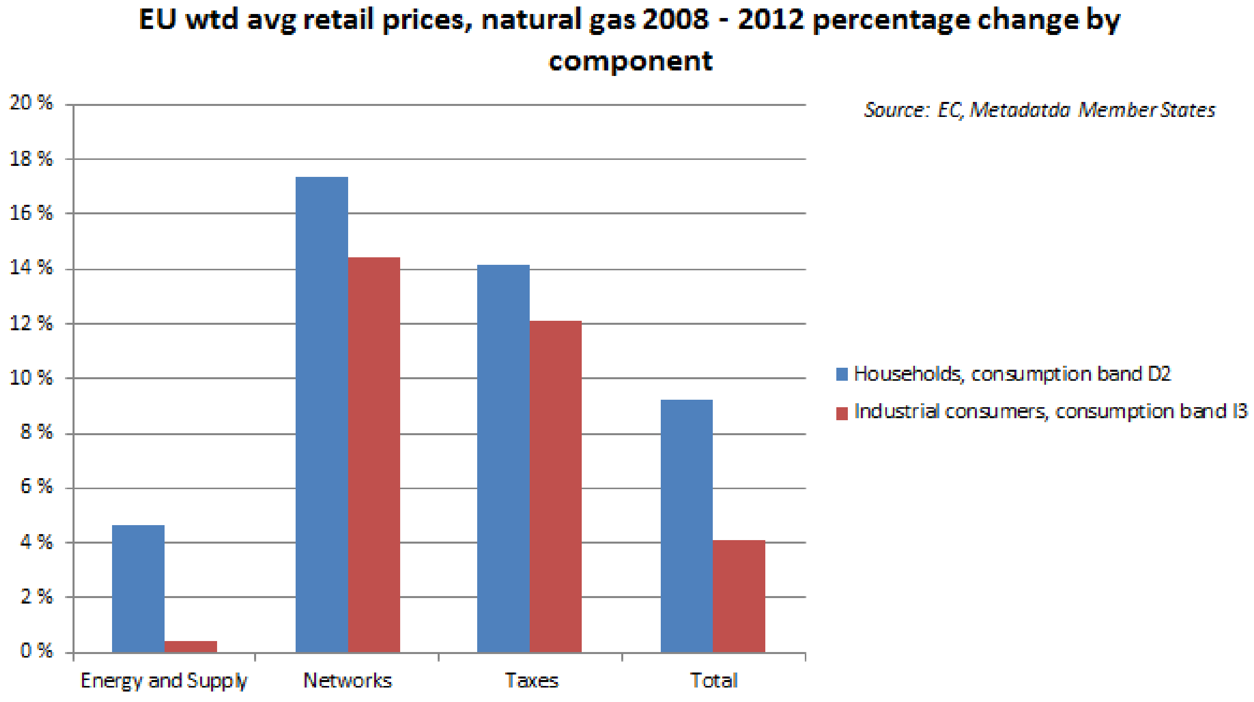
The data collected from Member States[62] indicates that, on EU level, **the average gas bill for the median industrial consumers remained stable around 4.5 cents EUR / kWh during the period** covering 2008 – 2012. The energy component accounted for 3 cents EUR per kWh in 2008 and in 2012 but its relative share registered a slight decrease (from 70% to 68%) as the network and taxation elements increased marginally to 11% and 18% respectively.

The **average EU retail gas price for household consumers followed similar developments, gaining half a cent EUR in 5 years and reaching close to 7 cents EUR per kWh**. All components increased by a small margin but the relative share of energy went from 59% to 56% as the network and taxation elements grew faster, levelling at 21% and 23% in 2012.

The next chart illustrates that these developments contrasted sharply with the ones observed for the electricity bill. The component growth of the different elements of the gas bill was much more homogenous and not a single element grew by more than 20%.

As shown in Figure 6, only the energy component of the electricity bill registered moderate increases on a similar scale to the one observed for all elements of the natural gas bill.

Figure 49. EU28 weighted average retail prices for natural gas, 2008-2012 percentage change by component



Looking into the evolution of the average EU gas bills through 2008 - 2012, it appears that household consumers witnessed bigger increases for all components. As a result, the total bill increased by 9% for households as opposed to just 4 % for industrial consumers. 4 of these

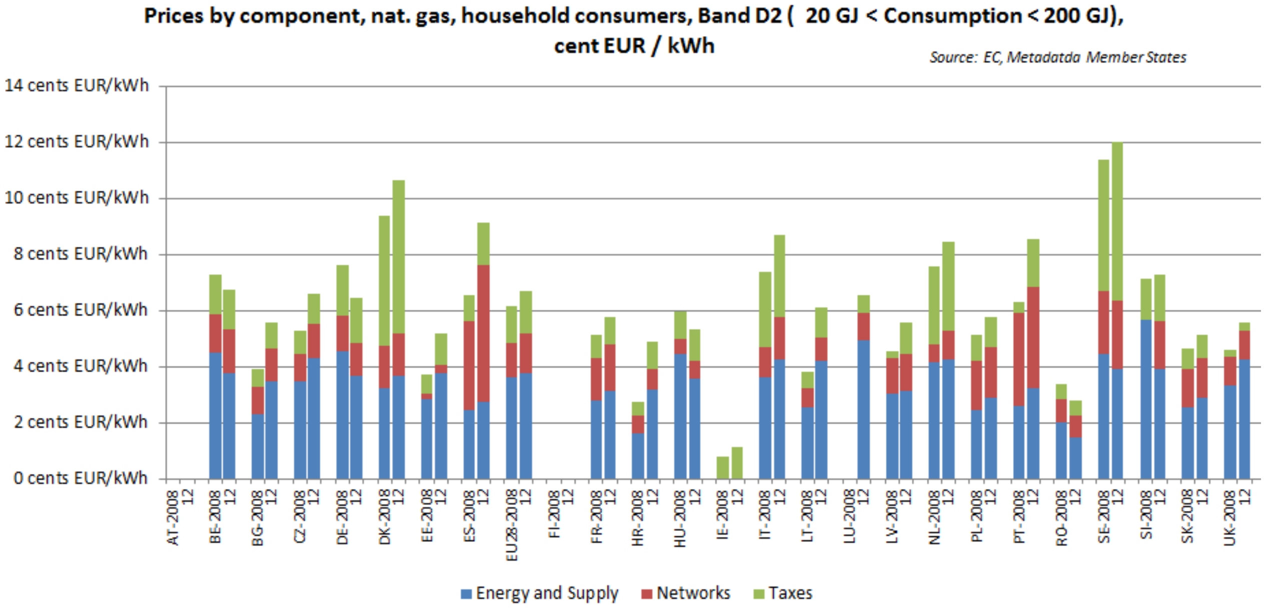
[62] The data was gathered under a reporting exercise, in the spirit of recital (16) and Annex II (n) of Directive 2008/92/EC. The data request concerned the exact composition of the cost elements reported under energy and supply, network and taxation components of retail prices of electricity and gas for industrial and household consumers (median bands) in 2008 and in 2012. Data for other years, consumer bands and components was not requested or reported.

percentage points were due to the lower rise of the energy component industry and 1 was linked to the stronger increase of taxes and network costs for domestic consumers.

Components at national level

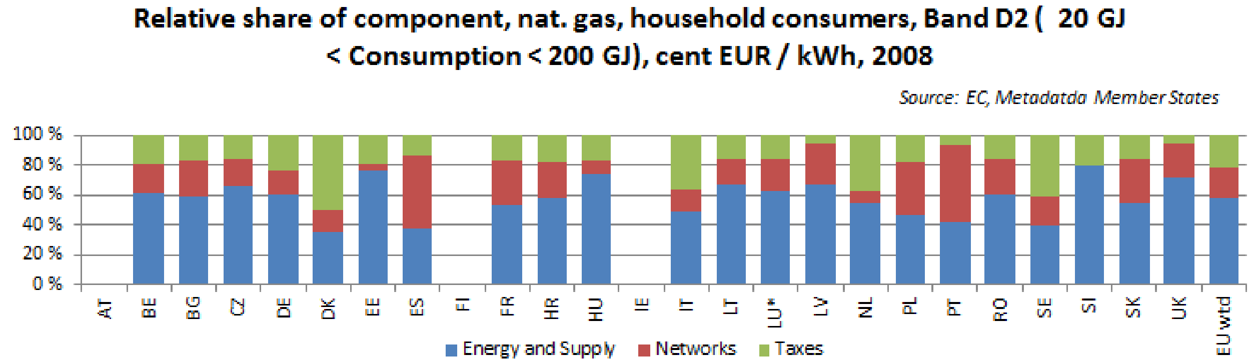
Similar to the case of electricity, the broad EU numbers conceal a wide range of variation for the retail gas prices across Member States. Figure 50 and Figure 51 trace the level and the relative share of the price components for each Member State and for the **median household consumers** in 2008 and in 2012.

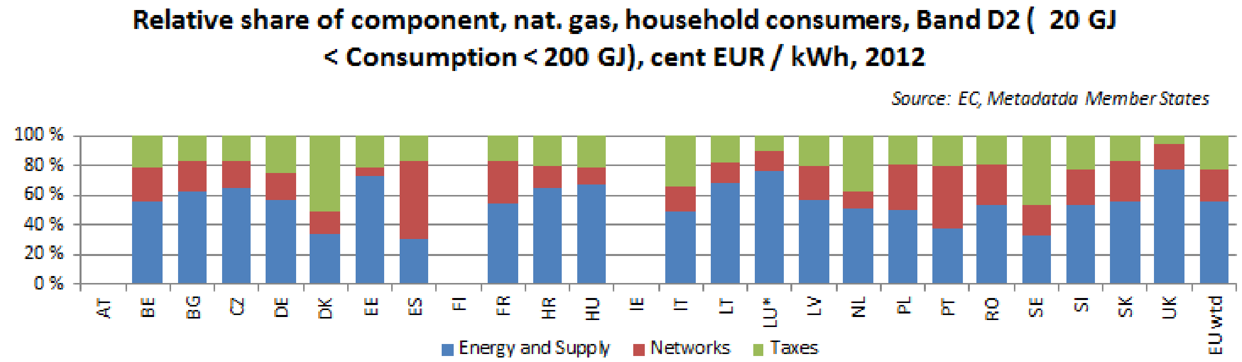
Figure 50. Natural gas prices by component, households, Eurocent/kWh (2012)



Note: No data was reported for: Austria (2008 and 2012), Cyprus (2008 and 2012), Finland (2008 and 2012), Greece (2008 and 2012), Luxembourg (2008) and Malta (2008 and 2012). Ireland reported only tax-related elements.

Figure 51. Natural gas prices, households, relative share of components





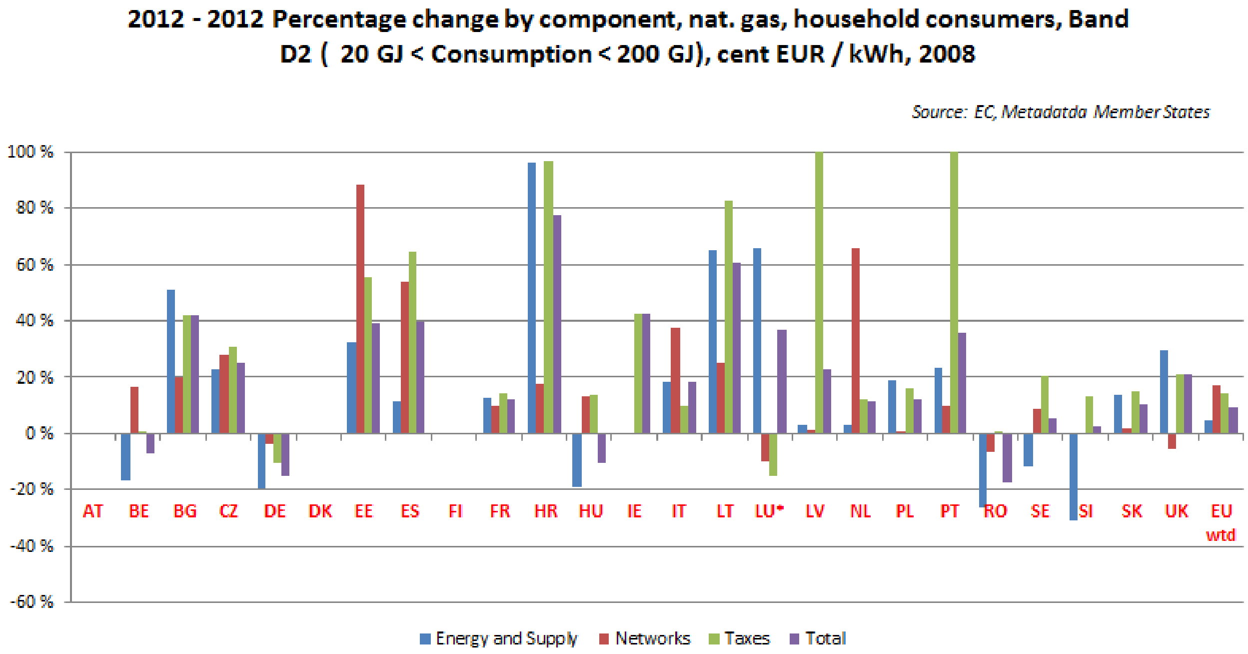
Note. No data was reported for: Austria (2008 and 2012), Cyprus (2008 and 2012), Finland (2008 and 2012), Greece (2008 and 2012) and Malta (2008 and 2012). Ireland reported only tax-related elements, so relative shares are not reported. * Luxembourg data is for 2009.

In 2012 the energy element varied between 1.5 Eurocent/kWh (Romania) and 5 Eurocent/kWh (Luxembourg) and accounted for 30-77% of the consumer price (with Spain and Denmark at the lower end and UK and Luxembourg at the higher end). Network costs ranged between 0.32 Eurocent/kWh (Estonia) and 4.9 Eurocents/kWh (Spain) and accounted for 6%-54% of the total price paid in these two countries. Taxation ranged between 5% (UK) and 52% (Denmark) and was at levels from 0.28 Eurocents/kWh (UK) to 5.66 Eurocents/kWh (Sweden).

At the European level, the energy-related costs appreciated by 4.5% between 2008 and 2012 (Figure 52). On the Member State level however, the same element fluctuated in broad bands ranging from decreases by 20%-25% in Romania, Germany and Hungary[63], to increases by more than 50% in Bulgaria, Lithuania and Luxembourg and reaching almost 100% in Croatia.

[63] The outlier for Slovenia is due to the fact that back in 2008 network and energy were bundled together; when both components are taken together, the 2008 and 2012 prices appear stable.

Figure 52 Natural gas prices, households, 2008 – 2012 percentage change by component



Note. * LU data is for 2009 as 2008 data is not available

Whereas the variation ranges observed for energy are comparable to the ones for networks, the retail price elements related to taxation were again the ones to register the highest movements.

With regards to the percentage change in the network component, the Member States were spread in a range from a 5%-10% decrease in the UK, Romania and Luxembourg to increases above 50% in Estonia, Spain and the Netherlands.

With regards to the percentage change in the taxation component, the majority of Member States witnessed an increase of 20% - 50%, the more notable exceptions being Germany and Luxembourg, where a modest decrease was observed and Estonia, Spain, Croatia and Lithuania where the tax-related costs for households rose by 50% - 80%. Latvia and Portugal were a special case where the taxation component grew by more than 300%, in both cases due to a significant increase in the VAT rate (and a new excise duty for the case of Latvia[64]).

Figure 53 and Figure 54 provide additional information on the evolution of retail prices for residential consumers in the capitals of 15 Member States, based on the household energy price index (HEPI) from VaasaETT and E-Control, the Austrian regulator[65].

The HEPI index breaks down the taxation component further into energy and non-energy related and it provides up-to date retail price data on a monthly frequency since January 2009.

[64] The national tax rate applied by Latvia is EUR 0.43 /GJ which is close to the EU minimum of EUR 0.3 /GJ.
[65] http://www.energypriceindex.com/

Annex 1 describes the main drivers by component and by Member State and provides a description of the elements of the end consumer bill for electricity and natural gas and for household and industrial consumers.

Figure 53. EU15 natural gas prices, residential consumers, 2009 – 2012

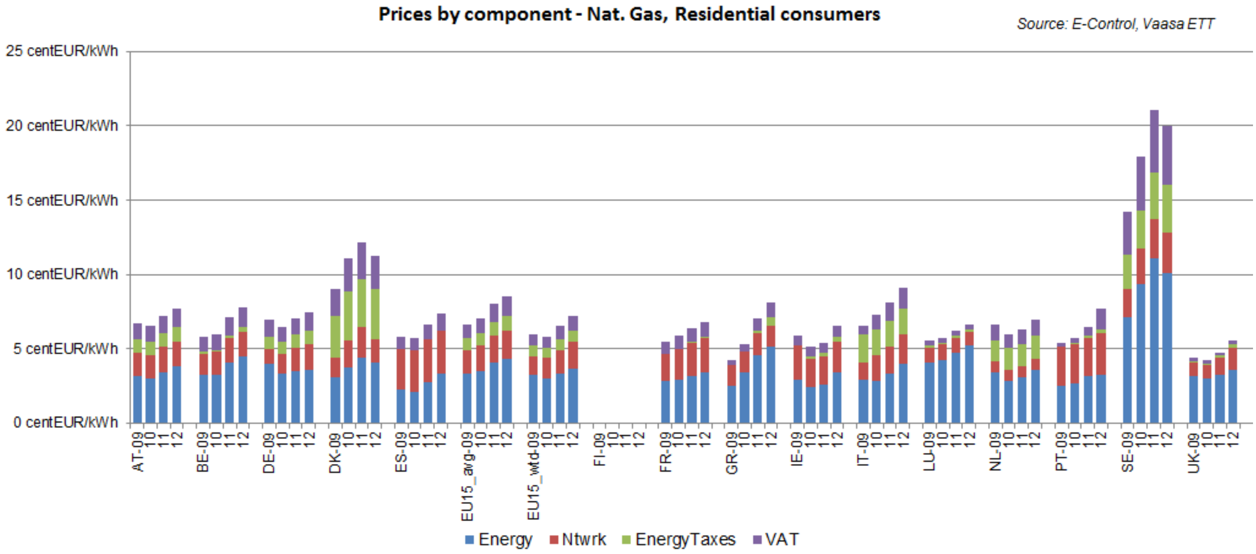
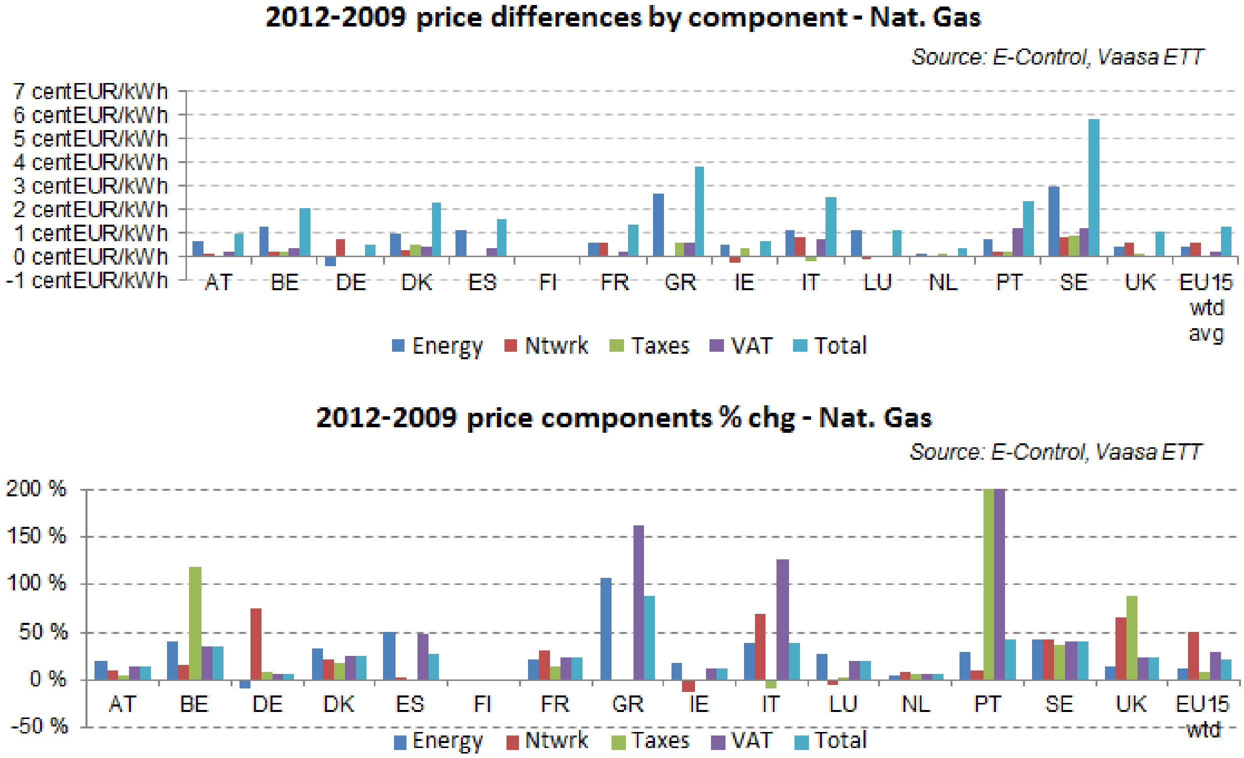


Figure 54. 2009 – 2012 differences and percentage changes by component, Eurocent/kWh



Turning now to **industrial consumers**, it appears that retail gas prices appreciated on average by 4%, from 4.44 Eurocent/kWh in 2008 to 4.62 Eurocent/kWh in 2012. This is the smallest

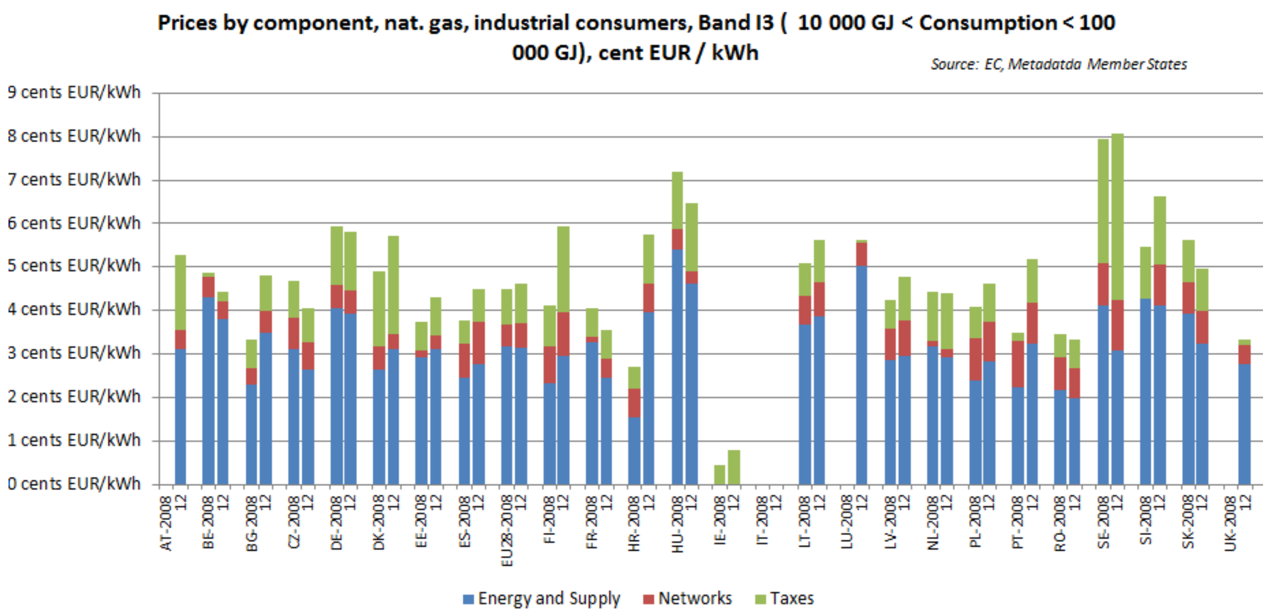
increase across the energy products (gas and electricity) and consumer types (households and industrial consumers) that are analysed in this report.

And yet this seemingly reassuring picture results from a variety of different combinations of ups and downs in components that are specific for each Member State, as illustrated by Figure 55 and Figure 56.

In 2012 the energy element was spread in a range between 2 Eurocent/kWh and 5 Eurocent/kWh. As for household consumers, Romania and Luxembourg were again to be found respectively at the cheap and expensive ends. The energy accounted for 38% of the consumer price in Sweden (lowest value) to more than 80% in Belgium, UK and Luxembourg (highest value).

Network costs ranged between 0.19 Eurocent/kWh in the Netherlands and more than 1 Eurocent/kWh in Finland and Sweden. These costs accounted from 4% (Hungary) to 22% (Spain) of the total price.

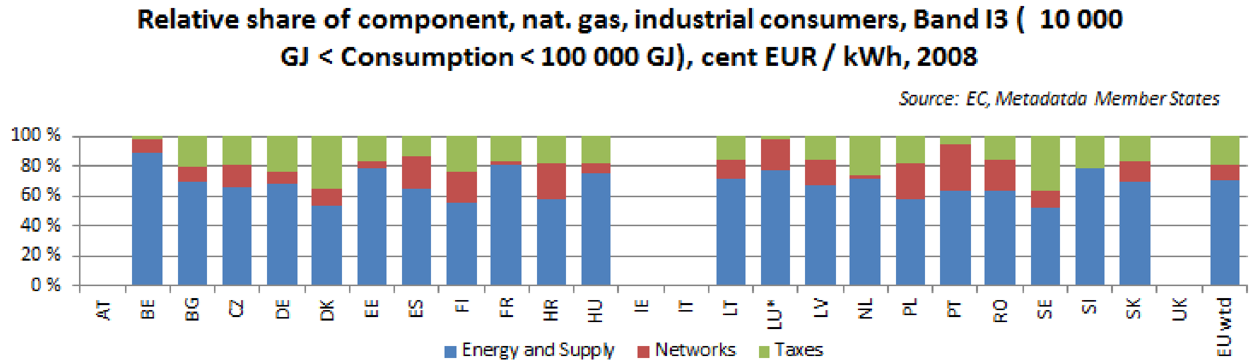
Figure 55 Natural gas prices by component, industrial consumers, Eurocent/kWh (2012)

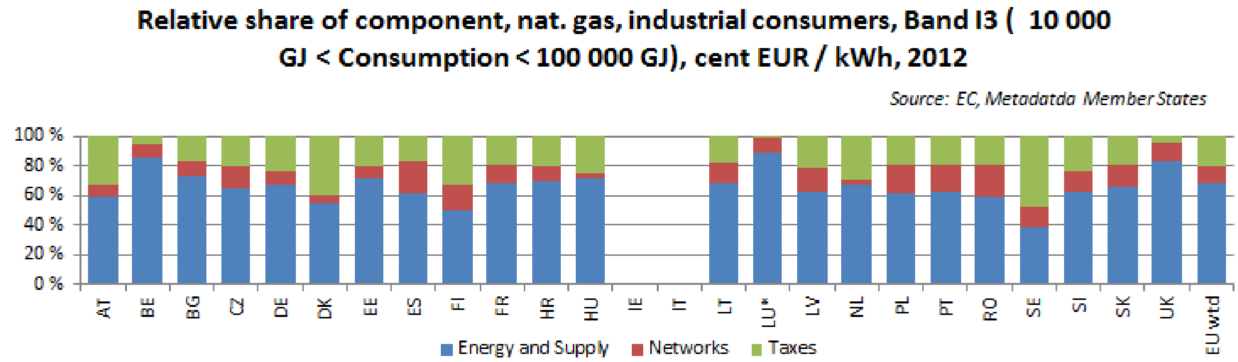


Note: No data was reported for: Austria (2008), Cyprus (2008 and 2012), Greece (2008 and 2012), Italy (2008 and 2012), Luxembourg (2008), Malta (2008 and 2012) and UK (2008). Ireland reported only tax-related elements.

As it was not possible to separate and take out the recoverable taxes and levies from the taxation part, Figure 55 and Figure 56 report on all taxes and levies and exclude possible exemptions. As such they should be seen as an upper limit. The tax-related elements accounted for less than 5% in the UK, Belgium and Luxembourg whereas in Austria, Finland and Sweden they represented more than a third of the price. The combined level of elements ranged from 0.06 Eurocents/kWh in Luxembourg to 3.83 Eurocents/kWh in Sweden, the majority of Member States being situated within a range of 0.5 Eurocents/kWh – 1.5 Eurocents/kWh.

Figure 56 Natural gas prices, industrial consumers, relative share of components



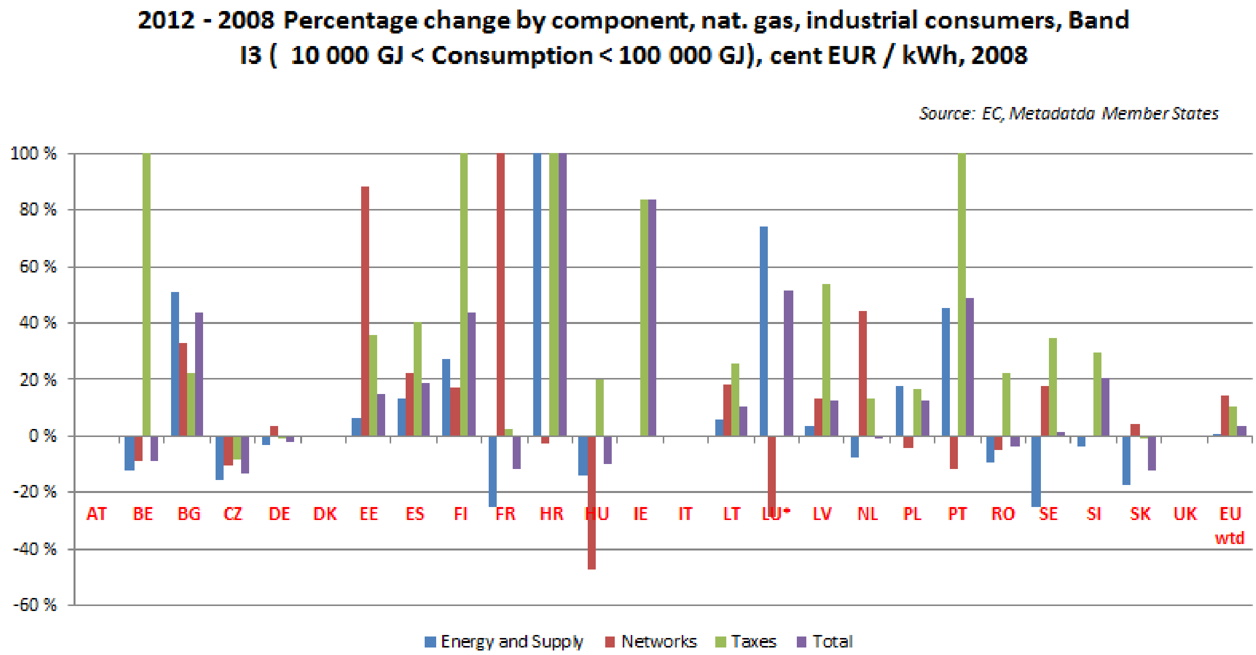


Note: No data was reported for: Austria (2008), Cyprus (2008 and 2012), Greece (2008 and 2012), Italy (2008 and 2012), Malta (2008 and 2012) and UK (2008). Ireland reported only tax-related elements. * Luxembourg data is for 2009.

From 2008 to 2012 the industrial consumers in Belgium, the Czech Republic, Hungary, and Slovakia experienced a price decrease of more than 10% in the energy component of their gas price. In France and Sweden the decline was higher than 25%. On the other extreme, industrial consumers in countries like Bulgaria and Luxembourg had to pay between 50% - 75% more in 2012 than what they paid back in 2008. In Croatia this increase was almost 150%, mostly linked to the shipping rate of gas delivered at the border.

The costs related to network elements in Hungary went down by 47% and Belgium, the Czech Republic, Croatia, Luxembourg, Poland, Portugal and Romania also registering decreases. On the other side, the French network tariffs increased 2.5 times as transmission and distribution charges rose from 0.09 Eurocent/kWh in 2008 to 0.27 Eurocent/kWh in 2012 and as the storage component went from 0.04 Eurocent/kWh to 0.18 Eurocent/kWh during the same period.

Figure 57 Natural gas prices, industrial consumers, 2008 – 2012 percentage change by component



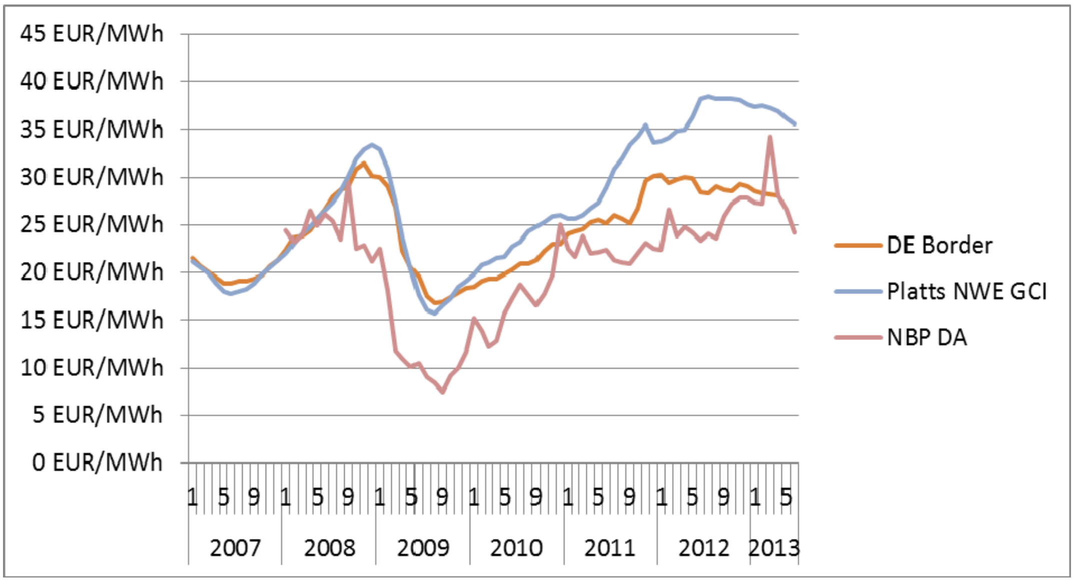
Finally, the taxation component decreased marginally in the Czech Republic, Germany and the UK whereas notable increases above 100% were observed in Belgium (increase in public levies and VAT and energy contribution), Finland (increase in the excise tax – energy content and CO2) and Croatia (increase in VAT rates). In Portugal the tax component increased by almost 500 % (increase in VAT rate).

1.2.1.1. Costs related to energy and supply

In the second half of 2012 the energy and supply component of household natural gas prices ranged from 1.5 cents/kWh (RO) and 4.9 cents/kWh (LU). In the case of industrial users the ranges were between 2 cents/kWh (RO) and 5 cents/kWh (LU). As natural gas prices still heavily depend on oil-indexed long term gas import contracts, and as indigenous gas production is constantly decreasing in Europe, higher oil prices result in higher import gas prices, especially in the Central and Eastern European countries where oil-indexation is dominant.

The 2012 annual survey on wholesale price mechanisms by the International Gas Union shows that 44% of gas consumption in Europe was priced on a gas-on-gas competition basis, as opposed to **51% of gas consumption which was still oil-indexed**. The share of gas-on-gas priced volumes has increased by a factor of 3 since 2005 and by more than 7% over the period 2010-2012. In contrast, oil-indexed consumption has gone down from representing almost 80% of consumption in 2005 to 51% in 2012. Strong regional differences persist in price formation mechanisms with about 70% of gas in North-West Europe (defined in the survey as UK, Ireland, France, Belgium, Netherlands, Germany, Denmark) priced on a gas-on-gas basis in 2012, compared to less than 40% in Central Europe (Austria, Czech Republic , Hungary, Poland, Slovakia and Switzerland).

Figure 58. Selected European benchmarks, wholesale natural gas



Source: Platts and BAFA

Figure 58 shows a selection of different wholesale price contracts for natural gas in the EU. The benchmarks presented represent a pure gas-on-gas competition benchmark set at EU's largest and most liquid hub (National Balancing Point, NBP in the UK), a theoretical pure oil-indexed price for gas (Platts Gas Contract Indicator, GCI) and the price of actual gas imports at the German border, as published by the German customs agency. This selection of benchmark is expected to capture the range of lowest wholesale price for gas in Europe (typically the NBP) to highest (the theoretical pure oil-indexed price). Estimates of the Commission show that a number of Member States in Eastern Europe pay border prices that are somewhere in-between the German border price and the pure oil-indexed price for gas.

These wholesale gas market benchmarks show similar trends over time. The peak of 2008 was followed by a collapse in 2009. Between 2010 and the first half of 2013 gas prices on NBP and the German border price have recovered to 2008 peak levels, while the pure oil-indexed price has well exceeded 2008 levels. While the German border price has traditionally been taken as an indicator showing the price of oil-linked gas into Europe, in the past few years the German border price has increasingly been dropping away from the Platts NWE GCI oil-indexed price indicator and converging towards the spot gas price, especially since the second half of 2012.

Even within the EU, the gap between the lowest and the highest wholesale gas price remains significant, as illustrated in Map 6. Member States with a diverse portfolio of gas suppliers and supply routes and with well-developed gas markets reap the benefit by paying less for imports and generally having lower prices. In 2012 the difference between the highest and lowest estimated wholesale prices in the EU stayed at around 18 Euro/MWh[66].

Based on the latest report from *Prospex Research*[67], the total traded volumes (including exchange spot and forward and OTC cleared and non-cleared) of the EU markets of natural gas stood at 32 200 TWh in 2011, a fifth consecutive year of strong growth. This number

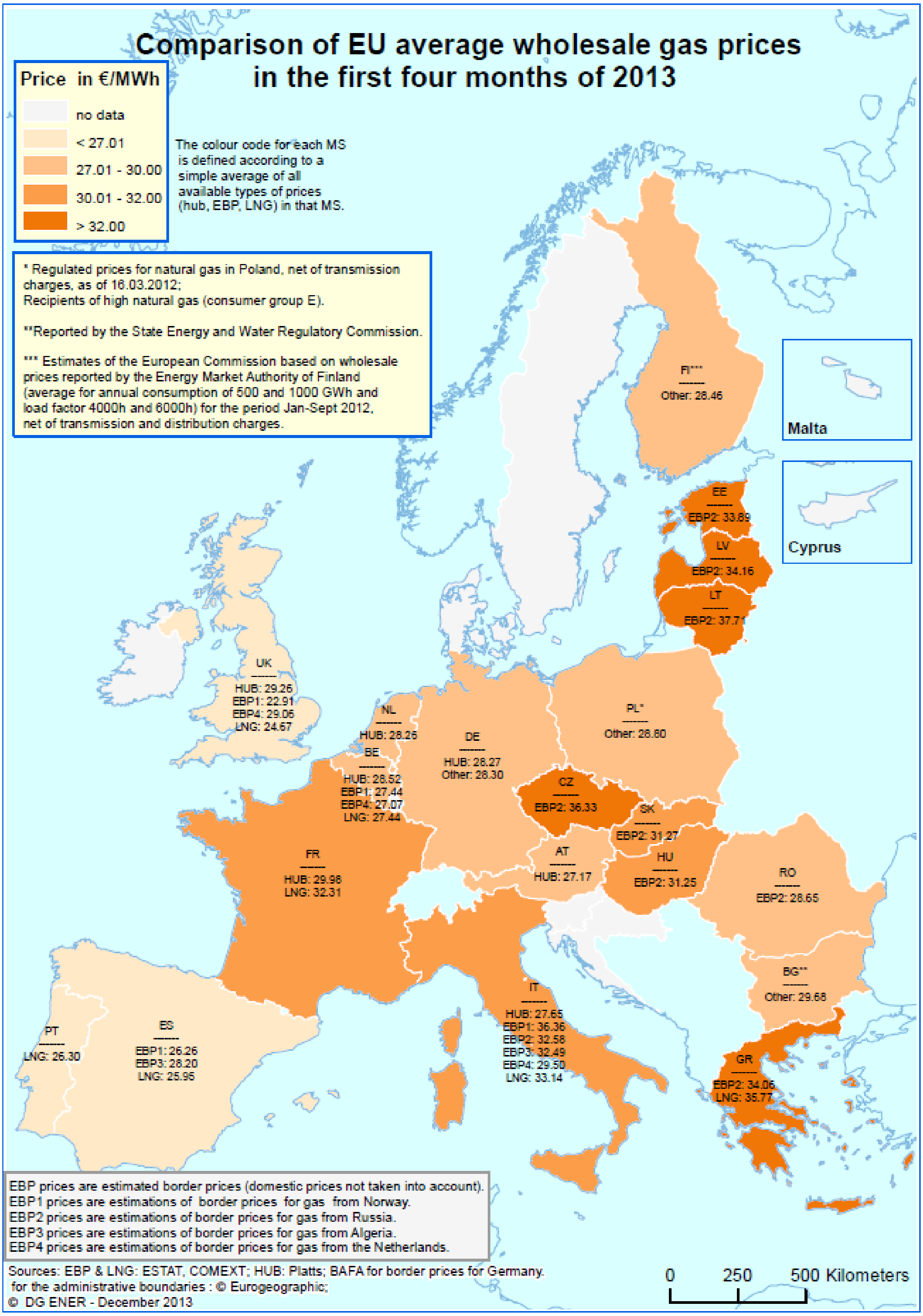
[66] Estimated border prices and estimated LNG prices based on data from Eurostat's database of international trade COMEXT. Day-ahead hub prices as reported by Platts.
[67] "European Gas Trading 2012", Prospex Research, www.prospex.co.uk

compares to a gross inland consumption in the EU of 4 600 TWh. The gas traded volumes are also approximately 4 times bigger than those recorded for electricity.

The UK market is by far the most liquid, recording trading volumes higher than 20 000 TWh. Market operators on the Dutch and German markets exchanged respectively 6 500 TWh and 2 100 TWh. The highest churn factors[68] were in the UK (23.6) and the Netherlands (16.3), followed by Austria (4.4), Belgium (4.2) and Germany (2.5). OTC accounts for more than 80% of the traded volumes. Similar to electricity markets, the cleared OTC has a much smaller share than the non-cleared OTC under which the gas volumes from the long term contracts are recorded.

[68] The churn facto is defined as the ratio of traded volume to physical consumption. It informs about the liquidity of the market place and the quality of the pricing signal that is discovered on that market.

Map 6 Wholesale prices for gas in the EU



Textbox 1 Competitive Pricing Brings Norwegian Gas Exports to the EU close to Russian Exports

Against the background of weaker demand in the course of 2012 exports of natural gas from Norway to the EU have risen to levels comparable with Russian natural gas exports.

Data on imports of natural gas from the Russian Federation and Norway is sometimes difficult to reconcile. Eurostat's database on international trade Comext contains no or patchy data on the gas import volumes from the Russian Federation and Norway for some big EU importers, such as Germany and France.

IEA statistics show that in 2011 Norway exported a total of 99 bcm. The Norwegian Petroleum Directorate production figures show that in 2012 Norway produced 114.8 bcm oil equivalent gas for sale: a 15% increase in natural gas exports on an annual basis. Of that amount, 107.6 bcm was exported to the EU, according to Gassco, the Norwegian TSO. Another source of information is the Gas Trade Flow platform of the IEA, according to which 105.8 bcm of Norwegian gas entered into Germany, France, the UK and Belgium between January and November 2012.

At the same time, the volumes of Russian gas entering the EU fell by approximately 8%. According to the 2011 annual report of Gazprom, in 2011 the company exported 150 bcm to European customers, out of which 26 bcm to Turkey. A breakdown of exports by country shows that the 2011 sales to the EU amount to 122 bcm5; in addition, in 2011 Gazprom exported 5.25 bcm to the three Baltic states. Gazprom's CEO Alexey Miller was quoted by ICIS-Heren European Gas Markets as saying that in 2012 Gazprom's exports of natural gas to Europe were equal to 138 bcm.

SUMMARY OF DATA ON EXPORTS TO THE EU

	2011	2012	y-o-y change
Norway total exports (bcm)	99[a]	107.6[b]	+16%
Gazprom exports to the EU (bcm, excluding the Baltic states)	122[c]	112-113 (est)[d]	-8%

Notes: (a) source of data: IEA. 2012. Key world energy statistics
(b)source of data: Norwegian Petroleum Directorate 2013, Gassco
(c) source of data: Gazprom website. Data excluding the Baltic states
(d) source of data: ICIS Heren 2013 based on the announcement of Alexei Miller on Gazprom's 2012 exports to foreign countries. No data for the Baltic states
There are a number of likely explanations for this evolution.

Norwegian companies have been actively changing their pricing policy. Torgrim Reitan, CFO of the Norwegian producer Statoil that controls 75% of Norwegian exports, was quoted by ICIS-Heren in October 2012 as saying that the company has concluded the renegotiation of some half of its contracts. New Statoil contracts are also being negotiated purely on a spot indexation basis, such as the November 2012 ten year deal with German firm Wintershall - the natural gas unit of chemicals firm BASF – which is spot-indexed mainly to the NCG and GASPOOL hubs. The contract is for a total of 45bcm, equal to more than 6% of Germany's annual gas consumption. These developments are pointing to a fundamental change in the way traditional natural gas exporters to Europe are pricing their product.

In addition, in January 2013 Norway's Ministry of Petroleum and Energy submitted a proposal to reduce the tariffs for transport and treatment of new gas volumes from the Norwegian shelf. This will reduce the cost of extraction companies in Norway, possibly facilitating more exploration, development of more discoveries and further measures on existing fields. Bloomberg have reported that the cuts could be by as much as 90% on the original fees.

In Russia, changes appear to have been less radical. In its 2011 annual report, Gazprom maintains that the oil price link is indispensable for long-term business planning. At the same time, as reported by Reuters, Gazprom has offered a number of discounts in its long-term prices in 2011 and 2012 to a number of companies. In its 2011 annual report Gazprom announced agreements to adjust pricing conditions with Italy's Edison and Sinergie Italiane, France's GDF SUEZ, Germany's WIEH and Win¬gas, and Slovakia's SPP. In 2012, agreements on contract price revision were signed with Austria's EconGas, Centrex and GWH Gashandel, Italy's Eni, Germany's E.ON Ruhrgas, Netherlands' GasTerra, and Poland's PGNIG. In accordance with these agreements, contract price formulas with oil indexation were adjusted.

Furthermore, Gazprom's officials were quoted by Reuters as saying that the company had set aside 4.4 billion USD for 2012 refunds and eventually paid out 2.7 billion USD. Reuters further quotes Gazprom officials as expecting to refund 4.7 billion USD in 2013.

The recent developments show that for the moment Norwegian producers are adapting faster to the new gas market conditions than other exporters. By changing the price setting mechanism to gas-on-gas they have been able to retain consumers and indeed increase their market share to the detriment of other exporters such as the Russian Federation and Algeria. At the same time, recent announcements on refunds following agreements on contract price revision seem to suggest that Gazprom is offering price discounts on its existing contracts without fundamentally changing the pricing mechanism.

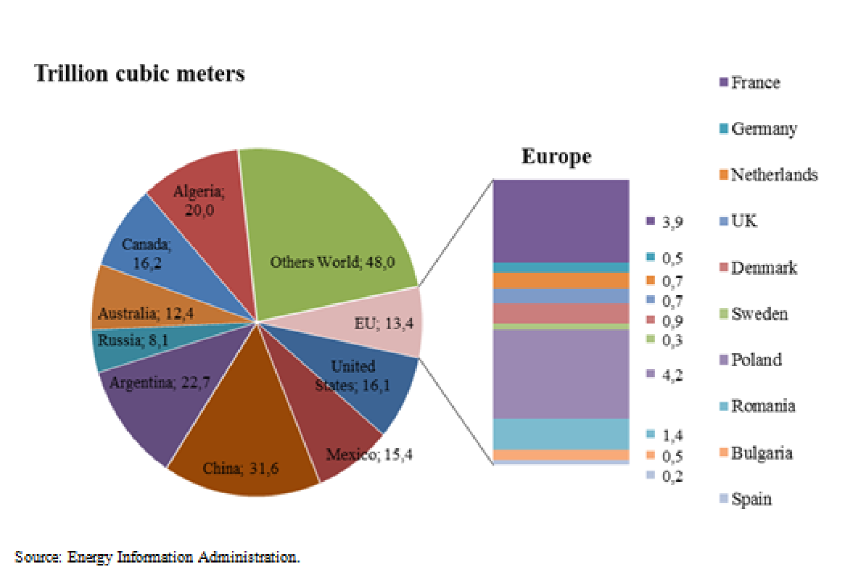
Yet, with gas exports hitting record levels, Norway is approaching full utilisation of its pipelines (transport capacity of the Norwegian pipeline system is 120 billion Sm3 per year). Further export growth of Norway may thus depend on transport capacity, including LNG terminals, and fields coming online.

According to some sources, recoverable shale gas in the EU could range between 2.3 tcm and 17 tcm[69], these estimates should however be seen in the context of the total proved natural gas reserves that for the EU were about 4 tcm in 2011[70].

Textbox 2 Potentials and uncertainties for shale gas exploration in the EU and the US[71]

Information on EU shale gas reservoirs is limited and uncertain, due to early stages of exploration. It appears nonetheless that potential shale gas producers in the EU may not be able to achieve similar production volumes and costs as their US counterparts. The main reason would be that Europe's shale gas reserves appear to be significantly smaller than the US ones. In addition, they would also be less concentrated: between one third and half of the potential US reserves are located in one basin while other US basins are also sizeable (Haynesville, 10% of total, around 2 tcm); on the other hand, the EU potential reserves are dispersed across several countries, this may entail lower economies of scale in their exploitation, compared to the US.

Unproved technically recoverable shale gas resources



Unproved shale gas Technically Recoverable Reserves²		
Tcm	2011	2013
Total EU	15,8	13.3
Of which		
France	5,1	3,9
Germany	0,2	0,5
Netherlands	0,5	0,7
Norway	2,4	0
UK	0,6	0,7
Denmark	0,7	0,9
Sweden	1,2	0,3
Poland	5,3	4,2
Bulgaria	/	0,5
Spain	/	0,2
Romania	/	1,4
Total US	24,4	16,1
Of which		
Marcellus	11,0	5.3
Total World	187,5	203,9

Source: EIA

[69] European Commission (2012), Unconventional gas: potential energy market impacts in the European Union, JRC Scientific and Policy Reports, p 29
[70] Further information on shale gas reserve estimates are available in the Forthcoming publication, Energy Economic Development in Europe, DG ECFIN
[71] ECFIN, Energy economic developments in Europe, forthcoming publication

Linking wholesale and retail markets: natural gas

The supply and demand of natural gas possess distinctive features that set it apart from other network industries such as electricity generation. Whereas the practise of administered, non-market prices still comes out as a suboptimal policy choice, those features ensure that the inefficiencies incurred are perhaps on a smaller scale than those for electricity.

Apart from chemical processing in the upstream, the characteristics of natural gas remain virtually unchanged from the extraction well to the delivery point as an end product. This contrasts strongly with the significant transformation of the input fuel that is turned into electricity. The production process for natural gas is much more homogenous, as extraction and delivery systems appear quite similar when compared to the variety of electricity generation technologies. As a result, the price of the end product is more closely linked to the input commodity than for electricity.

On the demand side, it is in general easier to find substitutes for the uses of natural gas than for those of electricity[72].

On the supply side, unlike electricity, only few Member States can rely on indigenous production of natural gas. As the European conventional resources are gradually being depleted, the relative share of natural gas delivered from external sources in gross inland consumption is projected to grow.

Historically, most Member States signed long term contracts with suppliers outside of the EU and those suppliers shipped and delivered the commodity at the border via a pipeline or with a fleet of LNG vessels. The contract price of gas was determined by its replacement value in the end-use sectors. Gas prices were indexed to the prices of energies competing with gas in final energy consumption – most often heating oil or diesel.

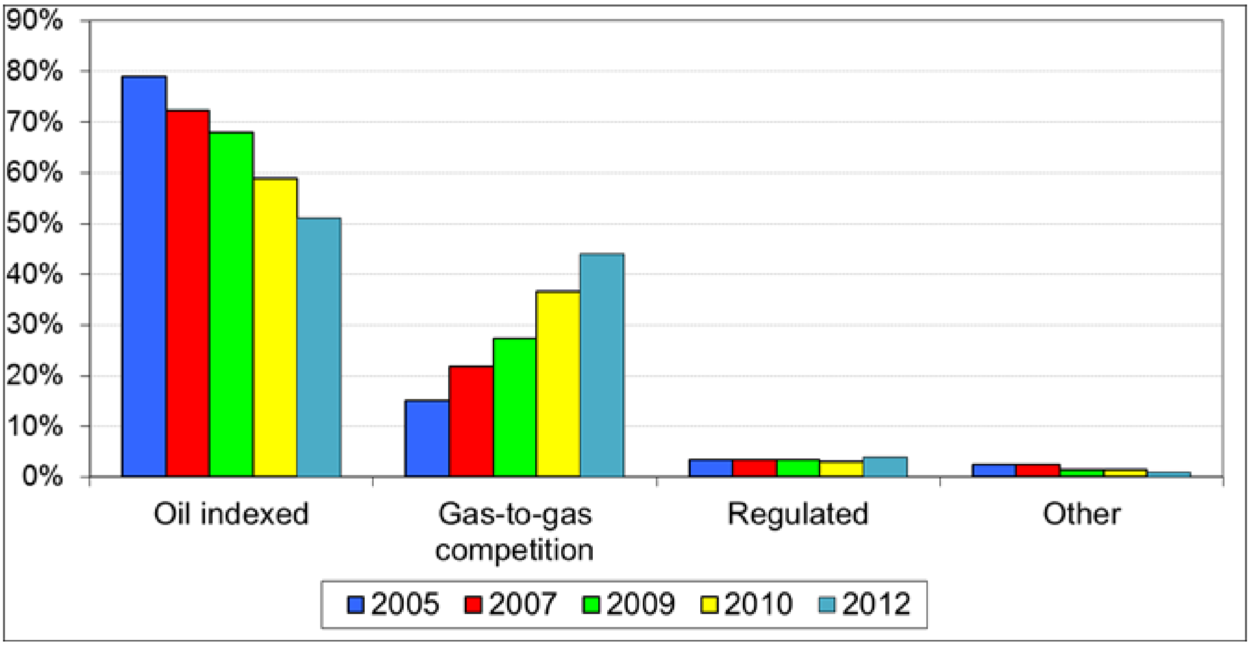
As a result from all of the above, the scope of price regulation seems to be more limited than for electricity. For example, few Member States can set end consumer prices below production costs because very few can produce natural gas in the first place. Setting prices at levels that would accumulate tariff deficits in the balance sheet of national companies does not seem to be an appealing option either: it can affect the bargaining power of those companies when they negotiate new terms with external suppliers.

Thus, the shortcomings of price regulation of natural gas are more subtle. Yet, such practises are slowing down the functioning of the internal energy market. Next to the clustering effect[73] which is similar to the one observed in electricity, fixing end-consumer prices extends the application of gas indexation.

The next charts illustrate that as the EU wholesale markets are maturing, more and more gas is being delivered under gas-on-gas pricing mechanisms. Administered prices that reflect oil indexation only would then delink the retail level from the true fundamentals of supply and demand on the EU gas market, as defined by the market conditions on the hubs.

[72] Yet, the demand elasticity should not be overestimated: the switching of heating sources for example entails significant upfront capital costs for end consumers.
[73] The regulated price offer acts as an anchor; it discourages pro-active consumer behaviour, it protects incumbents and sets implicit barriers to entry.

Figure 59 Wholesale gas price formation mechanisms in Europe



Source: International Gas Union

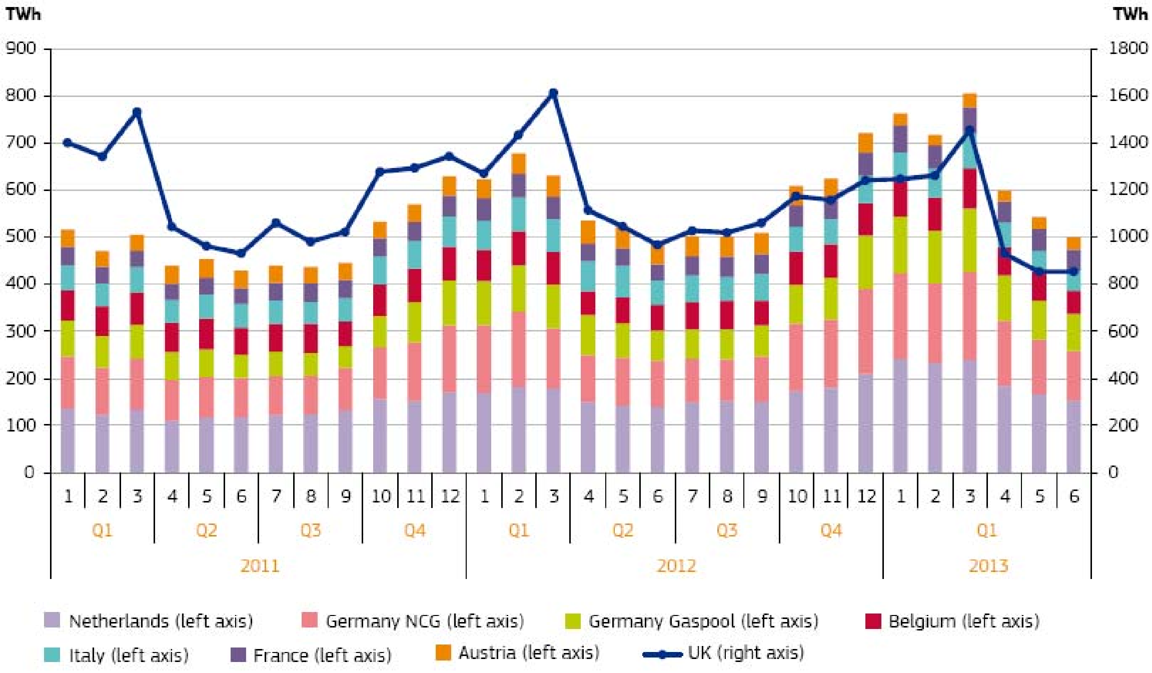
The rise of traded volumes in the European hubs, as shown in

Figure 59 and Figure 60 is also due to the fact that hub prices have been significantly lower than oil indexed prices throughout 2008 – 2012. This point is further developed in Section 1.2.1.1. It is interesting to observe that the lack of wholesale and network integration at the EU level is proving to be very costly for consumers situated in isolated areas with inexistent or very illiquid wholesale markets – which are the consumers that cannot benefit from cheaper sources of gas.

The latest market monitoring report from ACER-CEER [74] estimates for example that household consumers from Hungary, Italy, Romania, Latvia, Estonia, Greece, Poland, Finland, the Czech republic, Sweden, Slovenia and Lithuania could save between 100 and 200 Euros of their annual bill if the price for gas supplied at the border was comparable to the prices on the liquid hubs in Western Europe, as shown in Figure 61. In Bulgaria, one of the poorest Member States, consumers could save up to 250 Euros per year.

[74] The report is available here: http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf

Figure 60. Traded volumes on European gas hubs

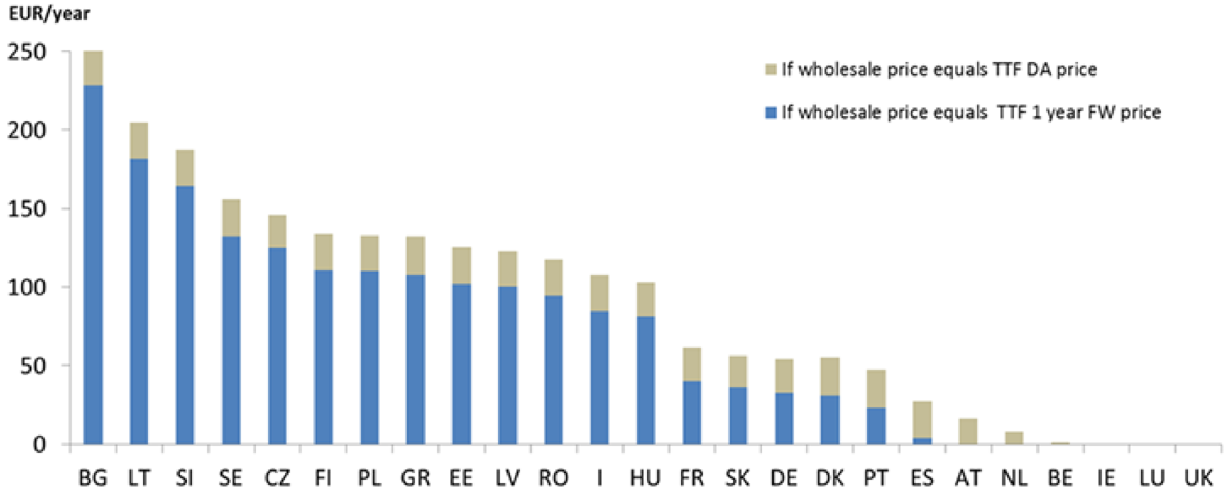


Sources: National Grid (UK), GTS (Netherlands), Huberator (Belgium), Gaspool (Germany), NCG (Germany), GTTGaz (France), Snamrete (Italy), CEGH (Austria). As of 15 July 2013: no data on volumes traded on Gaspool and PSV in June 2013.

The chart covers the following trading hubs:
UK: NBP (National Balancing Point); Belgium: Zeebrugge beach, ZTP and ZTPL; Netherlands: TTF (Title Transfer Facility); France: PEG (Point d'Echange Gaz); Itay: PSV (Punto di Scambio Virtuale); Germany: GASPOOL and NCG; Austria: CEGH (Central European Gas Hub)
Note: CEGH volumes after January 2013 are not directly comparable with the values before that date due to the entry into force of entry/exit system

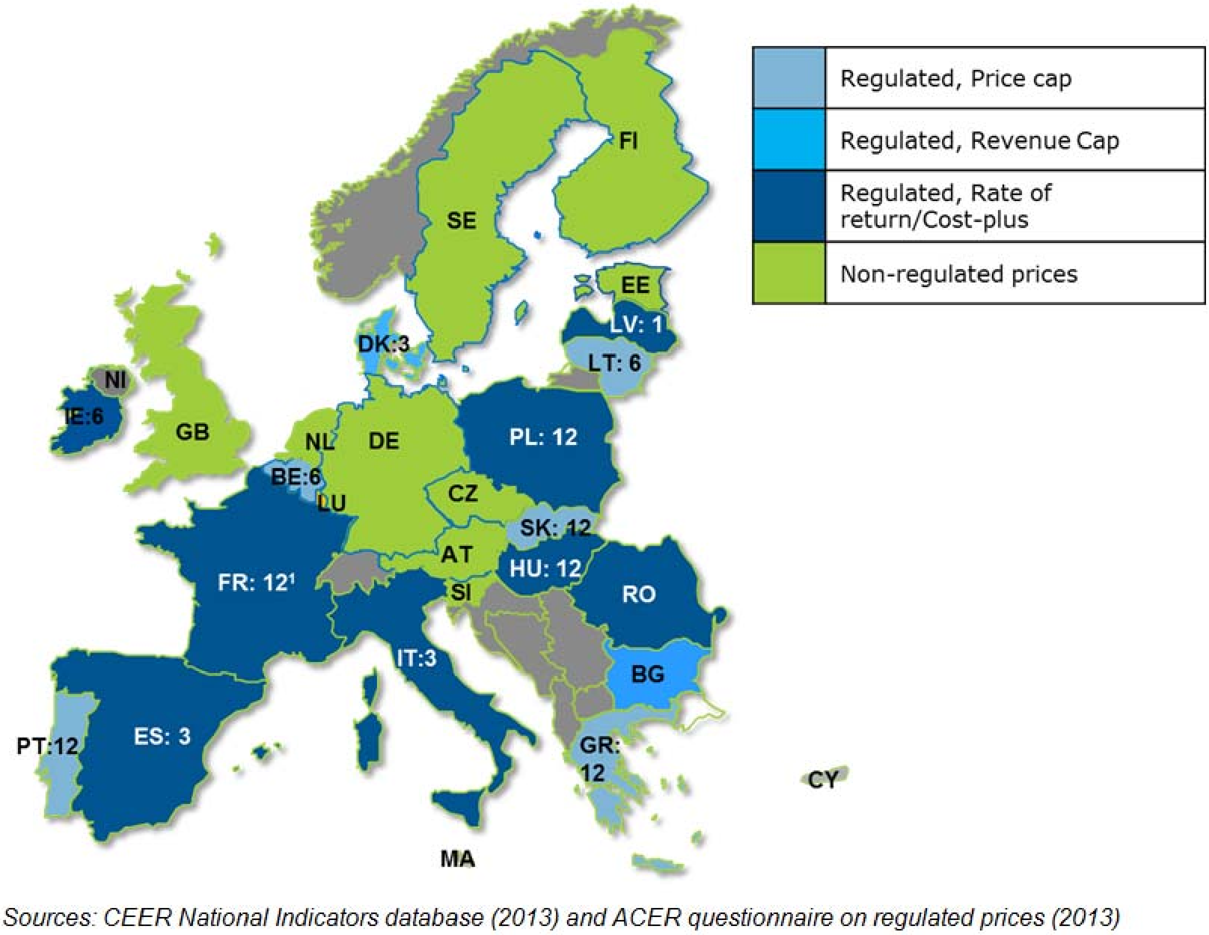
Barriers to the completion of the internal market are further analysed in the ACER-CEER report. It indicates that, "*in 2012, 46.2 million European household customers (about 46% of the total number of households with natural gas) were supplied under regulated prices (a 1.5% decrease compared with 2011)*".

Figure 61. Gross welfare loss per year, per typical household consumer, due to lack of wholesale and network integration in EU27 – 2012 (Euro/year)



Source: ACER analysis based on COMEXT (Eurostat) and Platts

Map 7 Method of price regulation (natural gas) and update frequency in months in Europe - 2012



Map 7, again from the market monitoring report of ACER and CEER, illustrates that 15 Member States continued to regulate prices in 2012. "*At the end of 2012, Bulgaria, Greece, Hungary, Latvia, Lithuania, Poland, Portugal, Romania, and Slovakia, more than 90% of households under regulated prices. In Denmark, France, and Italy between 70% and 90% of household consumers chose regulated prices. In Ireland, the number of households with regulated prices dropped to a record low (66%) in 2012, down from 98% three years before. In Spain and Belgium, fewer than 35% of household customers were still on regulated prices in 2012.*"

The Consumer Markets Scoreboards[75] show that consumers rank the gas market among the poorly functioning markets. In 2013, the market ranks 22nd out of 31 services markets. As is the case with electricity, the gas market has particularly poor scores on the choice of suppliers available in the market (lowest out of all services markets) and comparability of offers (fifth lowest). In addition, only 3% of consumers have switched products or services with their existing provider and 8% switched supplier during the past 12 months (3rd lowest among the 14 'switching services' markets)[76].

[75] http://ec.europa.eu/consumers/consumer_research/cms_en.htm
[76] Consumer Market Monitoring Survey 2013 commissioned by DG SANCO, to be used in the forthcoming 10th Consumer Markets Scoreboard

According to Commission services' empirical estimate on natural gas price drivers[77], the natural gas prices are largely driven by long term oil indexation contracts. Among other price determinants that influence the formation of retail natural gas prices, import dependency and diversification of imports are important factors. In parallel, market opening and especially the option of having access to hubs have a downward impact on retail prices by stimulating the diversification of gas supplies, enhancing market's liquidity and by promoting the most efficient allocation of gas supplies. Especially, market opening eliminates the possibility of having artificially low regulated prices and cross-subsidies between different consumer groups by promoting the cost reflectiveness of tariffs which provide incentives to new entrants to enter the supply market.

This is important, as in the natural gas market similarly to the case of electricity market the distribution of costs through regulated prices might be driven by political preferences, in favour of energy intensive industries. Finally, unbundling of networks and the population density put downward pressure on prices. The first driver benefits the consumers by contributing to lowering the infrastructure cost, especially under cases where a tight supervision of investment plans is exerted by regulatory authorities and the latter factor by lowering the transmission and distribution unit cost of investments. However, the downward effect of these factors is limited, as they affect a small part of the retail tariff.

1.2.1.2. Costs related to networks

In the second half of 2012 the network component of household gas prices ranged between 4.9 cents/kWh (Spain) and 0.32 cents/kWh (Estonia). In the case of industrial gas prices the network component ranged between 0.2 cents/kWh (the Netherlands) and 1.14 cents/kWh (Sweden).

As with electricity network costs, the proceeds collected from the network component of the end consumer bill are intended to reflect pipeline costs related to operational expenditures, depreciation and the cost of capital.

Pipeline operating costs vary mainly according to the number of compressor stations, which require significant amounts of fuel, and local economic conditions. The expected load factor determines the optimal mix of diameter and compression capacity. The pipeline diameter can be linked to the pressure level and to the type of transportation: transmission (mostly pipelines with high and median diameter and high pressure levels) or distribution (mostly pipelines with small diameters and low pressure levels).

As in the case of electricity network costs, direct comparison of unit tariffs should be done with caution due to differences between countries in areas such as quality of service, market arrangements, main technical characteristics, topological and environmental aspects of the networks, e.g. consumption density, generation location, that influence the level of such charges.

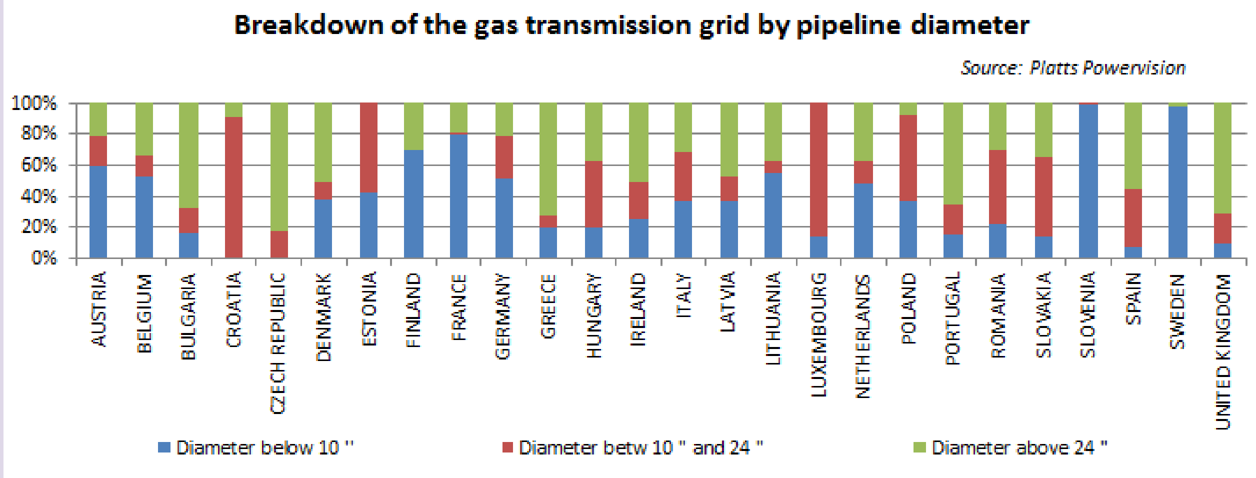
Detailed and harmonized information on gas networks in the EU is in general scarce with no scarce data on total length and age of operation by component. The Framework Guidelines on rules regarding harmonised transmission tariff structures for gas apply to the transmission

[77] DG ECFIN. Energy Economic Development in Europe

services offered at all entry and exit points of gas TSOs, irrespective of whether they are physical or virtual[78].

Figure 62 Length and relative share of Member States gas grids by pipeline diameter

	< 10" (km)	10"–24" (km)	> 24" (km)	Total (km)
AUSTRIA	4243	1398	1522	7163
BELGIUM	1912	479	1227	3618
BULGARIA	431	415	1758	2603
CROATIA	0	695	70	765
CZECH REPUBLIC	35	569	2753	3357
DENMARK	1078	324	1440	2841
ESTONIA	326	436	0	761
FINLAND	606	0	257	863
FRANCE	26799	476	6313	33588
GERMANY	34603	18187	14337	67127
GREECE	207	82	741	1029
HUNGARY	1021	2253	1925	5199
IRELAND	526	524	1057	2106
ITALY	10529	9039	9055	28623
LATVIA	403	184	520	1108
LITHUANIA	998	148	660	1806
LUXEMBOURG	41	239	0	280
NETHERLANDS	4063	1208	3144	8415
POLAND	5801	8668	1149	15618
PORTUGAL	168	225	738	1130
ROMANIA	1154	2405	1570	5129
SLOVAKIA	762	2888	1970	5621
SLOVENIA	752	6	0	758
SPAIN	908	4573	6627	12108
SWEDEN	965	0	20	985
UNITED KINGDOM	1637	3421	12771	17828



Note. The pipeline diameter can be linked to the pressure level and to the type of transportation: transmission (mostly pipelines with high and median diameter and high pressure levels) or distribution (mostly pipelines with small diameters and low pressure levels)

[78] See Draft Framework Guidelines on rules regarding harmonised transmission tariff structures for gas http://www.acer.europa.eu/Gas/Framework%20guidelines_and_network%20codes/Documents/outcome%20of%20BoR27-5%201_FG-GasTariffs_for_publication_clean.pdf

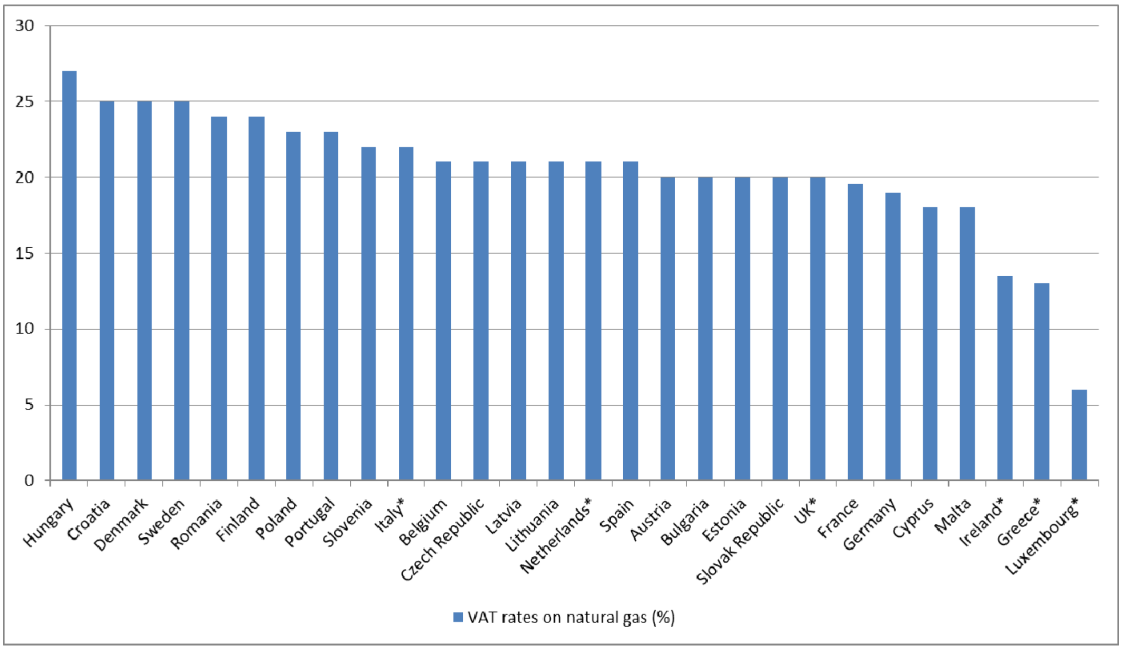
1.2.1.3. Costs related to taxation

In 2012 median EU households paid between 0.28 Eurocent/kWh (UK) and 5.66 Eurocent/kWh (SE) for the taxation component. In the case of industrial consumers, taxation accounted for between 0.06 Eurocents/kWh (LU) and 3.83 Eurocent/kWh (SE). The Energy Tax Directive sets minimum levels of excise duty for natural gas used for heating at €0.15 per gigajoule for business use and €0.3 per gigajoule for non-business use.

Tax Rates - VAT and excise duties

As with electricity (see section 1.1.1.3), VAT rates on natural gas are broadly constant across Member States. Luxembourg and Greece charge reduced VAT rates of 6% and 13%, respectively, on natural gas consumption for heating (business and non-business use), as well as propellant use. Ireland charges a reduced VAT rate of 13.5% on natural gas for industrial/commercial use, as well as heating use (business and non-business use), while the UK, Italy and the Netherlands charge reduced rates of 5%, 10% and 19%, respectively, on natural gas for non-business heating use. VAT rate on gas in Croatia, Sweden and Denmark is at 25% and in Hungary at 27%.

Figure 63. VAT rates on natural gas



Source: European Commission

Note: *Reduced VAT rates, see details in text.

The Energy Tax Directive sets minimum levels of **excise duty** for natural gas used for heating at 0.15 Euro/GJ in the case of business use (0.5 Euro/MWh)[79] and at 0.3 Euro/GJ (1 Euro/MWh) for non-business use and for industrial/commercial use.

Table 18. Excise duties levied on natural gas, Euro/MWh, 2013

Natural gas, EUR/MWh (1)	Industry commercial use	Heating business use	Heating – non-business use
Belgium (2)	0,47	0,47	0,97
Bulgaria	1,55	0,18	0,18
Croatia	1,98	1,98	3,92
Czech Republic	1,22	1,22	1,22
Denmark	39,50	33,71	33,71
Germany	13,88	4,10	5,50
Estonia	0,00	2,52	2,52
Greece	5,40	5,40	5,40
Spain	4,14	0,00	0,00
France	1,19	1,19	0,00
Ireland	4,10	4,10	4,10
Italy	1,15	1,22	4,28
Cyprus	9,35	9,35	9,35
Latvia	1,65	1,65	1,65
Lithuania	0,00	0,00	0,00
Luxembourg	0,00	0,54	1,08
Hungary	1,12	1,12	1,12
Malta	9,35	3,02	3,02
Netherlands	19,03	19,03	19,03
Austria	5,97	5,97	5,97
Poland	0,00	0,00	0,00
Portugal	1,08	1,08	1,08
Romania	9,35	0,61	1,15
Slovenia	4,42	4,42	4,42
Slovakia	9,35	1,33	1,33
Finland	10,47	10,47	10,47
Sweden	10,25	10,25	34,17
UK	0,00	0,00	0,00

Source: European Commission Excise Duty Tables[80].
Notes: (1) Some Member States impose other charges and levies that form part of the price of natural gas paid by the final consumer, including environmental taxes, natural gas taxes, concession fees, CO2 and energy taxes, strategic stockpile fees, grid charges (in addition to transmission and distribution).; (2) In Belgium, a federal contribution of EUR 0.468/GJ is applied;

The levels of excise duty which Member States charge in addition to the minimum rates set by the Directive vary significantly by country and are frequently applied unevenly across sectors. For example, in Bulgaria, Denmark, Germany, Malta, Romania and Slovakia, natural gas for industrial and commercial use is subject to higher excise duties than natural gas used for heating.

[79] Business use is defined in Article 11 of the Directive as "use by a business entity … which independently carries out , in any place, the supply of goods and services, whatever the purpose or results of such economic activities".
[80] See details on exemptions from excise duties at http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_ii_energy_products_en.pdf

Tax exemptions

As indicated in the discussion on the role of taxation on electricity prices (section 1.1.1.3), tax exemptions may be available in some countries to specific sectors.

In eleven EU countries natural gas for heating use by businesses pays zero or lower excise duty than heating use by non-businesses. Seven EU countries levy zero excise duty on gas used for industrial and commercial purposes; out of these seven four levy zero excise duty on gas used for heating by businesses.

Most of the Member States applying a total tax exemption for natural gas used for heating base it on Article 15(1) (g) of the Energy Taxation Directive, which allowed this exemption/reduction for the maximum period of 10 years; this possibility expired in the end of 2013. Member States using this option need to comply with EU minimum as from 1 January 2014. The other possibility for tax exemptions is for energy intensive business; however every measure has to comply with the state aid rules.

In the **United Kingdom**, the Climate Change Levy is a tax imposed on consumption by business and the public sector of electricity, natural gas and other fuel sources, but energy intensive industries qualify for a reduction of 80% on this levy, on condition of meeting certain energy-saving targets set out in a Climate Change Agreement (see details in section 1.1.1.3).

In **Denmark**, under the Green Tax Package scheme, EIIs are completely exempt from energy taxes, and almost completely exempt from carbon taxes.[81] Processes which participate in Voluntary Agreements, committing them to energy efficiency improvements, are eligible for a rebate of 100% on their energy tax and 97% on their carbon tax.

In the **Netherlands**, taxes on natural gas and electricity consumption are based on a bracket system, which sets marginal rates based on the amount of use. The rates decrease with increased use, and different rate schedules apply for industrial, residential and agricultural use.

In **Belgium**, EIIs with an environmental agreement are entitled to a 100% exemption on the excise tax on fuels they use, as well as on electricity consumption.[82]

In **Finland**, a special rate of EUR 0.244/MWh applies to consumers with consumption greater than 70,000 MWh per year in the steel industry (out of the scope of the Energy Taxation Directive).

[81] ICF report, p142
[82] OECD p67

1.2.2. Natural gas price developments in selected industries

Based on the methodology described in Annex 2, the results of several case studies for selected energy-intensive industries are presented below with regard to natural gas prices. All caveats on the interpretation of the results for electricity prices reported by the sampled plants apply in the case of gas prices too. As in the case of electricity, this section starts with presenting and comparing the variation of natural gas price data for each of the seven sectors assessed.

In particular, for each sector and the related EU-wide sample (not split into regions) the average natural gas prices paid by operators are presented together with standard deviation. The consumption ranges are also presented using the median and box plots, the former indicating the value which splits the sample in half; the latter indicating the range of values between which 50% of the data sample lay.

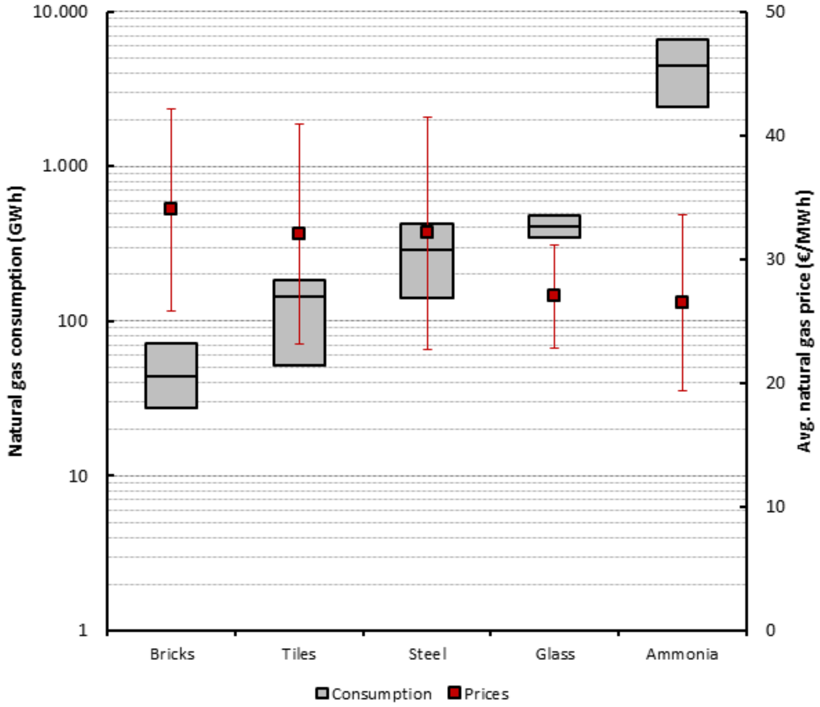
Natural gas data is not available or used for all sectors as, for example, both chlorine and aluminium producers mainly rely on electricity as energy input. The number of questionnaires used for each sector is reported below.

Table 19 Number of questionnaires used in cross-sectoral analysis

(sub)sector	N. of questionnaires Natural gas
Bricks and roof tiles	16
Wall and floor tiles	20
Float glass	10
Ammonia	10
Chlorine	-
Steel	13
Aluminium	-
Total	**69**

As in the case of electricity although with lower observed gaps, larger consumers pay lower prices. The difference in the price of natural gas paid by an average producer of bricks and an average producer of ammonia is of 7.0 €/MWh. Gas prices in the sample of large users discussed are mainly determined by the energy component and do therefore offer less flexibility than electricity contracts for possible discounts or exemptions.

Figure 64 Natural gas consumption range and price variations grouped by sector (69 plants)



Source: CEPS, calculations based on questionnaires

Table 20 Average natural gas prices and median consumption in various sectors (69 plants)

	Bricks	Tiles	Steel	Glass	Ammonia
Average price (€/MWh)	34.0	32.0	32.1	27.0	26.5
Median consumption (GWh)	44.3	142.5	288	406.2	4,446.3

Source: CEPS, calculations based on questionnaires

1.2.2.1. Bricks and roof tiles

The results of the case study for bricks and roof tiles presented below are based on the answers provided by a sample of 13 plants. The share of the sampled plants in EU production is unknown. Production volumes are reported using different units due to homogeneity of products.

Table 21 Number of questionnaires used in the brick and roof tiles case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison
23	13	13	13	8	6

Data collected show that the average price of natural gas paid by the 13 sampled producers of bricks and roof tiles has increased by 30% between 2010 and 2012, from 30.4 to 39.5 €/MWh. The spread between the lowest and the highest price has also increased, going from 29.4 to 38.8 €/MWh. Different geographical regions have all seen an increasing trend although of different intensity, as can be seen from the table below.

Table 22 Descriptive statistics for natural gas prices paid by the 13 sampled EU producers of bricks and roof tiles (€/MWh)

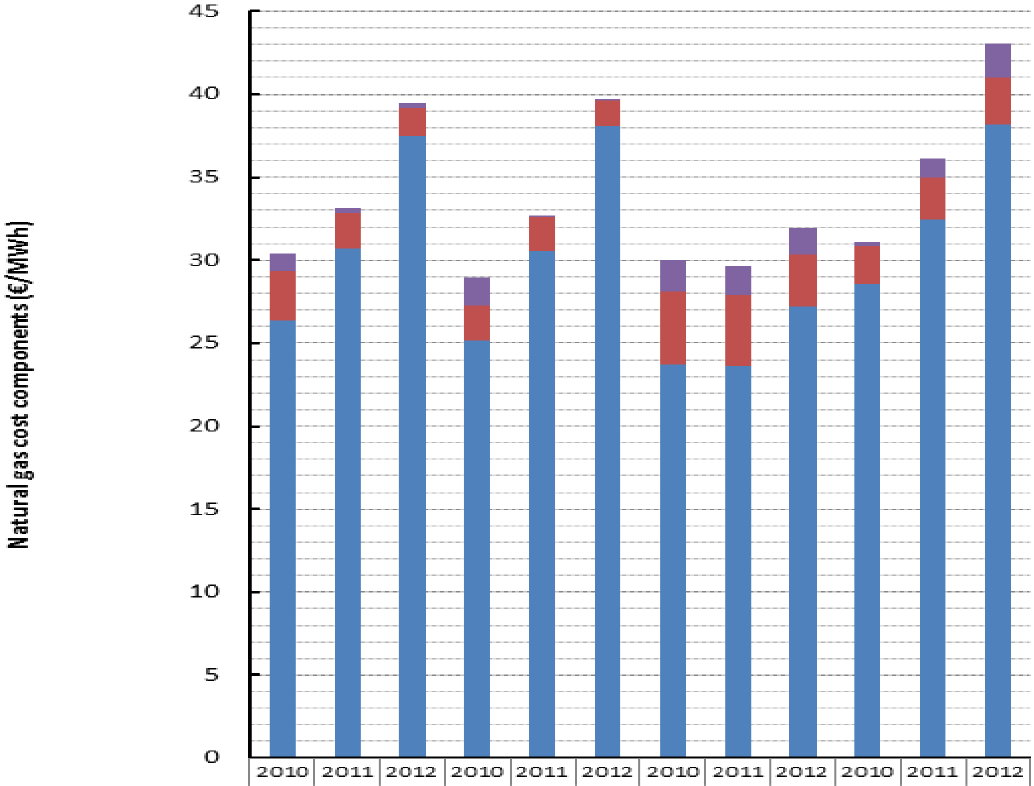
Natural Gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	30,4	33,2	39,5	29,9
EU minimum	18,7	25,6	24,7	32,1
EU maximum	48,1	57,2	63,5	32,0
Northern Europe (average)	28,9	32,7	39,7	37,4
Central Europe (average)	30,0	29,7	31,9	6,3
Southern Europe (average)	31,2	36,2	43,2	38,5

Northern Europe includes 5 plants: IE, UK, BE, LU, NL, DK, SE, NO, LT, LV, FI, EE
Central Europe includes 3 plants: DE, PL, CZ, SK, AT, HU
Southern Europe includes 5 plants: FR, PT, ES, IT, SI, HR, BG, RO, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires

On average, the 5 operators in Southern Europe pay the highest price for natural gas. They already did in 2010, but also faced a considerable increase in the period 2010-2012 (+38.5%), compared to the moderate one observed in the 3 plants in Central Europe (+6.3%).

In terms of components, the energy component is the major driver of natural gas prices in the 13 sampled plants. Over the period examined and for the whole of the sample examined, it has increased by 42%, from 26.4 to 37.5 €/MWh. Such evolution, accompanied by a decreasing impact of the other components in absolute terms, has implied a significant increase of the relative impact of the energy component on the overall price, which has gone from 87% to 95%.

Figure 65 Components of the natural gas bills paid by the 13 sampled bricks and roof tiles producers in Europe (€/MWh)



	EU			Northern Europe			Central Europe			Southern Europe		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Other (excl. VAT)	1,0	0,3	0,3	1,7	0,1	0,1	1,9	1,8	1,5	0,2	1,2	2,1
Grid fees	3,0	2,1	1,7	2,1	2,1	1,5	4,4	4,3	3,1	2,3	2,5	2,8
Energy component	26,4	30,7	37,5	25,2	30,5	38,1	23,7	23,6	27,2	28,6	32,5	38,2

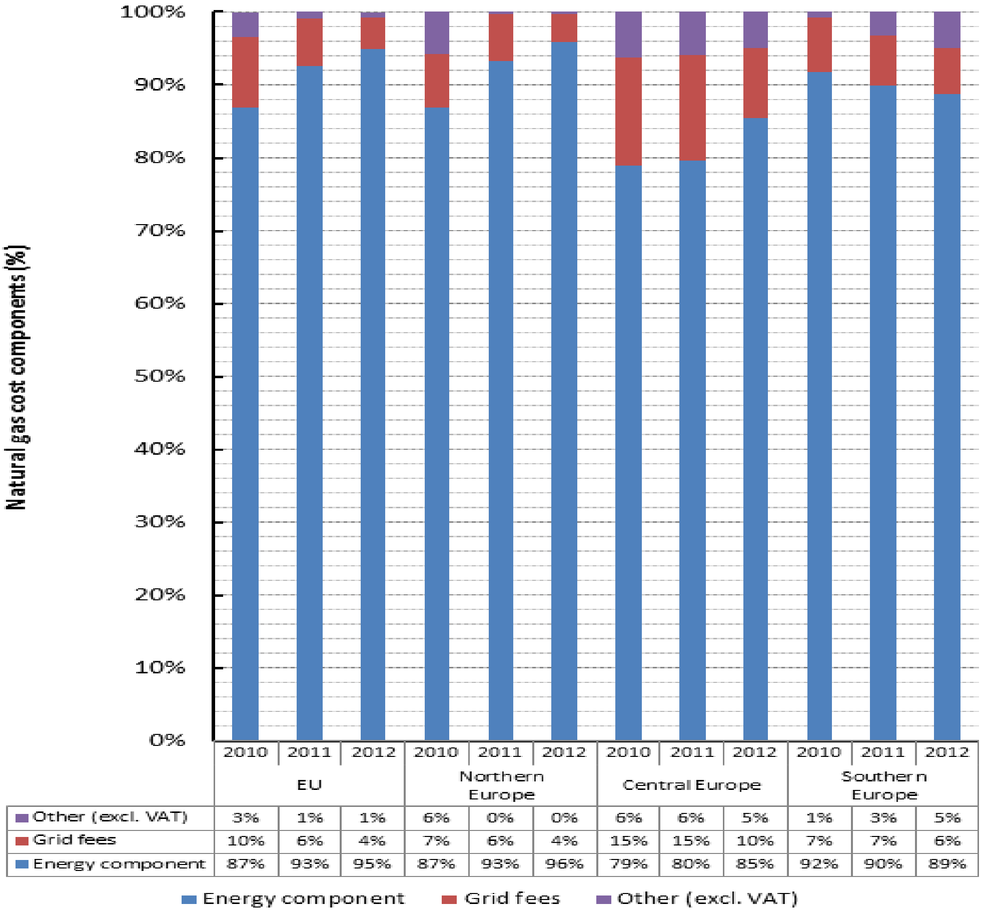
Energy component   Grid fees   Other (excl. VAT)

Source: CEPS, calculations based on questionnaires.

While an increase in the energy component can be observed in all regions and in particular in Northern and Southern Europe (5 plants in each of the two regions), Southern Europe was characterized by an increase also in the other two components, that is grid fees and non-recoverable taxes, which went up by 22% and by a factor of 9.5%, respectively.

As a share of total price of natural gas, grid fees in 2012 have the largest share in the 3 plants in Central Europe (10%) followed by the 5 plants in Southern and the 5 plants in Northern Europe (6% and 4%, respectively).

Figure 66 Components of the natural gas bills paid by the 13 sampled bricks and roof tiles producers in Europe (%)



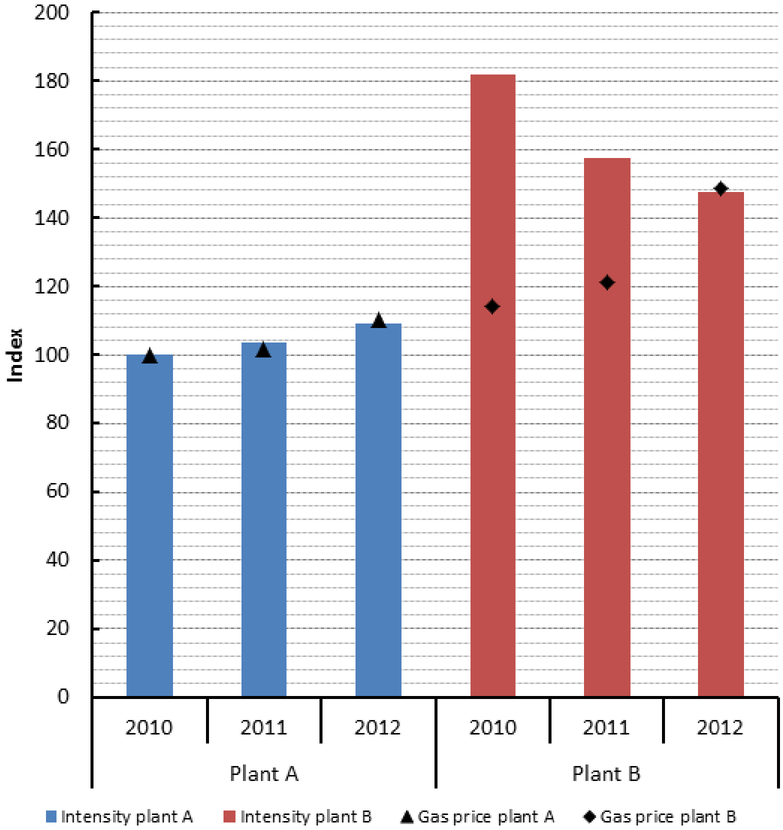
	EU 2010	EU 2011	EU 2012	Northern Europe 2010	Northern Europe 2011	Northern Europe 2012	Central Europe 2010	Central Europe 2011	Central Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other (excl. VAT)	3%	1%	1%	6%	0%	0%	6%	6%	5%	1%	3%	5%
Grid fees	10%	6%	4%	7%	6%	4%	15%	15%	10%	7%	7%	6%
Energy component	87%	93%	95%	87%	93%	96%	79%	80%	85%	92%	90%	89%

Source: CEPS, calculations based on questionnaires

As indicated in the description of the methodology (Annex 2), case studies also looked at the issue of gas and/or electricity intensity for the sampled plants. In particular, the most and the least efficient plant of the sample - in terms of one or the other energy input - are compared in terms of gas or electricity price.

In the case of bricks and roof tiles, the efficiency gap between the most and least efficient plant (plant A and B, respectively) has been reducing between 2010 and 2012, while the differential in the gas price paid increased considerably. General conclusions cannot be drawn but it seems clear that, under current conditions, potential efforts from plant B to further reduce its gas intensity and get closer to best performers in the sector would not allow addressing the clear competitive disadvantage represented by far higher gas prices.

Figure 67 Natural gas intensity and natural gas prices of two plants (indexed values)



Source: CEPS, calculations based on questionnaires. Lowest value = 100.

1.2.2.2. Wall and floor tiles

The results of the case study for wall and floor tiles presented below are based on the answers provided by a sample of 12 plants to a questionnaire and to each sections of it, as reported in the table below.

It is not possible to establish the share of the sampled plants in EU production due to the homogeneity of products, respondents reported production volumes using different units or did not disclose production volumes.

Table 23 Number of questionnaires used in the wall and floor tiles case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and margins
24	12	12	12	6	6	9

Data collected from the 12 sampled plants shows that the average price of natural gas paid by the sampled producers of wall and floor tiles has increased by 27% between 2010 and 2012, from 25.0 to 31.7 €/MWh.

The spread between the lowest and the highest price paid by the 12 respondents in the sample has diminished, going from 11.3 to 10.2 €/MWh although the price range that plants in the sample faced moved upwards - in particular the lower prices paid by some operators increased faster – associated to an increasing gap of prices paid by different operators.

Different geographical regions have all registered an increasing trend although of different intensity, as it can be seen from the table below:

Table 24 Descriptive statistics for natural gas prices paid by 12 sampled EU producers of wall and floor tiles (€/MWh)

Natural Gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	25,0	26,2	31,7	26,8
EU minimum	21,0	23,1	27,6	31,4
EU maximum	32,3	35,3	37,8	17,0
Central and Northern Europe (average)	25,7	23,8	28,7	11,7
South-Western Europe (average)	25,6	29,7	34,7	35,5
South-Eastern Europe (average)	23,0	25,0	31,4	36,5

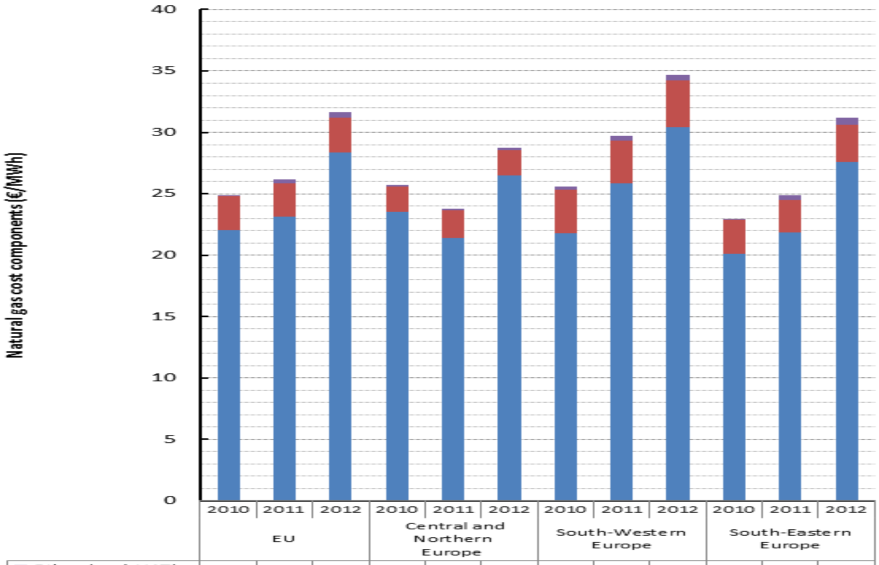
Central and Northern Europe includes 3 plants: IE, UK, BE, LU, NL, DK, DE, PL CZ, LV, LT, EE, SE, FI
South-Western Europe includes 5 plants: ES, PT, FR
South-Eastern Europe includes 4 plants: IT, SI, AT, HU, SK, HR, BU, RO, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires

On average, in 2012 the 5 operators in South-Western Europe paid the highest price for natural gas, following an increase of more than 35% since 2010. An even higher increase was

registered for the 4 operators in South-Eastern Europe (36.5%) which however were paying the lowest price in 2010.

The energy component is the major driver of the natural gas price, representing on average about 90% of the total in 2012 (28.4 €/MWh compared to 22.1 €/MWh in 2010). An increase is observed also for the other two components whose cumulated weight on total price remained nevertheless stable.

Figure 68 Components of the natural gas bills paid by the 12 sampled wall and floor tiles producers in Europe (€/MWh)



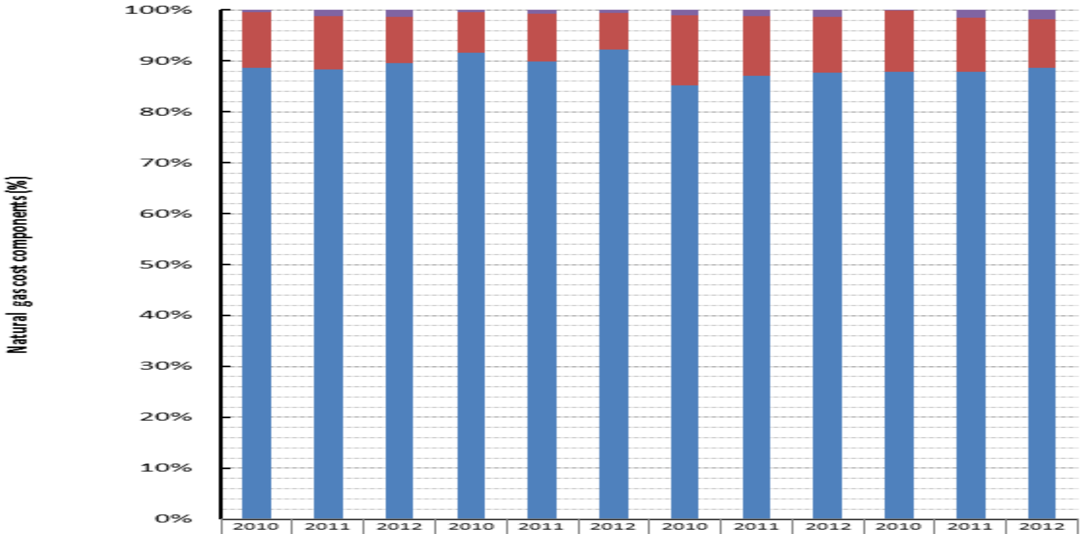
	EU 2010	EU 2011	EU 2012	Central and Northern Europe 2010	Central and Northern Europe 2011	Central and Northern Europe 2012	South-Western Europe 2010	South-Western Europe 2011	South-Western Europe 2012	South-Eastern Europe 2010	South-Eastern Europe 2011	South-Eastern Europe 2012
Other (excl. VAT)	0,1	0,3	0,4	0,1	0,2	0,2	0,3	0,4	0,5	0,0	0,4	0,6
Grid fees	2,7	2,7	2,9	2,1	2,3	2,0	3,5	3,5	3,8	2,8	2,6	3,0
Energy component	22,1	23,1	28,4	23,5	21,4	26,5	21,8	25,8	30,4	20,1	21,9	27,6

Source: CEPS, calculations based on questionnaires.

An increase in the energy component can be observed in all regions assessed and in particular in South-Western and South-Eastern Europe (39% and 37%, respectively as accounted for by 5 and 4 plants, respectively) which is clearly the main driver of the sustained increase in the overall price for the two regions discussed above.

As indicated in the description of the methodology adopted, case studies also looked at the issue of gas and/or electricity intensity for the sampled plants. In particular, the most and the least efficient plant of the sample - in terms of one or the other energy input - are compared together with the gas or electricity price they pay.

Figure 69 Components of the natural gas bills paid by the 12 sampled wall and floor tiles producers in Europe (%)



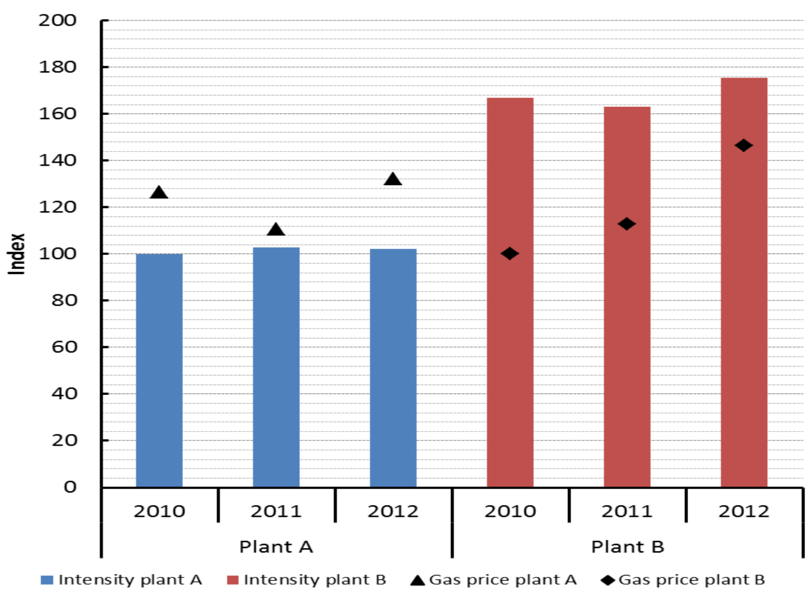
	EU 2010	EU 2011	EU 2012	Central and Northern Europe 2010	Central and Northern Europe 2011	Central and Northern Europe 2012	South-Western Europe 2010	South-Western Europe 2011	South-Western Europe 2012	South-Eastern Europe 2010	South-Eastern Europe 2011	South-Eastern Europe 2012
Other (excl. VAT)	0%	1%	1%	0%	1%	1%	1%	1%	1%	0%	2%	2%
Grid fees	11%	10%	9%	8%	10%	7%	14%	12%	11%	12%	11%	10%
Energy component	89%	88%	90%	92%	90%	92%	85%	87%	88%	88%	88%	89%

Energy component   Grid fees   Other (excl. VAT)

Source: CEPS, calculations based on questionnaires.

In the case of wall and floor tiles, the efficiency gap between the most and least efficient plant in the sample of 12 plants (plant A and B, respectively) has slightly increased between 2010 and 2012, while the differential in the gas price paid decreased. As for the other case studies, general conclusions cannot be drawn but the data suggests that, under current conditions, increasing gas prices equally affect best and lest performers in the sector and reduce the advantages associated to increased energy efficiency.

Figure 70 Natural gas intensity and natural gas prices of two plants producing wall and floor tiles (indexed values)



Source: CEPS, calculations based on questionnaires. Lowest value = 100.

1.2.2.3. Float glass

The results of the case study for float glass presented below are based on the answers provided by a sample of plants to a questionnaire and to each sections of it, as reported in the table below. The 10 plants represent about 19% of European production.

Table 25 Number of questionnaires used in the float glass case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs	Margins
10	10	10	7	10	7	4

Data collected shows that the average price of natural gas paid by the 10 sampled producers of float glass has increased by 28% between 2010 and 2012, from 23.7 to 30.3 €/MWh. The spread between the lowest and the highest price has also increased, going from 9 to 12 €/MWh, reflecting increasing disparities between operators in the sample.

Starting from very close levels in 2010, different geographical regions have all registered an increasing trend, which determined new relative positions in 2012. In particular, the increase was particularly sustained in the 4 plants in Southern and Eastern Europe (40% and 37.4%, respectively).

Table 26 Descriptive statistics for natural gas prices paid by the 10 sampled EU producers of float glass (€/MWh)

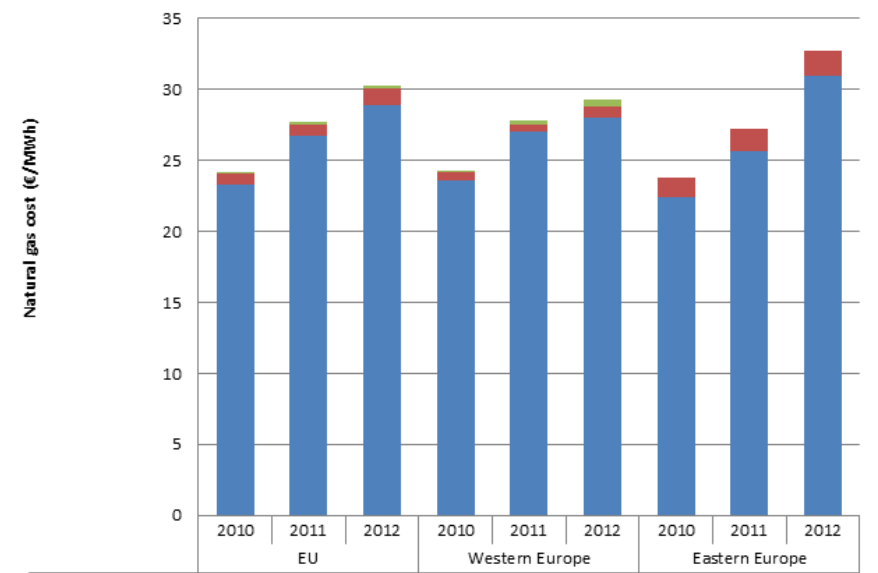
Natural gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	23.7	27.3	30.3	27.8
EU minimum	19.0	23.8	24.4	28.4
EU maximum	27.6	31.6	36.5	32.2
Western Europe (average)	23.6	27.3	28.7	21.6
Southern Europe (average)	23.7	27.7	33.2	40.1
Eastern Europe (average)	23.8	27.2	32.7	37.4

Western Europe includes 6 plants: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes 2 plants: BG, RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes 2 plants: IT, MT, CY, PT, ES, EL, SI
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires

As with other sub-sectors assessed, the energy component represents the major driver of natural gas prices of the 10 float glass producers, accounting for about 95%. Between 2010 and 2012 this component has increased by 24%, from 23.3 to 28.9 €/MWh. Several plants in the sample declared that the major price driver in their gas contract was the rise in oil price as their natural gas prices are linked to the price of oil. The major increase of the energy component is observed for the 2 plants in Eastern Europe (38%). The impact of other components, although still marginal in absolute terms, has also increased. In particular grid

fees have increased from 0.80 to 1.09 €/MWh, while other non-recoverable taxes and levies have increased from 0.11 to 0.28 €/MWh.

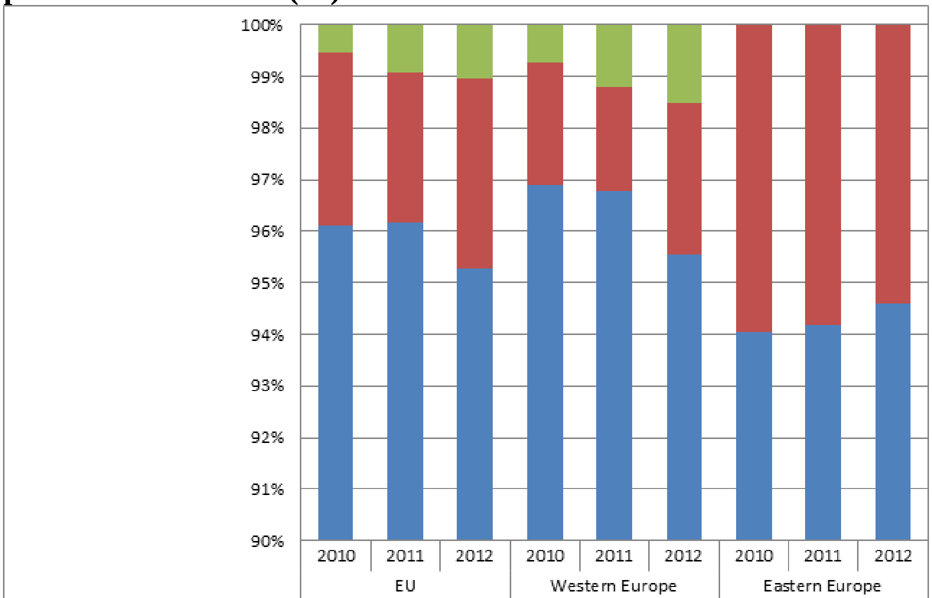
Figure 71 Components of the natural gas bills paid by the 10 sampled float glass producers in Europe (€/MWh)



	EU 2010	EU 2011	EU 2012	Western Europe 2010	Western Europe 2011	Western Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012
Other (excl. VAT)	0,1	0,2	0,3	0,2	0,3	0,4	0,0	0,0	0,0
Grid fees	0,8	0,8	1,1	0,6	0,5	0,8	1,4	1,6	1,7
Energy component	23,2	26,7	28,9	23,6	27,0	28,0	22,4	25,6	31,0

Note: The analysis of the natural gas bill components was not possible for plants in Southern Europe.
Source: CEPS, calculations based on questionnaires.

Figure 72 Components of the natural gas bills paid by the 10 sampled float glass producers in the EU (%)



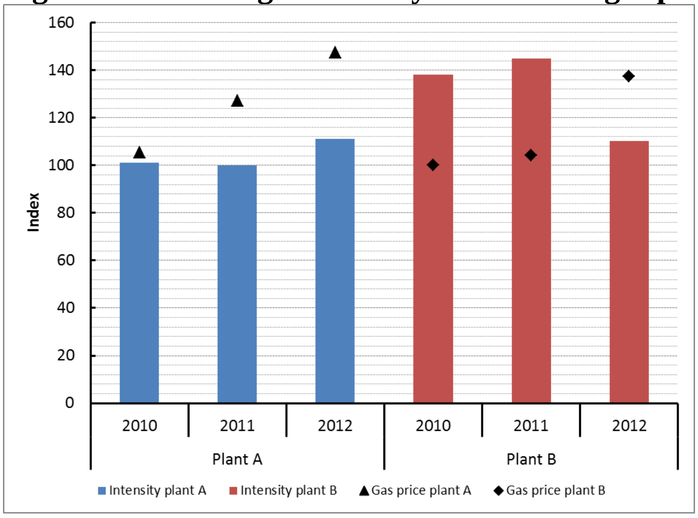
	EU 2010	EU 2011	EU 2012	Western Europe 2010	Western Europe 2011	Western Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012
Other (excl. VAT)	0,5%	0,9%	1,0%	0,7%	1,2%	1,5%	0,0%	0,0%	0,0%
Network cost	3,4%	2,9%	3,7%	2,4%	2,0%	2,9%	6,0%	5,8%	5,4%
Energy component	96,1%	96,2%	95,3%	96,9%	96,8%	95,6%	94,0%	94,2%	94,6%

Note: The analysis of the natural gas bill components was not possible for plants in Southern Europe.
Source: CEPS, calculations based on questionnaires.

Case studies also looked at the issue of gas and/or electricity intensity for the sampled plants. In particular, the most and the least efficient plant of the sample - in terms of either electricity or gas - are compared in terms of the gas or electricity price they pay.

In the case of float glass, the efficiency gap between the most and least efficient plant in the sample of 10 plants (plant A and B, respectively) decreased between 2010 and 2012 and the same level of efficiency could be observed at the end of the period. As for the other case studies, general conclusions cannot be drawn but data suggests that, under current conditions, increasing gas prices equally affect best and worst performers in the sector and reduce the monetary advantages associated to increased energy efficiency.

Figure 73 Natural gas intensity and natural gas prices of two plants (indexed values)



Source: CEPS, calculations based on questionnaires. Lowest value = 100.

1.2.2.4. Ammonia

The results of the case study for ammonia producers are based on the answers provided by a sample of plants to a questionnaire and to each section of it, as reported in the table below. The 10 sampled plants represent in total about 26% of EU27 production. Considering that about 80% of the global ammonia production is used for the production of fertilisers, the case study focused on ammonia plants that in the vast majority of cases are integrated in large installations that subsequently produce fertilisers. The sample includes 2 small, 4 medium and 4 large-sized plants, which represent a total of about 27% of EU production capacity. The 10 plants are located in 10 different member states.

Table 27 Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs
10	10	10	10	10	7

Considering that about 80% of the global ammonia production is used for the production of fertilisers, the case study focused on ammonia plants that in the vast majority of cases are integrated in large installations that subsequently produce fertilisers.

Natural gas is the predominant fuel used by the 10 sampled plants, for which it accounts for about 90-94% of total energy costs. Data collected show that the average price of natural gas paid by the sampled producers of ammonia has increased by 41% between 2010 and 2012, from 22.2 to 31.2 €/MWh.

The gap of prices paid by sampled producers has also increased. Sustained price increase can be observed in all the geographical regions defined, in particular in Eastern and Southern Europe (49% and 48%, respectively), with the latter one resulting to be the region with the highest price in all three years assessed.

As regard the different price components, the energy part constitutes the major part of the price, accounting for more than 95% of the total price of the 10 sampled plants. Between 2010 and 2012, the energy component increased on average for the whole sample by 42%, from 21.2 to 30.1 €/MWh, and even more for the operators in Eastern Europe (+54%). The share of other components in the total price for the 10 sampled plants is relatively limited and as in the case of grid fees even decreasing (from 4% to 2.4%).

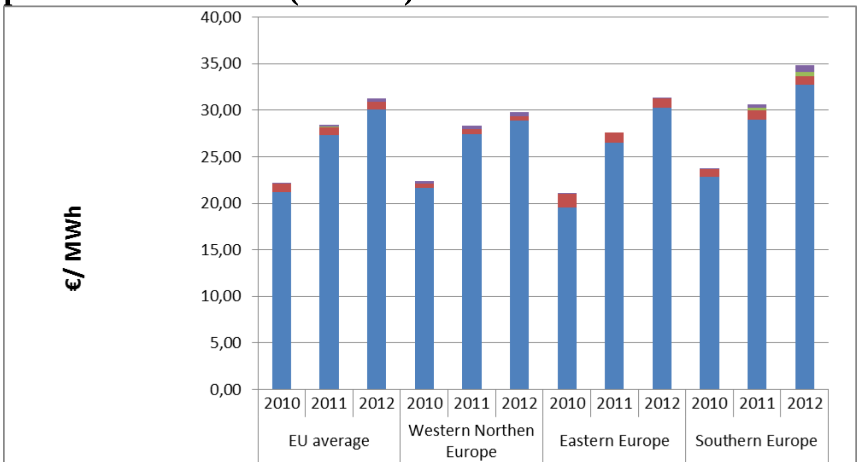
Table 28 Descriptive statistics for natural gas prices paid by the 10 sampled EU producers of ammonia (€/MWh)

Natural gas price (€/MWh)	**2010**	**2011**	**2012**	**% change 2010-2012**
EU average	22.2	28.5	31.2	40.5
Western-Northern Europe (average)	22.4	28.4	29.8	33.0
Southern Europe (average)	23.6	30.7	34.8	47.5
Eastern Europe (average)	21.0	27.6	31.2	48.6

Western-Northern Europe includes: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes: RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes: IT, MT, CY, PT, ES, EL, SI, BG
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons. The number of sampled plants per region cannot be disclosed due to confidentiality.
Source: CEPS, calculations based on questionnaires.

The comparison between regions does not reveal particular differences but for the fact that, as from 2011, the plants in Southern Europe are the only ones that pay a RES levy, although this still represents a very limited share of total price (around 1%).

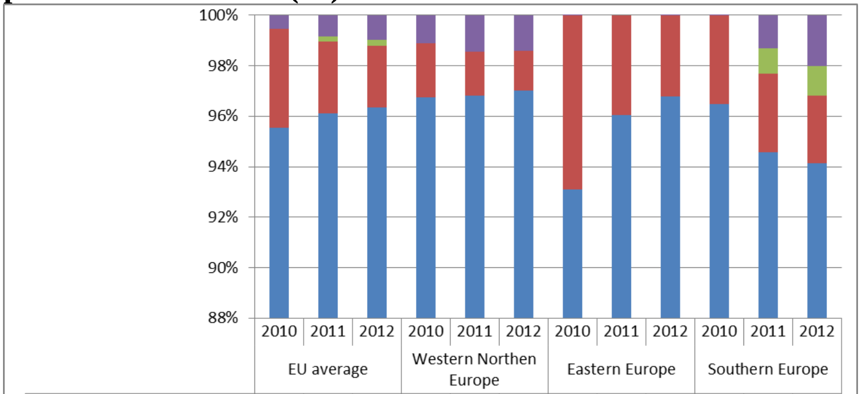
Figure 74 Components of the natural gas bills paid by the 10 sampled ammonia producers in the EU (€/MWh)



	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
	EU average			Western Northen Europe			Eastern Europe			Southern Europe		
Other non-recoverable taxes	0,12	0,24	0,30	0,25	0,41	0,42	0,00	0,00	0,00	0,00	0,40	0,70
RES levy	0,00	0,05	0,07	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,32	0,41
Grid fees	0,87	0,82	0,76	0,48	0,50	0,47	1,45	1,10	1,00	0,83	0,95	0,93
Energy component	21,20	27,36	30,10	21,67	27,47	28,89	19,58	26,54	30,23	22,81	29,00	32,76

Source: CEPS, calculations based on questionnaires.

Figure 75 Components of the natural gas bills paid by the 10 sampled ammonia producers in the EU (%)

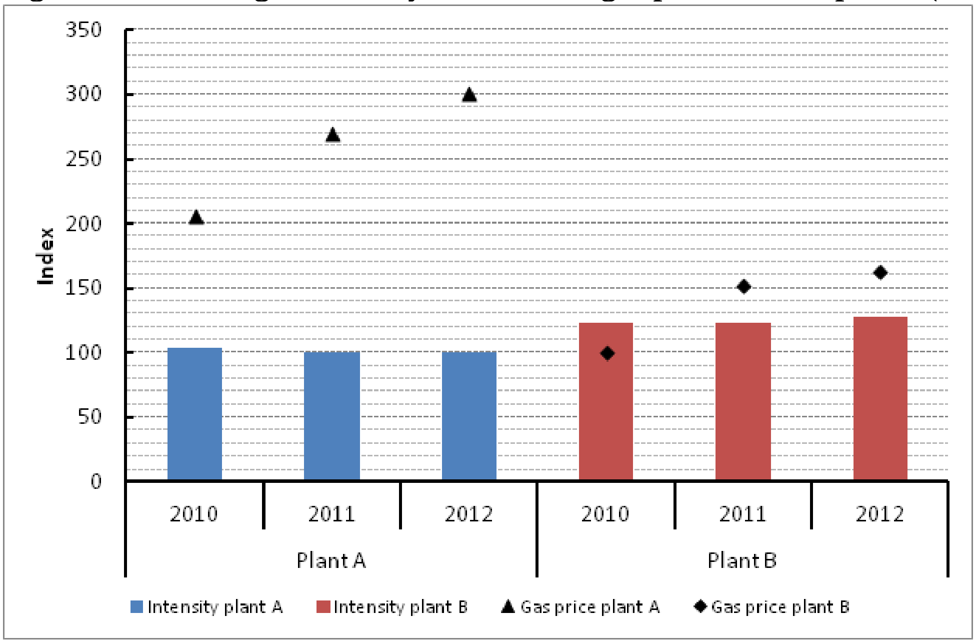


	EU average 2010	EU average 2011	EU average 2012	Western Northen Europe 2010	Western Northen Europe 2011	Western Northen Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other non-recoverable taxes	0,5%	0,9%	1,0%	1,1%	1,4%	1,4%	0,0%	0,0%	0,0%	0,0%	1,3%	2,0%
RES levy	0,0%	0,2%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1,0%	1,2%
Grid fees	3,9%	2,9%	2,4%	2,1%	1,8%	1,6%	6,9%	4,0%	3,2%	3,5%	3,1%	2,7%
Energy component	95,5%	96,1%	96,4%	96,7%	96,8%	97,0%	93,1%	96,0%	96,8%	96,5%	94,6%	94,1%

Source: CEPS, calculations based on questionnaires.

Case studies also looked at the issue of gas and/or electricity intensity for the sampled plants. In particular, the most and the least efficient plant of the sample of 10 plants - in terms of one or the other energy input - are compared together with the gas or electricity price they pay. In the case of ammonia, the comparison suggests no relation between efficiency gains and price levels.

Figure 76 Natural gas intensity and natural gas prices of two plants (indexed values)



Source: CEPS, calculations based on questionnaires. Lowest value = 100.

1.2.2.5. Steel

The results of the case study for steel producers are based on the answers provided by a sample of 17 plants, out of more than 500 steel plants in the EU. The sample installations were self-selected by the industrial sector.

Table 29 Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and Margins
17	17	15 (gas) 17 (electr.)	14 (gas) 17 (electr.)	11 (gas) 14 (electr.)	3	*

* Data available from the steel cumulative cost assessment study[83]

For each technology[84], sampled plants had different capacity in order to reflect a distribution similar to that of the steel making universe.

Most steel makers are large gas consumers. Large BOF integrated plants producing flat products included in the sample, i.e. the vast majority of European BOF plants, consume between 1 and 1.5 mln MWh of natural gas per year, most of it in the rolling facilities. EAF and rolling facilities included in the sample consume between 450 and 700 thousands MWh of natural gas per year.

The prices of natural gas paid by the 14 sampled steel producers were on the rise throughout the entire observation period. Data collected show that the average price of natural gas paid by these sampled producers went up by 32% from 24.4 to 32.2 €/MWh between 2010 and 2012. Different geographical regions have all registered an increasing trend although of different intensity, as can be seen from the table below:

[83] http://ec.europa.eu/enterprise/sectors/metals-minerals/files/steel-cum-cost-imp_en.pdf
[84] See technology explanations, abbreviations and representation in the sample in section 1.1.2.

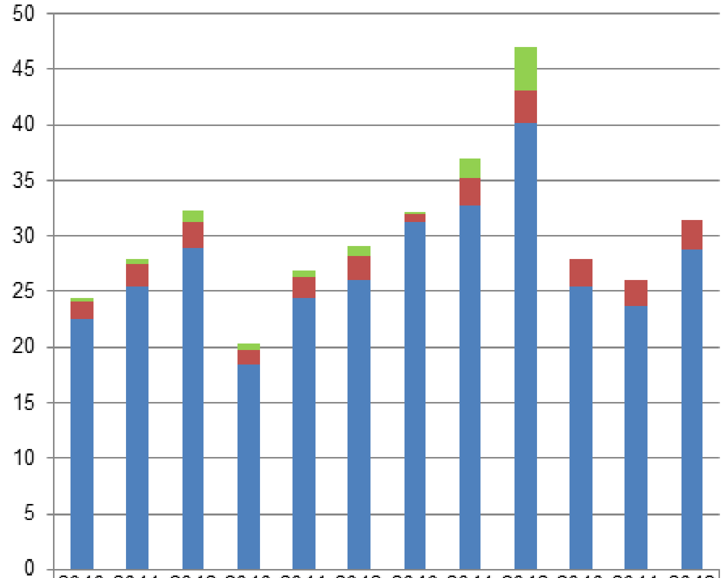
Table 30 Descriptive statistics for natural gas prices paid by 15 sampled EU producers of steel (€/MWh)

Natural Gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU (average)	24,4	27,8	32,2	32,0
EU (minimum)	17,8	23,0	26,6	49,4
EU (maximum)	35,4	47,9	59,1	66,9
Central and Eastern EU (average)	27,6	26,1	31,3	13,4
Southern EU (average)	32,0	36,7	47,2	47,5
North-Western EU (average)	20,2	26,7	28,9	43,1
BOF Average	24,4	26,2	30,8	26,2
EAF Average	24,0	28,6	32,6	35,8

North-Western Europe includes 9 plants: FR, BE, LU, NL, IE, UK, DE, AT, DK, FI, SE
Central and Eastern Europe includes 3 plants: PL, SI, HU, RO, BG, CZ, SK, EE, LV, LT
Southern Europe includes 5 plants: IT, ES, PT, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculations based on questionnaires.

In terms of components, the energy part is the major driver of natural gas prices for the 14 sampled plants in Europe (one respondent provided data on price trends, but not on components). Over the period examined, for the sampled plants it has increased by about 28%, from 22.5 €/MWh, to 28.9 €/MWh. The share of energy in the total price paid by the sampled plants in 2012 was down to 89%, compared to 92% in 2010, while other components increased. The strongest increase was observed in other non-recoverable taxes, which increased by a factor of 2.3 (from 0.3 to 1.0 €/MWh), although their weight in total price remained relatively limited (around 3%), also in comparison to network costs which represent about 8%.

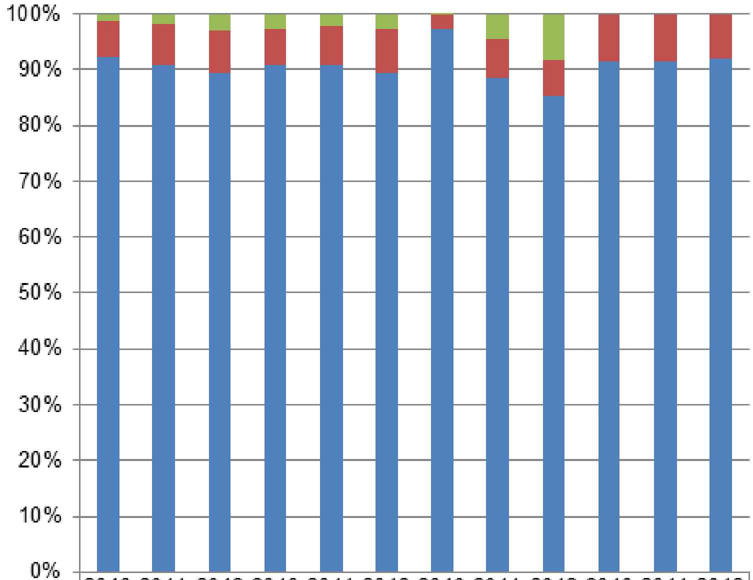
Figure 77 Components of the natural gas bills paid by 14 steel producers in the EU (€/MWh)



	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
		EU			North-West			South			Center-East	
Other Taxes	0,3	0,5	1,0	0,5	0,6	0,8	0,0	1,7	3,9	0,0	0,0	0,0
Network Costs	1,6	2,1	2,5	1,3	1,8	2,3	0,8	2,5	3,0	2,4	2,3	2,5
Energy Component	22,5	25,4	28,9	18,4	24,4	26,0	31,2	32,8	40,1	25,5	23,7	28,9

Source: CEPS, calculations based on questionnaires.

Figure 78 Components of the natural gas bills paid by 14 steel producers in the EU (%)



	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
		EU			North-West			South			Center-East	
Other Taxes	1%	2%	3%	3%	2%	3%	0%	5%	8%	0%	0%	0%
Network Costs	7%	7%	8%	6%	7%	8%	3%	7%	6%	9%	9%	8%
Energy Component	92%	91%	89%	91%	91%	89%	97%	89%	85%	91%	91%	92%

Source: CEPS, calculations based on questionnaires.

1.3. Chapter conclusions

- The retail segment is an essential element of the internal energy market (IEM) and ensuring conditions for fair competition and transparent price mechanisms on that segment is a necessary step in completing the IEM.

- The **progress on achieving a functioning retail market for electricity and natural gas** in the EU **has so far been difficult**. **Persistent divergences across Member States remain** with few indications that prices may align in the near future.

- **Strong factors are slowing down the completion of the retail IEM**: the relative share of non-market elements in the end consumer bill is growing; the majority of final consumers are still under the non-competitive offer of the incumbents; the perceived complexity of bills and pricing schemes dampens demand response; too many Member States still practice regulated prices over large group of consumers which in turn brings such undesirable effects as cross subsidization, the accumulation of tariff deficits and creating barriers to entry as the regulated benchmarks acts as an anchor to competitive commercial offers. **Coordinated EU action may prove to be the most efficient tool to mitigate those factors**.

- The end consumer bill can be schematically broken down by 3 sub aggregates: energy, network and taxation. **In the case of electricity**, the **energy element** followed broadly developments on the wholesale markets, although the recent wholesale price decreases have only partly translated into retail prices. It remained stable on average, registering a 3% decrease for the median industrial consumer and a 7% increase for the households. It turns out that the element that can be directly linked to the operation of the IEM **was the one that was least affected by price increases**. However, its relative share in the final energy bill decreased from 46% to 42% for the domestic consumers in the last 5 years[85].

- Costs related to the **network component** increased by 18% - 30% for consumers. Grid maintenance and development were among the driving factors for the transmission-related costs. The work of ENTSO-E, especially the TYNDP, has done much to improve the understanding on the different elements and the comparability of different costs across Member States. Yet, the transmission-related costs are only a minor part of the network component as the greater share of that element goes to cover expenses on the distribution grid. **There is room for improving the cooperation of DSOs in Europe** much in line to what has been done on the TSO level; as a minimum the visibility of that price component should be improved, perhaps by applying harmonised accounting standards.

- The **taxation and levy element** was a strong driver both for industrial and household consumers: in 5 years (2008 – 2012) it grew by more than 120% and 30% respectively. The energy taxation policy is a national competence, but a certain degree of harmonisation is provided through the EU energy tax directive. Yet, **with regards to the energy- policy related instruments** in forms of various charges and levies, especially those introduced to respect commitments to the 20-20-20 targets**, there may be a case of sharing best practices and learning from the experience of other Member States**. The design of these instruments and their optimal use should make sure that consumers are not overburdened beyond the targets.

[85] The figures for industrial consumers were 67% and 55% respectively.

- As a rule, prices of **natural gas** were more stable than those of electricity, registering modest increases in the range of 5-10% at the EU level from 2008 to 2012. Yet, the same dispersed picture of specific Member State cases emerges as for electricity, so in some cases it is difficult to generalise. Natural gas tends to be more expensive in the new Member States, especially when prices are measured in purchasing power standards. These countries can reduce the negative impacts of high gas prices on competitiveness and household expenditure by more grid integration, by the introduction of internal market rules and by establishing a more diversified portfolio of suppliers and routes.

- The **energy and supply component** of the retail price for natural gas remained stable. Between 2008 and 2012 on average for industrial consumers the energy component increased by less than 0.5% and for households increased by 4.6%. During the observed period its relative share declined from 70% to 68% (industrial consumers) and from 59% to 56% (household consumers). As in the case of electricity, the broad EU numbers conceal a wide range of variation for the retail gas prices across Member States and across types of consumers.

- Cost items related to the **network component** of the end consumer bill for natural gas increased by 10-15% from 2008 to 2012; as a result, its relative share increased by a percentage point from 11% to 12% (industrial consumers) and from 20% to 21% (household consumers). Based on the available data, it was not possible to break down the costs on transmission and distribution and to estimate how much is attributable to maintenance and grid development. Transparency on these elements should be improved, as well as on the methodologies used by NRAs to estimate investment and operating costs and to define rates of return on this regulated activity. There is a room of improving the cooperation of DSOs in Europe, similar to what was done on the transmission level.

- Over the period 2008 – 2012 increases in the **taxation component** were in the range of 12-14%, significantly lower than the rates observed in electricity. The relative share of tax-related elements in the tax registered a marginal increase (from 18% to 20% for industrial consumers and from 22% to 23% for household consumers).

- In addition to the analysis of statistical data on electricity and gas retail prices, in-depth analysis of **price data at plant level** in a selection of energy intensive industrial sectors through case studies indicated that electricity and gas prices were on the rise in the period 2010-2012. The general trend results from the combination of increasing prices, although at highly variable speed, registered in all regional samples, and in some cases widening price differentials could be observed between the regions.

- Network fees, taxes and levies, including support schemes for renewables were identified as drivers for the electricity prices in the surveyed plants whereas the energy component remained stable and on comparable level across regions. Gas prices were influenced by energy and supply costs which, based on the sector and regions assessed, varies between 80% and 97%. The registered increase in gas prices was mostly linked to increased commodity price and indexation of gas to oil price. With taxes, levies and network charges having a negligeable impact on the price dynamics.

- The case studies indicate that the dynamics of price increases varied across industrial sectors and across Member States of the EU (presented in this report as regions for

confidentiality reasons) and that important differences remain in the price levels of electricity and gas paid by plants in the same industrial sector but located in different Member States.

- These intra-EU electricity and gas price differentials indicate real locational advantages, but also suggest there may be a scope for improving procurement practices by industry, as well as for Member States to increase efforts in completing the internal market and in ensuring the cost effectiveness of policies financed through electricity and gas prices.

2. Energy costs in the EU

Introduction

While energy prices receive major attention and are the focal point in the discussion about trends in the energy sector, it is energy costs which are more important for households and for industry. Energy costs are determined by both energy price levels and by consumption. Improvements in the energy efficiency and reductions in the sectoral or overall energy intensity of industry can mitigate the overall impact of rising prices on households and industry.

This chapter looks into the effects of rising prices on the EU economy by examining the energy cost burden on different parts of the economy. Building on the previous chapter's consideration of price evolution over time, this chapter looks at the levels of energy costs for different consumer groups. It explores the evolution of these costs over time and sketches a picture of how changes in energy prices are affecting economic activity. There is a focus in particular on energy intensive industries; these sectors are at the heart of the debate on energy prices and costs and offer a particular example of how changes in energy prices might affect the EU's global competitiveness as well as its economic and industrial structure.

The chapter is divided broadly into three sections:

- Section 2.1 focuses on the domestic sector, looking at how households' expenditure on energy has changed in recent years and what effects this has had on consumers' behaviour. It also considers the concept of "vulnerable consumers", an important dimension of energy policy. Macro-statistical data shows changes in energy expenditure as a share of disposable income and provides an overview of changes in energy costs over the last decade. This analysis has been complemented by data on applied weights of energy products from the Harmonised Index of Consumer Prices, which provides a proxy for share of household expenditures on energy products.

- Section 2.2 focuses on the issue of energy costs for industry and looks at the importance of energy costs for industrial competitiveness, attempting to identify those industries most exposed to rising energy costs and to chart the relationship between energy costs and production costs. Two approaches are applied to identifying energy intensive industries: one based on a comparison of electricity and gas consumption with gross value-added numbers; another based on a comparison of the share of energy costs with the total production costs of different industries.

- Complementing this macro-statistical approach, section 2.2.3 ends the chapter with bottom-up studies of electricity and gas costs from several energy intensive sectors; ceramics (bricks and roof tiles and wall and floor tiles), float glass, chemicals (ammonia, chlorine), aluminium and steel. The section closes with a discussion on the share of energy in production costs and indirect emission costs in the sampled plants and sectors.

2.1. Household energy costs

Evolution of energy costs in households' budget

Household energy expenditure[86] can be measured as the share of total household expenditure spent on products such as electricity, gas, heating, liquid or solid fuels; alternatively, expenditure levels on energy can be compared to total disposable income. The latest available data shows a high degree of variation across EU Member States. **Between 2010 and 2011, household energy expenditure represented between 3.5% and 10% of disposable income in different Member States**. At the lower end of this range are Southern Europe countries (Spain, Cyprus, Greece), where heating needs are lower. At the higher end are Central and Eastern European countries (Czech Republic, Estonia, Croatia, Slovenia), where household incomes are below the EU average. Despite their colder climates, Northern and Western European countries are at the lower end of the range because of their high disposable household incomes.

Compared to 1999/2000, **in most Member States the share of household energy expenditure within total disposable income increased by 0-2.5 percentage points**. Increases in household energy expenditure (as measured against disposable income) were greater than 0.5 percentage points in Portugal, Croatia, Spain, Cyprus, the UK, Belgium and the Czech Republic, as Figure 79 shows. In practice this means that if energy expenditure numbers are adjusted by changes in household disposable incomes, in 2010/11 households had to pay 15-30% more proportionally on energy products in most of these countries than a decade before.

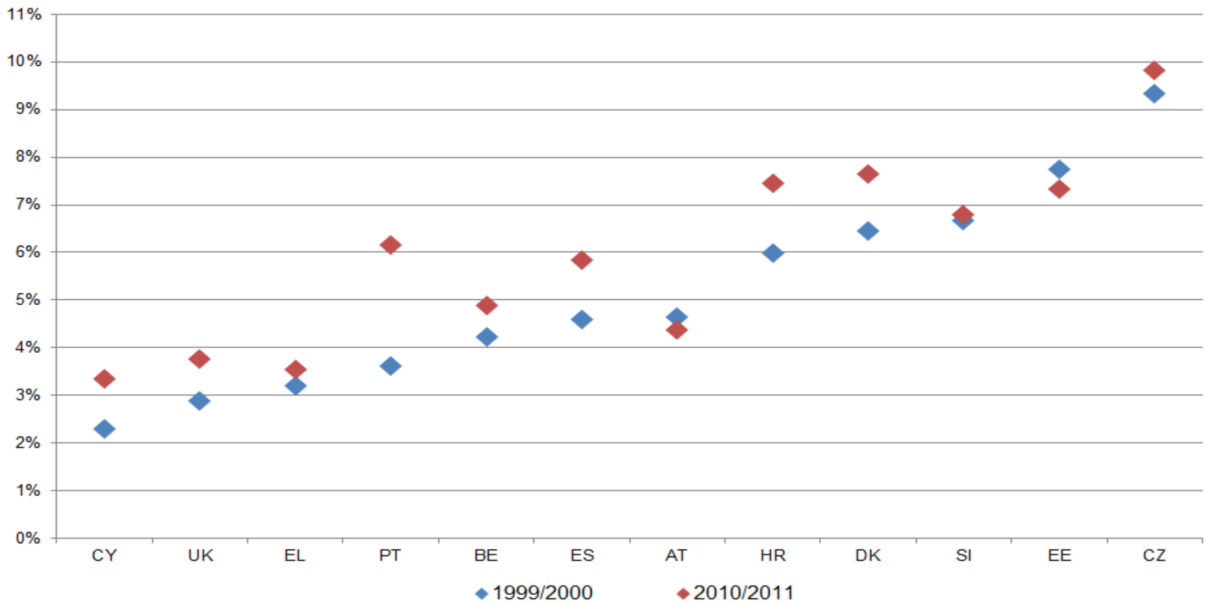
Household expenditure on transport fuels varied less by Member State than that of household energy expenditure related to heating and lighting needs. **In 2010/2011 transport fuel expenditure as a share of disposable income varied between 2.5% and 4.5%**, as Figure 80 shows.

The share of transport fuel expenditure in households' disposable income rose by 1 percentage points in Greece, by 0.4 percentage points in the UK and by 0.3 percentage points in Denmark and Estonia; in some countries this share decreased slightly since 2000 (by 0.4 percentage points in Slovenia and by 0.3 percentage points in Belgium). After making adjustments by changes in disposable incomes it can be estimated that households' expenditure on fuels rose in a lesser extent than in the case of household energy.

Across the EU, there is limited data[87] on energy expenditure in different income quintiles. The available data shows that lower income households tend to spend proportionally more on electricity, gas and heating-related fuels than medium or higher income households. In contrast, higher income households tend to spend a greater share of disposable income on transport fuels.

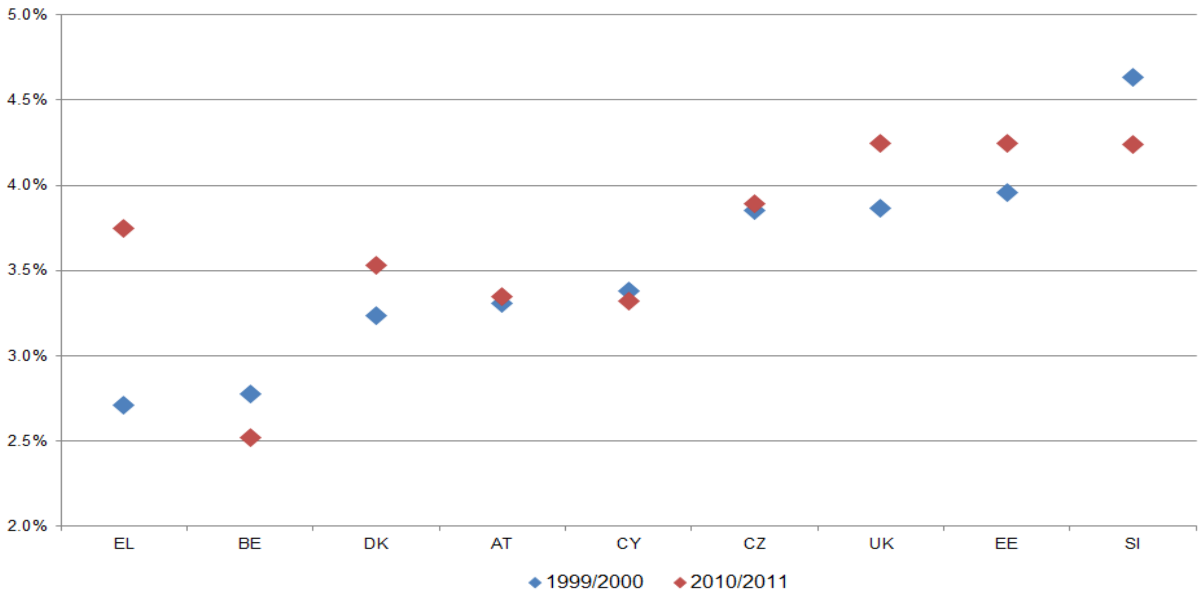
[86] In this paragraph transport fuels are not included in households' energy related expenditure.
[87] In order to better track developments in household expenditures on energy, all Member States should have comparable data in time and content; conclusion in this paragraph on expenditures related to income group are based on partial information

Figure 79. Share of electricity, gas and other household fuels in households' disposable income



Source: Eurostat, Household Budget Survey (HBS) statistics

Figure 80. Share of transport fuels in disposable income of households in some EU countries



Source: Eurostat, Household Budget Survey (HBS) statistics

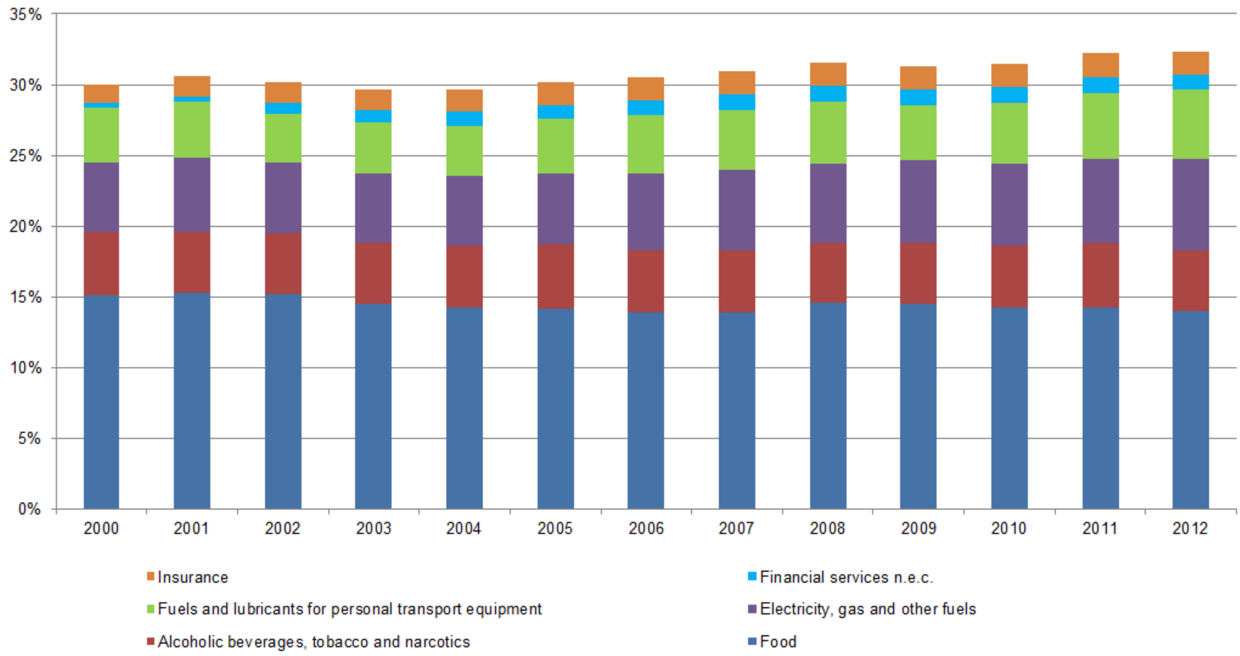
Given the lack of sufficiently detailed and recent data for many Member States, the Household Budget Survey (HBS) offers only a limited picture of the EU as a whole. HBS data collection is carried out once every 5 years in Member States and data reference periods are not harmonised across the EU. The selected time period (1999/2000 until 2010/2011) allows a more comprehensive presentation of the share of energy expenditure, given data completeness constraints.

This analysis can be complemented by using other data sources. The Harmonised Index of Consumer Prices (HICP) is an indicator used for monetary policy decisions and is calculated in each Member State using a common methodology. The HICP assigns a weight to each consumption group (e.g. food, energy, transport, services) and is updated annually in each country based on household consumption data. The assigned weight represents the importance of goods and services in a country's consumption structure. HICP is not fully comparable with HBS data due to different methodologies. Nevertheless, changes in the weight assigned to energy in the HICP can be a good proxy for assessing its importance in the consumption of EU households.

Figure 81 shows changes in applied weights for several important product and service groups. The relative weight of food products slightly declined between 2000 and 2012[88], while the share of alcoholic beverages and tobacco remained practically the same. The weight of financial services showed dynamic growth over this period (from 0.3% to 1.1%), and the importance of insurance services also increased.

The weights of household energy products and transport fuels increased during this period (from 4.9% to 6.4% and 3.8% to 4.9% respectively), pointing to the increasing importance of energy in EU household expenditure[89]. In 2012, the total weight of energy products in the HICP was **2.6 percentage points higher** on EU average than in 2000.

Figure 81. Change in annual weights of some products and services in the Harmonised Index of Consumer Prices in the EU between 2000 and 2012



Source: Eurostat (Consumer Price Statistics)

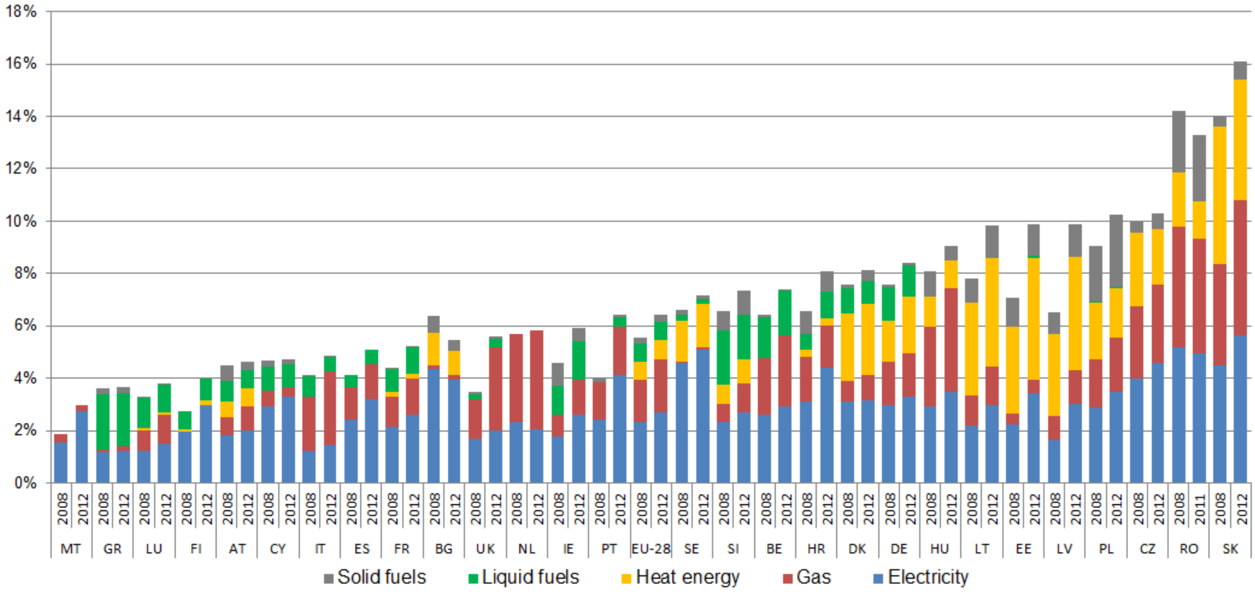
[88] 2012 HICP weights represent in reality the consumption structure of the households in earlier (2010 or 2011) periods across the EU Member States, these data are therefore comparable with HBS statistics time periods presented on the previous page

[89] The increasing share of expenditures on energy products puts into the focus the issue of vulnerable consumers, as they are especially exposed to increasing energy costs. A short overview on the concept of vulnerable consumers can be found .

In the '**Household energy products**' category presented on Figure 81 contains several energy products, such as *electricity, gas, liquid fuels, solid fuels and heat energy*[90].

Figure 82 compares HICP weights for five energy products in 2008 and 2012 in 28 Member States and at EU-28 level as a whole.

Figure 82. Weights of household energy products in the Harmonised Index of Consumer Prices in 2008 and 2012



Source: Eurostat (Consumer Price Statistics). Data for Romania is only available for 2011.

In 2012, Malta had the lowest weight of household energy (3%), while Slovakia had the highest (16.1%). For the EU-28, the average weight was 6.4%.Between 2008 and 2012 the increase in household energy's weight was over 2 percentage points in Latvia, Estonia, Portugal, Slovakia, UK and Lithuania, and was between 1 and 2 percentage points in Croatia, Ireland, Finland, Poland, Belgium, Hungary and Spain. Romania and Bulgaria experienced decreases less than 1 percentage point. For the EU-28, the weight of household energy went up on average by 0.9 percentage points between 2008 and 2012.

Different energy products have different weights across the EU. For example, in 2012 the *weight of electricity* ranged from 1.2% in Greece to 5.6% in Slovakia, also exceeding 4% in Sweden, the Czech Republic, Croatia and Portugal.

Similarly, *natural gas* varied widely (from 0% in Finland to 5.2% in Slovakia), having a weight of less than 1% in nine Member States and greater than 4% in two Member States (Hungary and Slovakia).

Heat energy is especially important in Central and Eastern European countries; its weight in the three Baltic States and Slovakia was greater than 4%. In Denmark, Germany or the Czech Republic the weight of heat energy is also above 2%, while in fourteen Member States its weight was less than half percent.

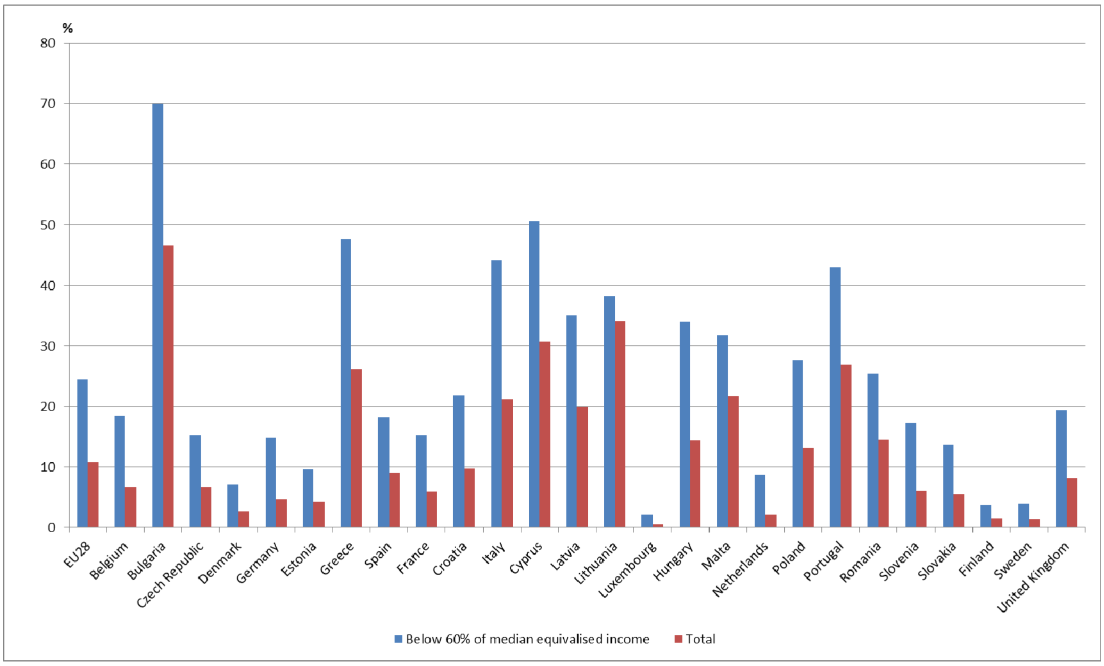
[90] Heat energy statistical category refers to district heating

In 2012, the weight of *liquid fuels* was greater than 1% in Slovenia, Belgium, Ireland, Germany, Luxembourg, France, Croatia, while their share in Greece was more than 2%.

In most Member States, *solid fuels* are not significant items in HICP weights, but in Poland this heating source had a weight of 2.7% in 2012, and its weight was greater than 1% in Romania, Estonia, Latvia and Lithuania.

In total, energy costs are putting growing pressure on households. As shown in Figure 83, almost 11% of the population of the EU was unable to keep their homes adequately warm in 2012. The situation is worse for lower income households[91]. In the EU as a whole 24.4% of the population living in lower income households are unable to adequately heat their homes. In 17 Member States more than 20% of lower income households cannot keep their homes warm. The share of people unable to warm their homes goes as up to 46.5% in Bulgaria, reaching a very high (70%) in the lower income households in the country.

Figure 83. Inability to keep home adequately warm

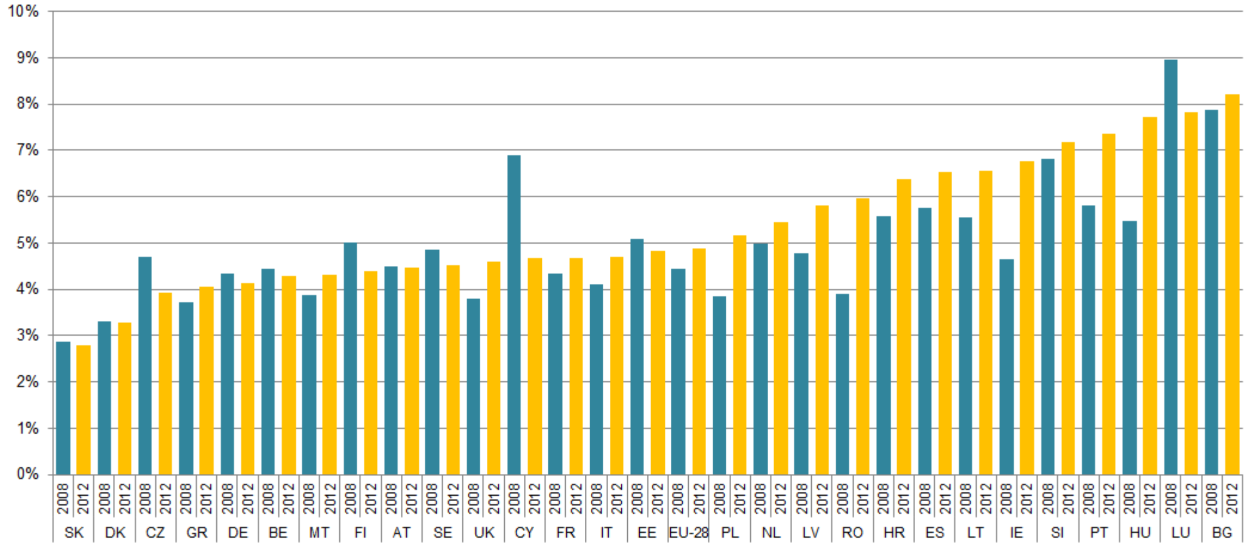


Source: Eurostat. Income and Living Conditions (ILIC) questionnaires

As Figure 84 shows, the weight of *transport fuels* increased in the majority of the EU Member States between 2008 and 2012 (by 0.5 percentage points on average in the EU-28). In three Member States (Hungary, Ireland and Romania) the increase in weight of transport fuels exceeded 2 percentage points and in another four countries (Portugal, Poland, Latvia and Lithuania) the increase was greater than 1 percentage point. In 2012 the weight of transport fuels ranged from 2.8% (Slovakia) to 8.2% (Bulgaria). There were two Member States (Cyprus and Luxemburg), where the decrease in the weight of transport fuels exceeded 1 percentage point, while in nine other countries the decrease remained below 1 percentage point.

[91] Below 60% of equalised median income

Figure 84. Weight of transport fuels and lubricants in the Harmonised Index of Consumer Prices in 2008 and 2012

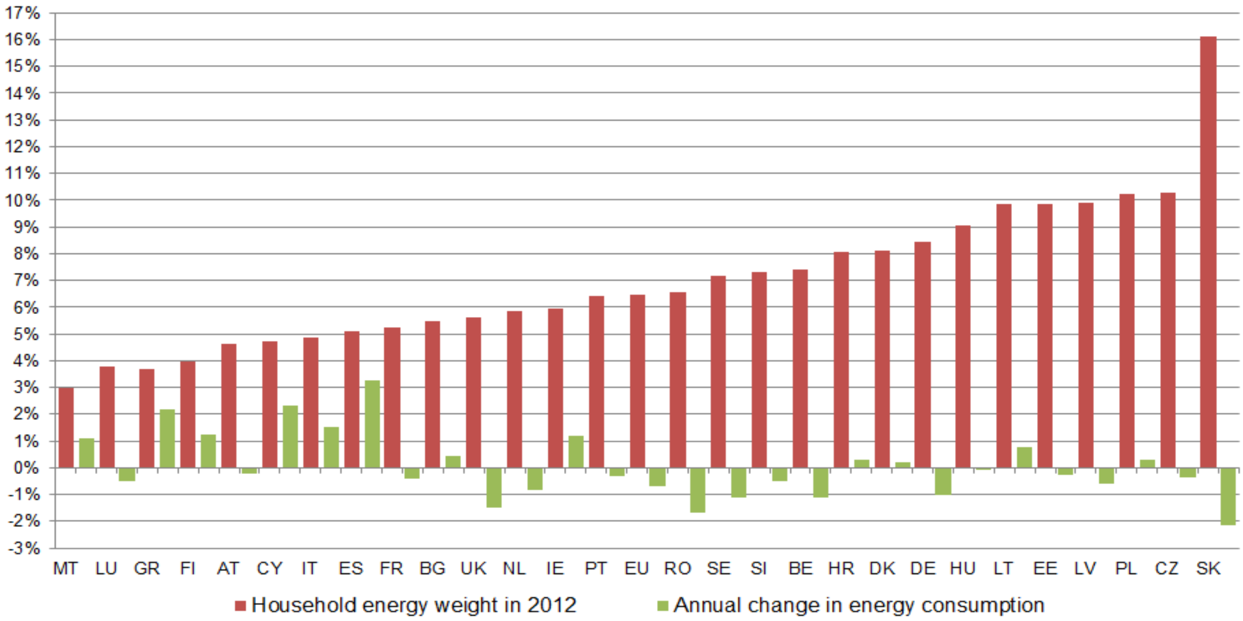


Source: Eurostat (Consumer Price Statistics)

Energy efficiency has also played a role in the evolution of household expenditure on energy products. Figure 85 shows a (somewhat weak) relationship between the current weight of household energy products in the HICP and changes in energy consumption over a longer period: the higher the weight of energy products, the greater the probability of a decrease in energy consumption between 2000 and 2011.[92]

[92] HICP weights for 2012 are presented on the chart, however, these weights represent the household energy consumption of one or two years earlier, assuring the consistency between the consumption structure and the observed period of change in energy consumption (2000-2011)

Figure 85. Weight of household energy in the 2012 HICP and the annual change in household energy consumption between 2000 and 2011



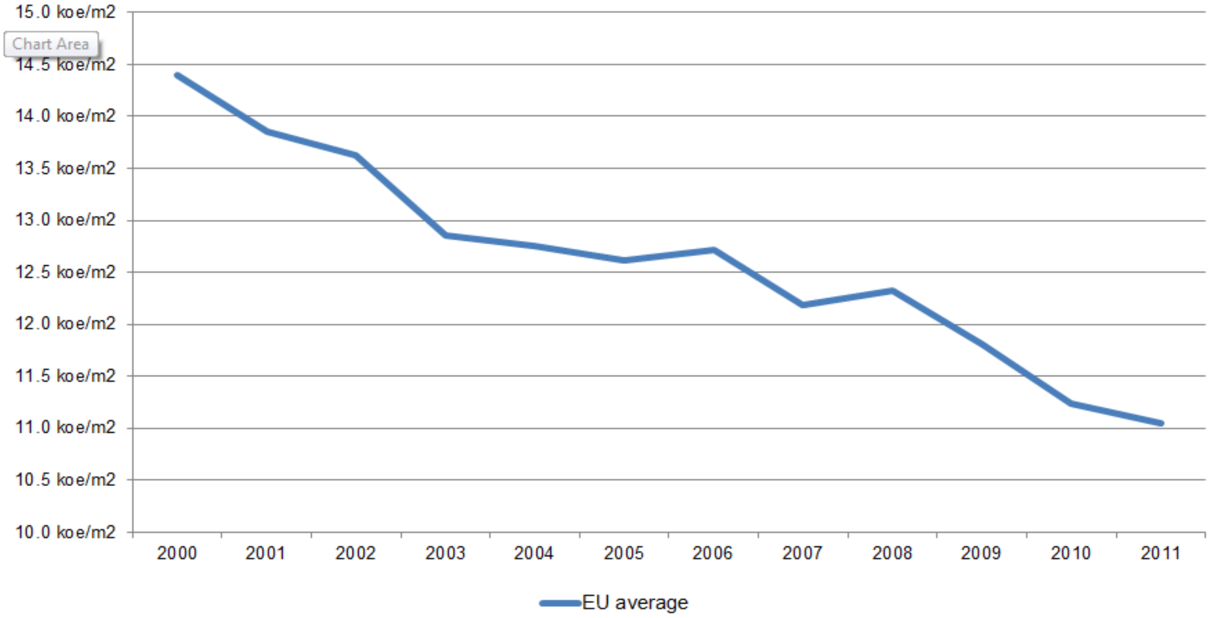
Source: Eurostat, ODYSSEE energy efficiency database

Between 2000 and 2011, decreases in household energy consumption were observed in most Member States with a share of household energy products above the EU average. In contrast, household energy consumption increased in several countries where the share of energy products in the consumption of households was below the EU average. This shows how high energy costs can create incentives to reduce energy consumption. However, it is important to emphasize that improving residential energy efficiency in general mitigates rather than reduces energy costs; in most Member States, households spent proportionally more on energy products in 2012 than a decade earlier, as Figure 82 shows.

It is important to note that rise in energy costs should be understood in monetary expenditures, as consumption of energy[93] decreased in most of the EU Member States. Figure 86 shows how energy consumption on space heating of residential buildings decreased between 2000 and 2011 in the European Union. On average, households used 23% less energy on space heating per square metre in 2011 than in 2000. These gains were to a large extent due to the diffusion of new dwellings, which consume significantly less energy than dwellings built a couple of decades before. Refurbishment of the existing buildings also play an important role, however, the aggregate impact is limited by low refurbishment rates of the building stock.

[93] The consumption of energy for space heating is expressed in energy units (e.g.: thousands of oil equivalent), while consumption expenditure or the share of energy products in the consumption of households is always expressed in monetary units or percentages

Figure 86 The evolution of energy consumption on space heating in the EU residential sector, in thousands of oil equivalent per square metre, between 2000 and 2011



Source: ODYSSEE energy efficiency database

2.2. Industry energy costs

As a key production input, energy is an important driver of industrial productivity growth along with other inputs such as capital, labour, material and services. The inputs that make the greatest difference to competitiveness vary by industry, segment and sub-segment of the global value chain. For instance, the price and the availability of energy inputs are important in many industries in manufacturing, distribution or logistics. In comparison, the determining factor for much of the service sector is the cost and qualifications of the labour force. The issue of energy prices and costs is therefore not equally important for all activities, but is unquestionably crucial in maintaining and developing a solid and competitive industrial base in the EU.

The first step in measuring the energy sector's impact on the competitiveness of the whole economy is to identify those activities most sensitive or exposed to the energy sector. This depends on various factors. For example, how much energy is needed to create a unit of value added, or whether they have energy price bargaining power (dependant on whether they are SMEs or large or active in only one or several Member States). It also depends on their individual tax treatment (entitlement to exemptions, rebates in taxes or other forms of subsidies or protection).

Some of these factors depend primarily on national competences, such as energy taxation rules, where the European Commission sets minimum tax levels for the applied tax rates but the actual tax burden varies across Member States. Other factors, such as state aid and competition rules, are to a greater extent (but not exclusively) European competences. Wider climate and energy objectives also have an influence on companies' access to and use of energy sources.

2.2.1. Identifying energy intensive industries

Energy costs are particularly important to energy intensive industries, insofar as these are heavy consumers, that can be exposed to international competition, which can occupy an important position in the economic value chain. There is no uniform definition of an energy intensive industry but there exist several possible approaches to identifying these sectors.

Energy costs here refer to costs actually incurred by enterprises for the purchase of energy products, implicitly taking into account all possible exemptions or reductions (e.g. network costs, taxes and levies, etc.).

This report applies a three-fold approach to defining energy intensive industries, taking into consideration:

1. Electricity intensity of individual industrial sectors above the average electricity intensity of the entire industry. Electricity intensity refers to the amount of electricity needed to produce a unit of value-added (e.g. one million euro) in a given industrial sector.

2. Gas intensity of individual industrial sectors above the average gas intensity of the entire industry. Gas intensity refers to the amount of natural gas needed to produce a unit of value-added (e.g. one million euro) in a given industrial sector.

3. The definition of energy-intensive industries provided in Article 17.1(a) of the Energy Taxation Directive (2003/96/EC), namely "An ‘energy-intensive business’ shall mean a business entity […] where either the purchases of energy products and electricity amount to at least 3.0 % of the production value or the national energy tax payable amounts to at least 0.5 % of the added value. Within this definition, Member States may apply more restrictive concepts, including sales value, process and sector definitions".

Based on the combination of these three factors, the following **five sectors can be considered as energy intensive industries**[94]:

- Manufacturing of paper and paper products[95]
- Manufacturing of chemicals and chemical products[96]
- Manufacturing of pharmaceuticals[97]
- Manufacture of non-metallic minerals[98]
- Iron and steel industry[99] and non-ferrous metals[100]

In terms of electricity and gas intensity (criteria 1 and 2), Figure 87 and Figure 88 show that iron and steel, non-ferrous metals, chemicals, glass and building materials and paper and pulp qualify as energy intensive industries through both their electricity and gas consumption[101]. Other industries, such as machinery, transport equipment or textile industries are less energy intensive than the average. Wood and wood product sector has relatively high electricity intensity, but low gas intensity. Refining of petroleum products is also an energy intensive industry. Refining is not included in the present analysis because the estimations of electricity and gas intensity are based on final energy consumption as reported in the energy balances, while refining is included in the energy transformation sector of the energy balances.

For some industries there are significant differences between electricity and gas use; for example, the building material industry is proportionally twice as gas intensive as electricity intensive, while for the paper industry the opposite holds.

While the amount of energy a given industry consumes in the production process varies widely across Member States, in most Member States the same set of industrial branches generally emerges as having energy intensity over the national average. In terms of share of energy purchase costs in costs related the production process (criterion 3),

Figure 89 shows that in 2010 the share of energy costs in total production costs varied between 4% and 10% for five industries listed above. Ore extraction is excluded as electricity and gas intensity is below industry average.

The importance of these five energy intensive manufacturing industries within the economy can be assessed through their relative share in annual Gross Domestic Product (GDP) or gross

[94] The names of industries differ from those in the chart legends, as NACE is the official nomenclature for business statistics, whereas energy consumption data is taken from the energy balances of Eurostat, using different names, though a correspondence has been established between the two statistics. In the case of ore extraction industry only energy consumption other than electricity and gas is significant, therefore it falls out of the scope of the analysis.

[95] NACE groups 17 and 18

[96] NACE group 20

[97] NACE groups 21

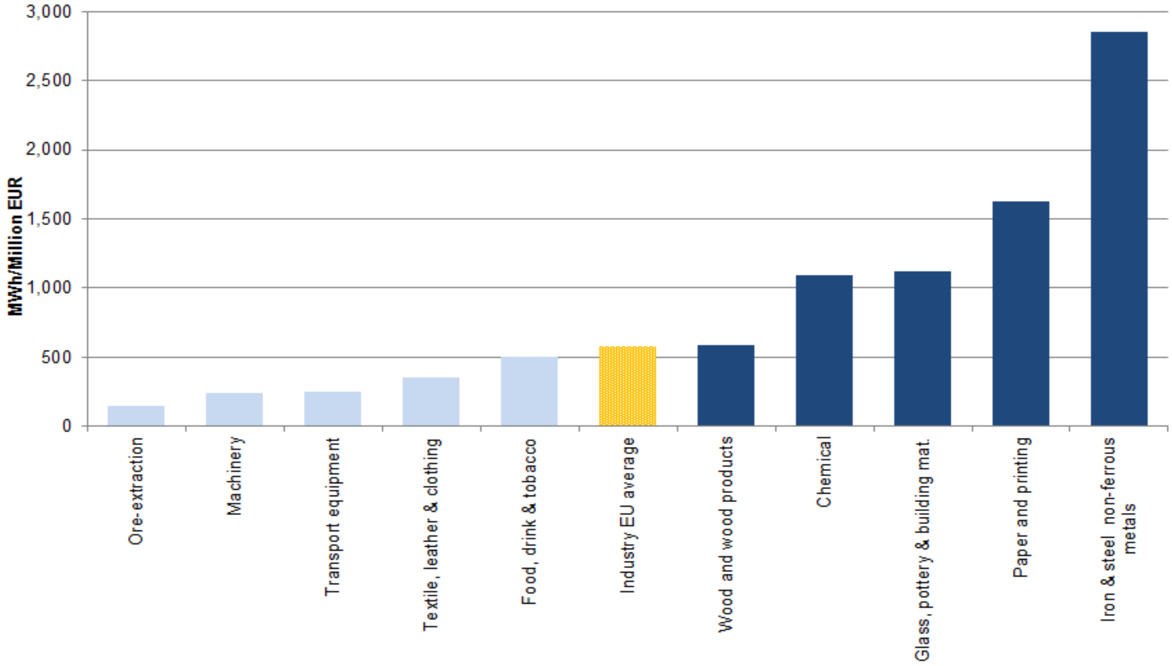
[98] NACE group 23, including building materials, glass, ceramics

[99] part of NACE group 24. Note that sectoral gross value added is only available at NACE 2-digit levels, while energy balance categories in some cases are composed of NACE 3-digit or 4-digit groups. For this reason the charts that contain energy intensity data iron and steel and non-ferrous metals are considered as one energy intensive industrial sector.

[100] part NACE group 24 (see previous footnote)

value-added of the manufacturing industry. In 2011 the combined share of the five industries was 4% of EU-27 GDP and 23% of the gross value-added of the manufacturing industry.

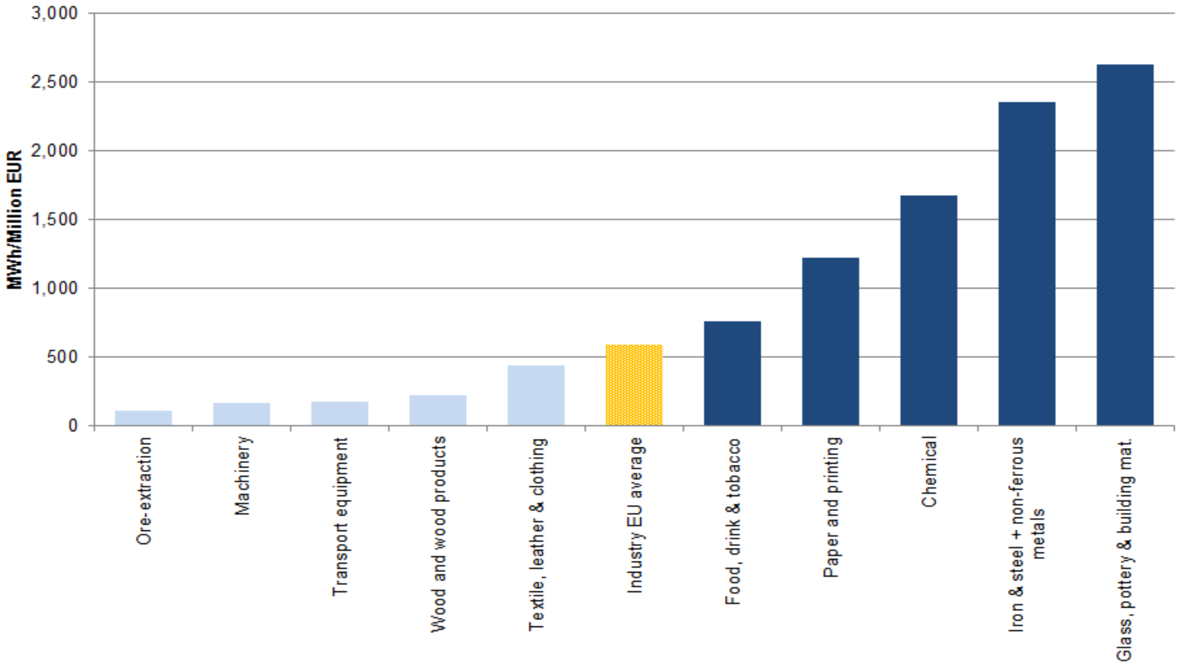
Figure 87 Electricity intensity in industrial sectors of the EU (EU average)



Source: Eurostat, 2011 annual data.

Note: The breakdown in national accounts is based on 2-digit NACE codes. Industry is manufacturing industry minus 'Other manufacturing' (no electricity and gas consumption data). Refining industry is not included (no final electricity and gas consumption in national balances). Industry average includes Mining and quarrying.

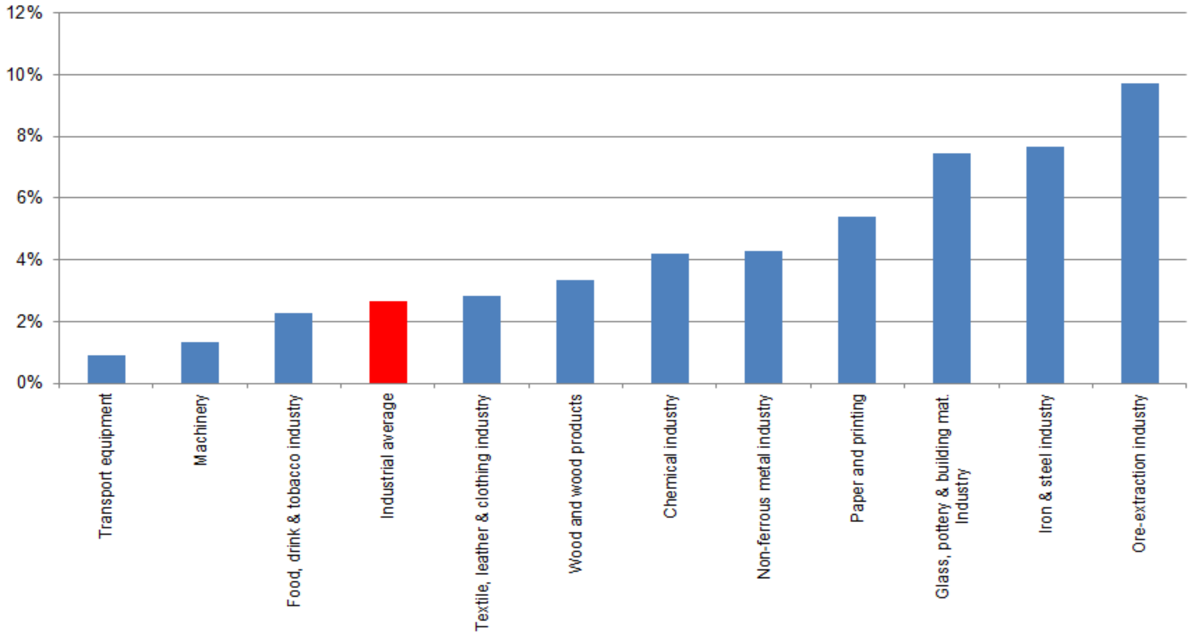
Figure 88 Gas intensity in industrial sectors of the EU (EU average)



Source: Eurostat, 2011 annual data

Note: The breakdown in national accounts is based on 2-digit NACE codes. Industry is manufacturing industry minus 'Other manufacturing' (no electricity and gas consumption data). Refining industry is not included (no final electricity and gas consumption in national balances). Industry average includes Mining and quarrying.

Figure 89. Average industrial energy purchase costs related to the total production costs in 2010 in the EU



Source: Eurostat Structural Business Statistics (SBS) database.

Note: Total production costs include purchase of goods for processing, including energy products and other items, such as labour costs. Total production costs were estimated from the SBS database of Eurostat as the difference between the total production value (gross annual turnover adjusted by changes in stocks and other correction items) and the gross operating margin (measure for profitability) in a given industry. Energy purchase costs include all energy products purchased for use as fuels, but exclude energy products used as raw materials and feedstock.

These aggregates are broad and include several differentiated industrial sectors and activities; nevertheless, they include core activities within the EU industrial value chain. It is important to note that these five industries cover several sub-sectors which might be different from an energy intensity point of view, as Figure 90 shows. The figure shows the dispersion in the share of energy costs among total production costs across EU Member States, and the average of countries with available data, being considered as proxy for the EU as a whole. From this chart two important conclusions can be drawn:

First, broader industrial sector definitions or groupings, for which statistical data on electricity and gas intensity are available, might also cover important sub-sectors having completely different energy intensity than the broader sector average. For example, in the case of paper and printing, manufacturing of pulp is energy intensive, whereas printing, belonging to the same energy balance category, is much less so. Similarly, in the case of building materials

manufacture of cement is highly energy intensive, whereas manufacture of porcelains or stone cutting is much less so.

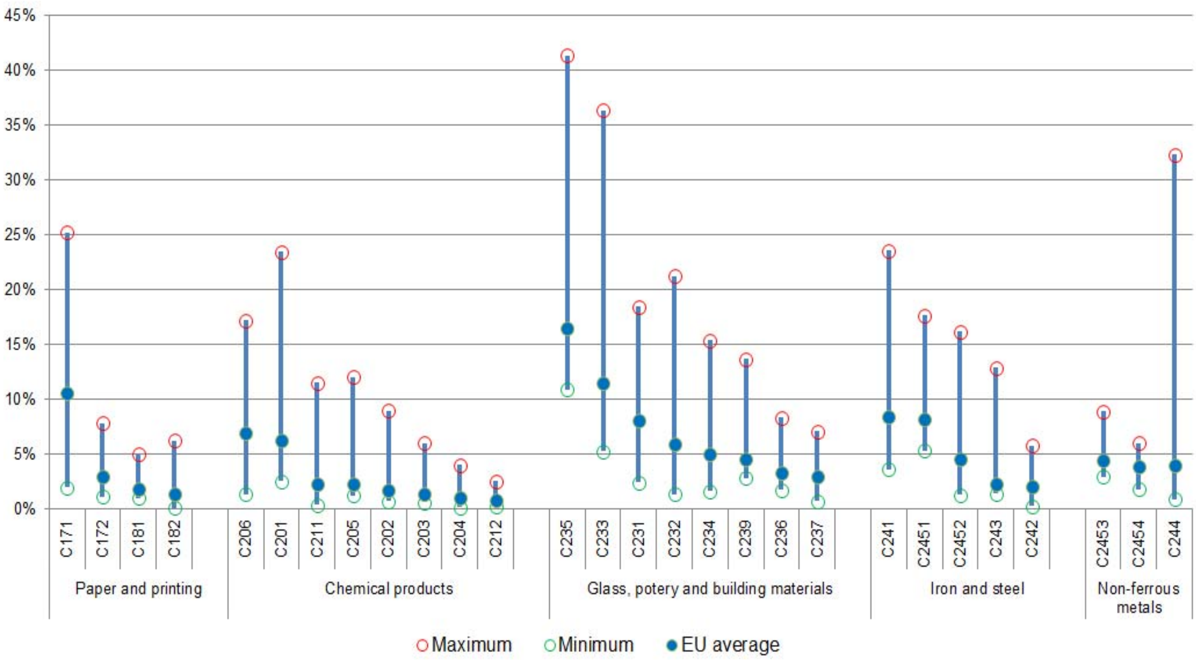
Going to even more detailed level presented in Figure 90, specific individual industries might have very high energy intensity, as

Table 31 shows. In some cases, (e.g.: chemical industry), energy products, like natural gas are also used as feedstock, and if use of energy products for purposes other than energy input is not excluded, higher energy intensity numbers can be observed. In other cases (e.g.: aluminium) the energy intensity of primary production is by several magnitudes higher than that of other secondary manufacturing activities in the same sector.

Second, in many sub-sectors significant dispersion in energy cost shares can be observed across the Member States, pointing to different energy intensity numbers in the same industry. This latter conclusion might cover different product structures in different Member States but also reveals potentials in energy efficiency improvements. Further gains in energy intensity might also contribute to improvements in the competitiveness of energy intensive sectors.

In Chapter 2.2.3 case studies on several industries based on data from individual plants are presented in order to complement this general analysis[102] and to provide detailed analysis of the structure of incurred costs, improvements in energy intensity, exposure of the industry to international trade, etc.

Figure 90 Share of energy-related costs among the production costs in some selected sub-sectors of energy intensive industries (lowest, highest Member State values and EU averages, 2010)



Source: Eurostat, Structural Business Statistics The name of the codes in the chart can be found in the legend below:

[102] However, it is also important to note that in some cases energy intensity trends of higher level industry aggregates do not exactly match those presented in the case studies, for various reasons. Energy intensity calculations of industry aggregates refer to the period of 2008-2011, while in the case of micro case studies the timeframe stretches from 2010 and 2012, given the assignment to the external contractor who provided the analysis. Moreover, cases studies were based on limited sampling results, whereas macro-statistical data cover the whole European Union. See more in Chapter 2.2.3

C171 - Manufacture of pulp, paper and paperboard; C172 - Manufacture of articles of paper and paperboard; C181 - Printing and service activities related to printing; C182 - Reproduction of recorded media; C201 - Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms; C202 - Manufacture of pesticides and other agrochemical products; C203 - Manufacture of paints, varnishes and similar coatings, printing ink and mastics; C204 - Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations; C205 - Manufacture of other chemical products; C206 - Manufacture of man-made fibres; C211 - Manufacture of basic pharmaceutical products; C212 - Manufacture of pharmaceutical preparations; C231 - Manufacture of glass and glass products; C232 - Manufacture of refractory products; C233 - Manufacture of clay building materials; C234 - Manufacture of other porcelain and ceramic products; C235 - Manufacture of cement, lime and plaster; C236 - Manufacture of articles of concrete, cement and plaster; C237 - Cutting, shaping and finishing of stone; C239 - Manufacture of abrasive products and non-metallic mineral products n.e.c.; C241 - Manufacture of basic iron and steel and of ferro-alloys; C242 - Manufacture of tubes, pipes, hollow profiles and related fittings, of steel; C243 - Manufacture of other products of first processing of steel; C244 - Manufacture of basic precious and other non-ferrous metals; C2451 - Casting of iron; C2452 - Casting of steel; C2453 - Casting of light metals; C2454 - Casting of other non-ferrous metals

Table 31 Estimated share of energy costs compared to total production costs in some industrial products

Industry	Energy as share of total production costs
Chemicals	Ammonia – 80% Ethylene – 60% Chlorine – 40%
Lime	About 40%
Aluminium	35-40%
Ceramic	About 30%
Cement	30%
Steel	20-30%
Glass	20-30%
Pulp and paper	15-20%

Source: IEA, OECD, Ecorys 2011

2.2.2. Energy costs evolution

One way for businesses in energy intensive industries to respond to increasing energy costs by improving their energy efficiency. The next two charts show a breakdown of changes in electricity and gas consumption in the industries being considered as either electricity or gas intensive. These changes can be decomposed into changes in gross value-added and changes in electricity and gas intensity. With two exceptions, gross value added figures were lower in 2011 than in 2008, as due to the slow economic recovery industrial production did not regain pre-crisis levels.

Figure 91 The impact of changes in electricity intensity and gross value added on electricity and gas consumption between 2008 and 2011

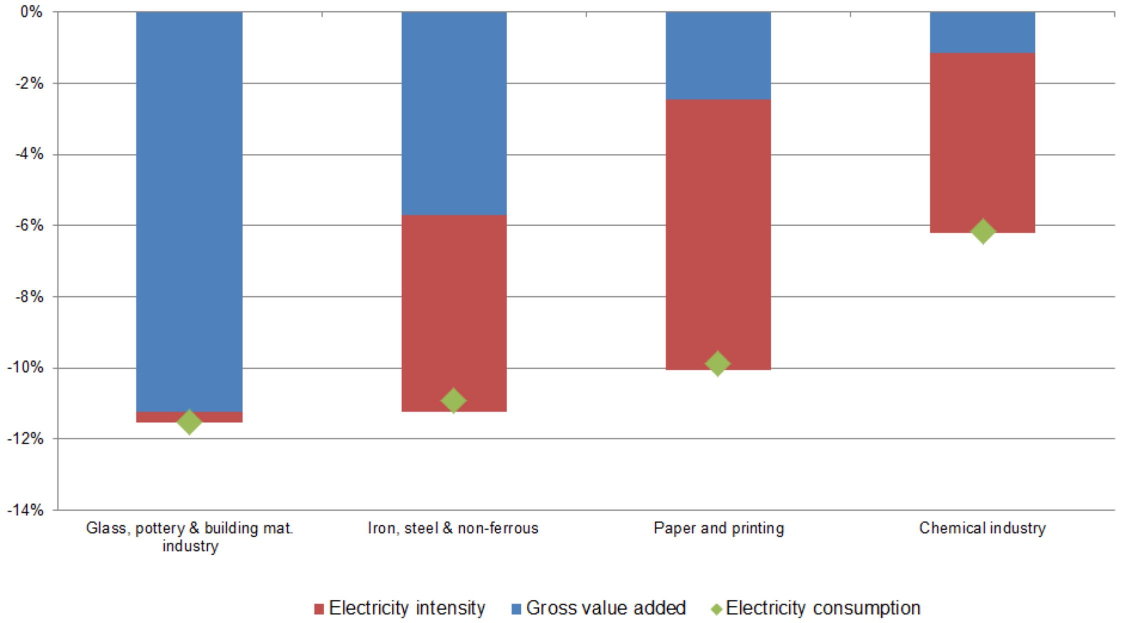
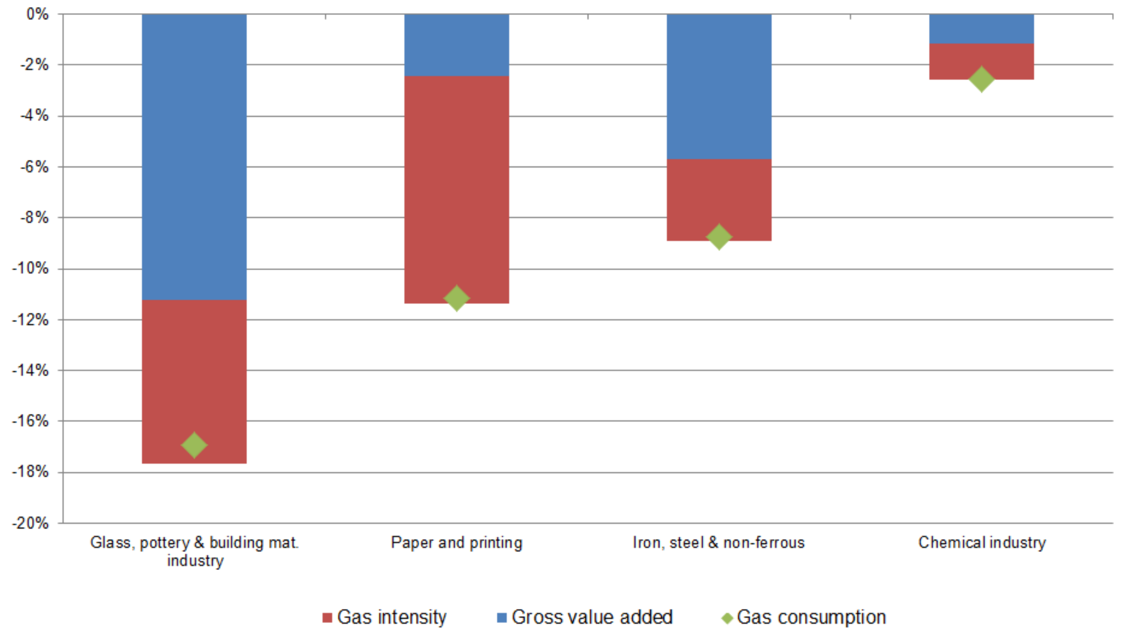


Figure 92 The impact of changes in gas intensity and gross value added on electricity and gas consumption between 2008 and 2011



Source: Eurostat national accounts and energy balances; own computations.
Note: Data in national accounts is at NACE 2-digit level, whereby industry refers to manufacturing industry.

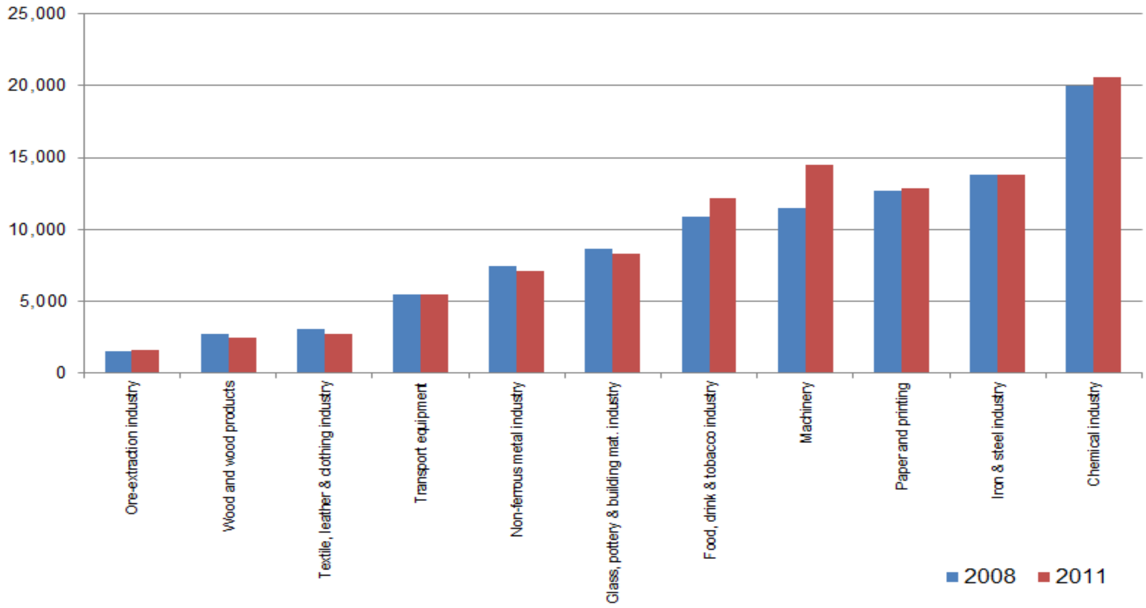
In the case of the *paper and printing* industries there were significant decreases in both electricity and gas intensity, underlining the importance of energy efficiency improvements in reducing energy consumption[103]. In other industries there were also improvements, with the

[103] Due to lack of data no information is available on the impact of changes in production composition (e.g.: substitution products by less energy intensive ones) in the industrial branches, as this factor might also influence electricity and gas consumption intensity. A general assumption has been made that at EU level product composition changes were not significant between 2008 and 2011.

exceptions of the glass and building materials industry where the decrease in electricity intensity was negligible.

As Figure 93 and Figure 94 show, among the industrial branches spending most on electricity and gas consumption[104] are a number of energy intensive industries (chemicals, iron and steel, paper and printing, glass and building materials), though other industrial branches representing a large share of EU industrial production (machinery, food) also spend billions of euros on electricity and gas.

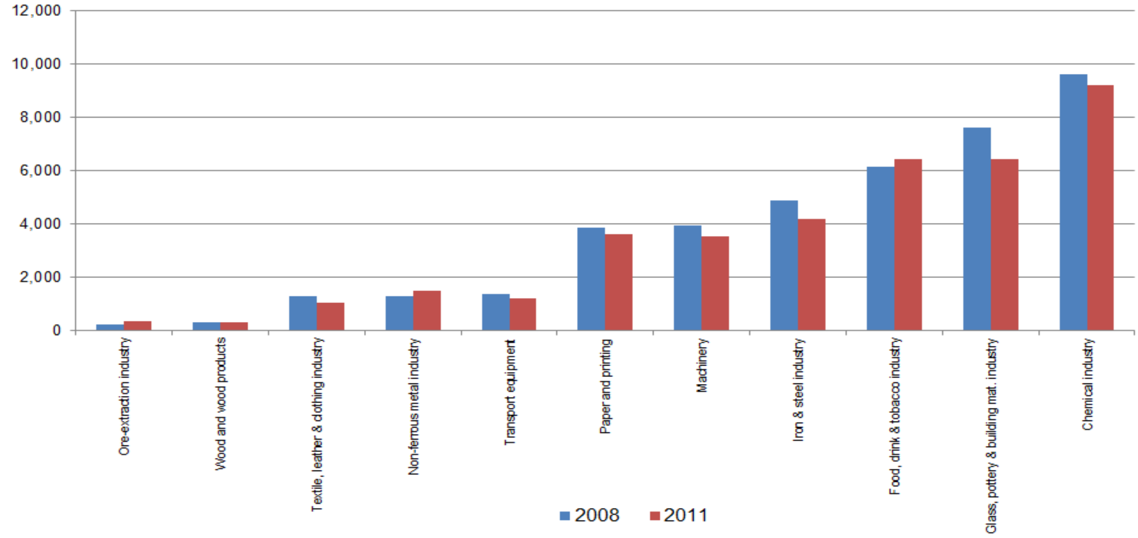
Figure 93 Estimated annual electricity expenditures in given industries in the EU, million EUR



Source: Eurostat energy balances and energy retail prices

[104] These figures are based on average price electricity and gas price data from Eurostat, hence they mask preferential energy purchase agreement concluded between industrial consumers and utilities and they do not provide information either on exemption from energy taxes or levies.

Figure 94 Estimated annual natural gas expenditures in given industries in the EU, million EUR



Source: Eurostat energy balances and energy retail prices

Table 32 and Table 33 show the relation between changes in electricity and gas intensities, gross value added, consumption and expenditures on these two energy products between 2008 and 2011 in the identified energy intensive industries and in the industry as a whole. Decrease in expenditures on electricity and gas in most of the energy intensive industries exceeded the decrease in the industry as a whole, driven by decreasing energy intensity, however, in some cases this was rather due to a significant fall in gross value added.

The tables show that in the period 2008-2011 for industry as a whole and for all four energy intensive sectors included – glass, pottery and building material industry, iron, steel and non-ferrous metal industry, paper and printing, and chemical industry – gross value added and electricity consumption fell more than estimated annual electricity expenditures (which in some cases increased).

The picture is more mixed in the case of gas expenditure, consumption and gross value added: in the period 2008-2011 for industry as a whole estimated annual gas expenditures fell by more than estimated gas consumption and gross value added. For some sectors – such as iron, steel and non-ferrous metals, as well as paper and printing – in the period 2008-2011 estimated gas consumption fell by more than estimated gas expenditure, though the decrease in both estimated gas consumption and expenditure of these sectors exceeded the drop in gross value added.

These estimates suggest that some industrial sectors may be squeezed by falling gross value added vis-à-vis consumption that is falling at a slower rate and expenditures that are in some cases increasing, especially in the case of electricity.

Table 32 Development of electricity intensity, gross value added, electricity consumption and electricity expenditures between 2008 and 2011 in the EU

	Estimated change in electricity intensity in %	Estimated change in gross value-added (%)	Estimated change in electricity consumption in %	Estimated change in annual electricity expenditures in %	Difference between change in electricity expenditures and gross value added (%)
Glass, pottery & building material industry	-0.3	-11.2	-11.5	-3.6	+7.6
Iron, steel & non-ferrous metals	-5.5	-5.7	-10.9	-1.8	+3.9
Paper and printing	-7.6	-2.4	-9.9	+1.6	+4.0
Chemical industry	-5.1	-1.1	-6.2	+2.9	+4.0
Industry	-5.6	-1.7	-4.0	+3.9	+5.6

Source: Eurostat, own computations

Table 33 Development of gas intensity, gross value added, gas consumption and gas expenditures between 2008 and 2011 in the EU

	Estimated change in gas intensity in %	Estimated change in gross value-added (%)	Estimated change in gas consumption in %	Estimated change in annual gas expenditures in %	Difference between change in gas expenditures and gross value added (%)
Glass, pottery & building material industry	-6.4	-11.2	-16.9	-15.5	-4.3
Iron, steel & non-ferrous metals	-8.9	-5.7	-11.2	-8.4	-2.7
Paper and printing	-3.2	-2.4	-8.7	-6.2	-3.8
Chemical industry	-1.4	-1.1	-2.5	-4.4	-3.3
Industry	-7.0	-1.7	-5.3	-6.8	-5.1

Source: Eurostat, own computations

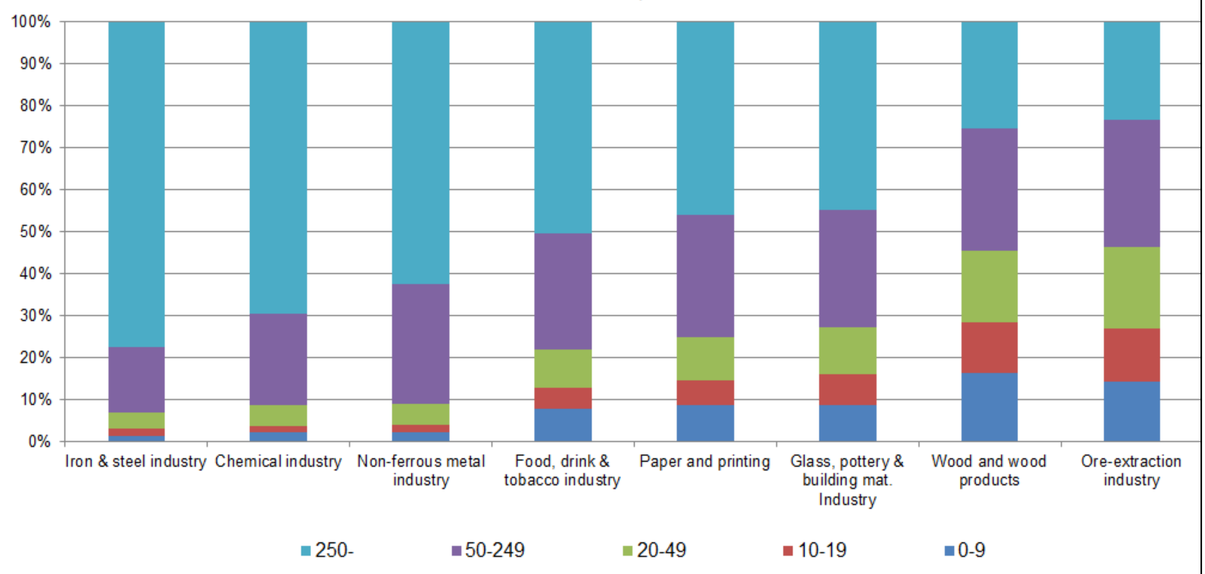
The role of small and medium size enterprises

Given that increases in energy costs may lead to relocation of activities between different countries, it is important to have solid knowledge on the role of smaller and medium size enterprises. Many factors other than energy costs may play a role on activity relocation, including tradability of the manufactured goods or other competitiveness factors. Small and medium sized enterprises are traditionally more closely bound to local economies, so they are more important for employment and local economic activity and may be less likely to relocate.

As Figure 95 shows, the role of larger, medium-sized or smaller enterprises, taking into account the annual turnover[1], differs significantly across industries. In the case of *iron and steel, chemical, and non-ferrous metals* industries, being capital-intensive sectors, a high concentration of large enterprises, having more than 250 employees, can be observed. Companies with fewer than 20 employees are almost negligible in these sectors.

Small and medium sized enterprises (SMEs), measured by annual turnover, have a significant share in *glass and pottery, building materials* and in *paper and printing industries*. In the *ore extraction* and *wood and wood products* sectors micro and smaller firms represent a significant share of the sector's employment and annual turnover. Medium sized enterprises have a substantial presence in all energy intensive industries, assuring 15-30% of employment or the annual turnover in all sectors.

Figure 95. Distribution of enterprise annual turnover among EU enterprises by size (number of employees) and manufacturing subsector in 2011



Source: Eurostat, Structural Business Statistics (SBS)

2.2.3. Energy costs in selected energy intensive industries (EIIs)

This section focuses on a bottom-up analysis of specific sectors based on individual data made available by industry. A certain number of (sub-)sectors amongst EIIs have been selected based on criteria such as the geographical spread of operators, the relative importance of gas and electricity as energy sources and the presence of large and small players in the market.

An external contractor[105] provided detailed analysis based on case studies for the following EIIs:

	Case study(ies) of the sub-sector(s)
Ceramic industry	• *Bricks and roof tiles* • *Wall floor tiles*
Glass industry	• *Float glass*
Chemical industry	• *Ammonia* • *Chlorine*
Non-ferrous metal industry	• *Primary aluminium*
Ferrous metal industry	• *Steel*

Starting from data collected at plant level, the methodology[106] adopted allows for the study of several real-life cases; these are not meant to be exhaustive but are rather indicative of the trends under assessment in the sampled plants and give important insights into the variability of operating conditions in some plants across the EU.

The presentation of the sectors which were the subject to the case studies includes information on energy and production costs, trade, energy intensity of the plants included in the samples and estimation of indirect CO_2 costs.

All these sectors are highly energy intensive, with electricity and gas costs accounting for a significant share of total production costs (see Table 34).

[105] Centre for European Policy Studies, CEPS, the results of the analysis have been delivered to Directorate General Enterprise of the European Commission

[106] Further information on the methodology, sampling, how the sample represents the given industry as a whole, geographical coverage, the anonymity of individual plant level data, etc. can be found in Annex 2

Table 34. Share of gas and electricity costs in production cost of the sampled plants

	Share of electricity costs in total production costs (%)	Share of natural gas costs in total production costs (%)	Share of energy costs in total production costs (%)
Wall and floor tiles (EU, avg 2010-2012)			25-30%
Bricks and roof tiles (EU, avg 2010-2012)			30-35%
Float glass (4 plants, avg 2010-2012)	3.6-4.0%	21.0-28.1%	35.1 - 39.1%
Ammonia (7 plants, avg 2010-2012)	3-6%	80-88%	
Chlorine plants (5 plants, avg 2010-2012)	43-45%		
Aluminium (11 plants, 2012)	13-48%		Grossly equal to the electricity costs
Steel (5 BOF, 10 EAF plants, 2012)			5% for BOF 12-15% for EAF

Source: CEPS and Cerame Unie (for wall and floor tiles and brick and roof tiles). For the sample of wall and floor tile plants electricity and natural gas represent 30-34% and 64-70% of total energy costs, respectively. For the sample of bricks and roof tiles, electricity and natural gas represent 25-27% and 73-75% of total energy costs, respectively.

2.2.3.1. Bricks and roof tiles

Brick and roof tiles, as well as wall and floor tiles (see 2.2.3.2), are sub-sectors of the ceramic sector. The ceramic sector represents an annual production value of around €25 billion, accounting for approximately 25% of global production. Overall, the EU ceramic industry is export-oriented, with 25% of its production sold outside the EU market. However, over the last decade its situation has changed considerably, with the rise of low-cost products from new competitors in emerging and developing countries (China, Brazil, India, and United Arab Emirates) and the persistence of trade barriers preventing effective access to major new markets. The ceramics sector comprises about 4000 companies, many of which SMEs.

The European bricks and roof tiles sub-sector is made up of more than 700 companies, from SMEs to large international groups. In recent decades, producers have invested heavily in improving the manufacturing process. By 2007 there was a 40% decrease[107] in the energy required for to produce a 1m² brick wall compared to the 1990s. After a period of boom, between 2007 and 2012 the production value of the EU-27 bricks and roof tiles sector decreased by 36.8%, from €8.7 to €5.5 billion. Six Member States are responsible for about 80% of total EU production (Germany, France, Italy, the UK, Spain, Poland, and the Netherlands).

This sub-sector is highly energy-intensive – Cerame Unie estimates that the share of energy costs in the total production costs in the sub-sector ranges between 30% and 35%. The carbon leakage evidence study[108] points that energy costs account for 10% of production costs in the clay materials manufacturing sector[109] and intermediate inputs represent 60% in the cost structure. For the 13 plants sampled in the case study, the share of energy in total production costs varies between 17 and 40% while the share of electricity and gas in total energy costs is between 25 and 27% for the former and 73 to 75% for the latter[110].

Table 35– Breakdown of production costs for bricks and roof tiles (EU estimated average)

Energy	30%-35%
Labour	25%-30%
Raw materials	20-25%
Other production costs	15%-20%
Total	**100%**

Source: Cerame-Unie (2013)

Due to relatively high transport costs and low value added, markets for bricks and roof tiles are mainly regional and trade intensity for the sector is relatively low. Nevertheless, a constant increase of extra-EU trade in recent years has been observed and increasing flows are registered at EU borders for some Member States, as Eurostat foreign trade data show.

Trade intensity[111] calculated for the whole EU27 has increased from 2.5% to 4.8%.

[107] Source: Cerame Unie
[108] Carbon leakage evidence study, see http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/cl_evidence_factsheets_en.pdf
[109] Includes wall and floor tiles and brick and roof tiles. Based on SBS
[110] The sampled plants do not use energy sources other than electricity or natural gas.
[111] The definition of trade intensity is taken from the criteria defined in the ETS Directive; that is, the ratio between the total value of exports to third countries plus the value of imports from third countries and the total EU market size (annual turnover plus total imports from third countries). This definition is applied throughout this whole chapter presenting the results of the case studies.

Figure 96. Trade intensity of the bricks and roof tiles sector

	2005	2006	2007	2008	2009	2010	2011	2012
Exports (€)	171.735.530	178.455.710	211.506.450	220.905.550	165.007.310	182.503.920	199.231.810	232.136.070
Imports (€)	30.899.710	41.020.270	71.145.380	80.020.710	40.389.740	37.434.060	35.289.950	35.179.880
Production (€)	8.034.272.646	8.976.886.053	8.725.317.369	6.828.768.517	6.120.953.696	5.688.462.745	5.953.003.413	5.500.764.826
Trade intensity (%)	2,5	2,4	3,2	4,4	3,3	3,8	3,9	4,8

Source: Eurostat Prodcom, database

Unlike other ceramics sub-sectors, dominated by a high share of SMEs, the bricks and roof tiles sub-sector is composed of an almost equal number of SMEs and larger producers.

Table 36 Descriptive statistics for natural gas intensities[112] for 10 out of 13 sampled bricks and roof tiles production plants in terms of physical output (MWh/tonne)

	2010	2011	2012
Europe (average)	0.52	0.54	0.56
Europe (median)	0.58	0.50	0.53

Source: CEPS

Table 37 Descriptive statistics for electricity intensities for 10 out of 13 sampled bricks and roof tiles production plants in terms of physical output (MWh/tonne)

	2010	2011	2012
Europe (average)	0.07	0.07	0.07
Europe (median)	0.07	0.06	0.06

Source: CEPS

[112] Based on data availability across the sampled plants of the sector, the two tables show average electricity and gas intensity over the observed period. Given the nature of the information provided and the related limitations associated with averages as well as the short timeframe assessed, data is not meant to support conclusive evidence about trends in technical efficiency; it is rather presented for the sake of completeness of information. The same conditions apply to energy efficiency numbers presented later in this chapter in other case studies.

2.2.3.2. Wall and floor tiles

Wall and floor ceramic tiles constitute the biggest sector in terms of turnover among European ceramic industries, with total estimated sales around €8.5 billion[113] in 2012. One third of the sector's production is exported outside of the EU. After a period of boom, between 2007 and 2012 the production value of the EU27 wall and floor tiles sector decreased by 29.5%, from 12.2 to 8.6 billion €. In the EU, five Member States are responsible for about 87% of total production (Italy, Spain, Poland, Germany and Portugal). Worldwide, production is dominated by Asian producers. In 2011, China accounted for about 45% of global production, followed by other Asian countries (24%) and the EU27 with about 11%.

The wall floor tiles subsector could be considered energy intensive: the production of one tonne of ceramic tiles required 6GJ (21.7 MWh) of energy.[114] Overall, according to Cerame-Unie, energy costs' share of total production costs ranges between 25% and 30%. The carbon leakage evidence study points that energy costs account for 10% of production costs in the clay materials manufacturing sector[115] and intermediate inputs represent 60% in the cost structure. Data from 10 of the 12 sampled plants, the share of energy in total productions costs varies between 17 and 29%. Electricity has a share of 30 to 34% of total energy costs, whereas natural gas has a share of 66 to 70%[116].

The production of wall and roof tiles consists of four main stages: (i) the preparation of the raw materials, (ii) shaping, (iii) drying and (iv) firing. Firing is the most energy-intensive stage of production, during which around 55-65%[117] of the total volume of energy used during the production process is consumed. Heating is provided by natural gas in about 85% of cases. Coal, oil and biomass gas are usually applied when the latter is not available.

Table 38 Breakdown of production costs for wall and floor tiles (EU estimated average)

Energy	25%-30%
Labour	25%-30%
Raw materials	30-35%
Other production costs	10%-15%
Total	**100%**

Source: Cerame-Unie (2013)

Due to their nature, ceramic tiles are highly tradable and high added value products. Trade intensity calculated for the whole EU27 is high and has increased over time, from 28.5% to 39.7%.

Figure 97 Trade intensity of the wall and floor tiles sector

	2005	2006	2007	2008	2009	2010	2011	2012
Exports (€)	2.708.752.630	2.960.279.860	2.964.298.190	2.871.026.610	2.164.586.540	2.473.806.180	2.674.057.450	3.091.461.990
Imports (€)	447.186.520	528.610.890	707.715.520	692.488.260	562.200.040	690.124.510	577.779.730	529.779.140
Production (€)	10.615.636.099	11.675.985.952	12.218.114.813	10.355.772.450	8.315.193.622	8.317.298.017	8.336.104.184	8.599.589.787
Trade intensity (%)	28,5	28,6	28,4	32,3	30,7	35,1	36,5	39,7

Source: Eurostat Prodcom database

[113] Source: Eurostat PRODCOM database
[114] G. Timellini, 2008) http://eippcb.jrc.ec.europa.eu/reference/BREF/cer_bref_0807.pdf
[115] Includes wall and floor tiles and brick and roof tiles. Based on SBS
[116] The sampled plants do not use energy sources other than electricity or natural gas.
[117] Depending of the characteristics of product, i.e. size, surface etc.

The EU is normally a net exporter of ceramic tiles and the main export destinations are Russia, Switzerland, North Africa and North America. However, European producers are facing increasing competition from foreign manufacturers, in particular China which controls more than 80% of the world reserves of some of the raw materials used in production (bauxite and graphite). Since 2002, imports of ceramic tiles from China at low prices have been growing constantly, at an average yearly rate of 49%. At the same time, after a drop in 2009, European exports have constantly increased, in 2012 surpassing their pre-crisis export values.

The wall and floor tiles sub-sector is characterised by a high number of SMEs, which are responsible for about 80% of total EU production.

The next two tables show the estimated evolution of electricity and natural gas intensity in the sector:

Table 39 Descriptive statistics for the natural gas intensities for 10 out of 12 sampled wall and floor tiles producers in terms of physical output (MWh/tonne)

	2010	2011	2012
Europe (average)	1.81	1.79	1.81
Europe (median)	1.73	1.68	1.69

Source: CEPS

Table 40 Descriptive statistics for the electricity intensities for 10 out of 12 sampled wall and floor tile producers in terms of physical output (MWh/tonne)

	2010	2011	2012
Europe (average)	0.23	0.23	0.23
Europe (median)	0.19	0.19	0.19

Source: CEPS

2.2.3.3. Float glass

There are four main sub-sectors within the glass sector: container, flat, fibre (mineral wool, textile and optical) and specialty glass. The term 'flat glass' includes all glass produced in flat form, regardless of the type of manufacturing process involved. Flat glass is the second largest glass sub-sector in the EU, after container glass. Float glass is the main product category of the flat glass sub-sector, alongside rolled glass[118].

The production process is standardized across producers and the different types of end-products are generally homogenous. The sub-sector's main downstream markets are the building and automotive sectors which absorb around 80% and 15% of production respectively[119]. The market for solar applications is still limited but growing and now accounts for about 5% of production. Approximately 17,000 people are employed in this sector in the EU. Global demand for flat glass is approximately 50 million tonnes. Demand is dominated by China (50%) , Europe (16%) and North America (8%).

Natural gas is the main fuel for glass production, followed by oil products. Both fuels are interchangeable in the melting process. Over three-quarters of the energy used in the float sector comes from furnace activities (i.e. melting the glass). Forming and annealing takes 5% and cutting 2%. The remaining energy is used for service, control systems, lighting, factory heating and other activities, such as inspection and packaging. Overall, energy costs' share of total production costs is about 21%.

In terms of costs, raw material and energy are the two largest elements, followed by labour costs and overheads. Soda ash is one of the most expensive raw materials used and accounts for around 60% of batch costs.[120] Since natural gas is mostly used in the production process, the price of natural gas is a primary cost driver for the flat glass industry.

Natural gas accounts for 28% of the production costs for the plants in sample and electricity and fuel oil for 6% each.

Transportation costs differ for transportation by land and sea. By land, flat glass is expensive to transport, which is why it is generally supplied on a local or regional basis. Distribution costs typically represent around 10-15% of total production costs.[121] However, intense competition between companies has led to glass being transported over longer distances, ultimately limited by cost.[122] For transportation by land, 200 km is seen as the norm and 600 km as the economic limit.[123]

After a peak in 2007 extra-EU imports have declined, but the recent increase has shown that transportation costs, in particular by sea, are not an obstacle and increased competition is being faced from producer in the Middle East, North Africa and China.

Trade intensity calculated for the whole EU27 is high and has increased over time, from 19.5% to 23.1%.

118 Float glass and flat glass are often used as synonyms in the literature, and also throughout this study. However, float glass is defined as flat glass produced with the float process. Hence, the term float glass refers both to a type of glass and to the process by which it is made. It is also called melted glass. The term flat glass refers to flat glass regardless of the technology used to produce it (i.e. it could be float glass or rolled glass).
119 Source: CEPS, based on industrial associations data
120 Pilkington, 2010
121 Pilkington, 2006
122 Ecorys, 2008
123 Glass for Europe, 2013

Table 41. Trade intensity of the float glass sector

	2005	2006	2007	2008	2009	2010	2011	2012
Exports (€)	464.350.140	575.414.930	663.216.840	672.336.660	526.466.220	691.197.710	661.980.570	585.557.590
Imports (€)	245.025.240	271.743.140	452.022.300	373.462.520	256.211.660	274.196.810	255.670.860	206.611.160
Production (€)	3.397.713.519	3.948.293.786	4.373.283.924	4.243.473.603	2.989.854.927	3.350.111.282	3.513.320.674	3.223.542.598
Trade intensity (%)	19,5	20,1	23,1	22,7	24,1	26,6	24,3	23,1

Source: Eurostat PRODCOM database

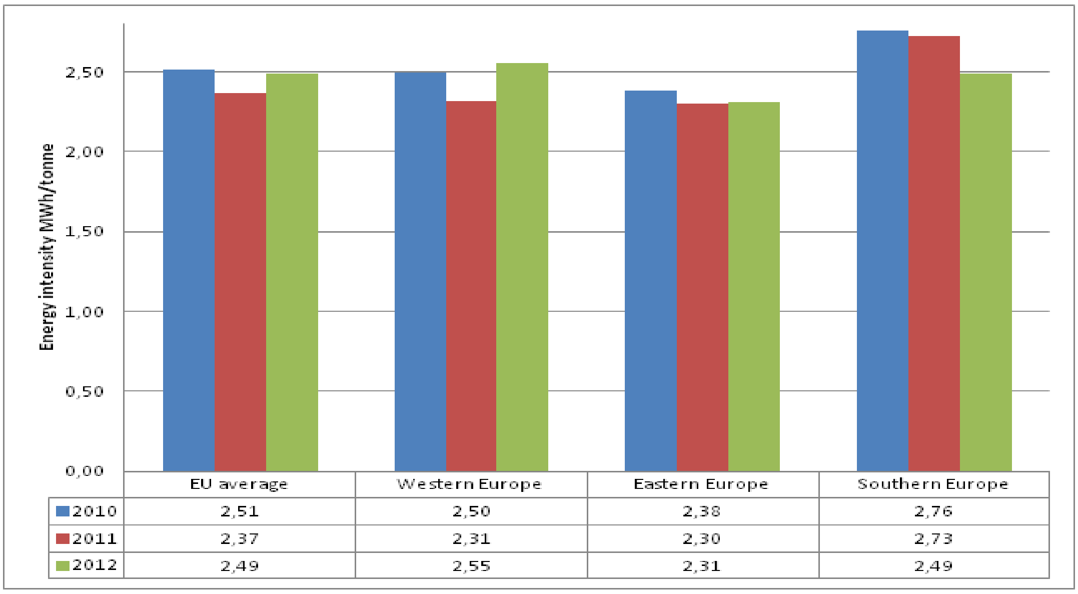
After a period of boom, between 2007 and 2012 the production value of the EU27 flat glass sector decreased by about 26%, from €4.4 to €3.2 billion. At the last count, 46 tanks were operating in the EU, 90% of which were run by four major groups: Saint Gobain, AGC, NSG Group (Pilkington) and Guardian, of which only the first has its parent company located in the EU. The production of flat glass is spread over 12 countries in EU. The Member State with the most float tanks is Germany (10 float lines), followed by Italy (6 float lines), Spain, France and Poland (5 float lines each) and Belgium and the UK (4 float lines each). These seven Member States together account for about 80% of total installed EU capacity.

Being highly capital-intensive, float glass production is mainly carried out by large players and the number of SMEs in the sector is not significant.

Based on data availability across sampled plants in the sector, the following two charts show the average electricity and gas intensity over the observed period for the EU and each region as defined in the case study.

Natural gas and fuel oil are used for heating the furnace and are interchangeable for this purpose. According to industry, using natural gas instead of fuel oil demands approximately 8% more energy. Three plants in the sample switched to natural gas from fuel oil during the time period studied. For these three plants, aggregated energy use from fuel oil and natural gas was considered for calculating energy intensities. For this purpose, fuel oil was converted from tonnes to MWh with conversion factors provided by industry.

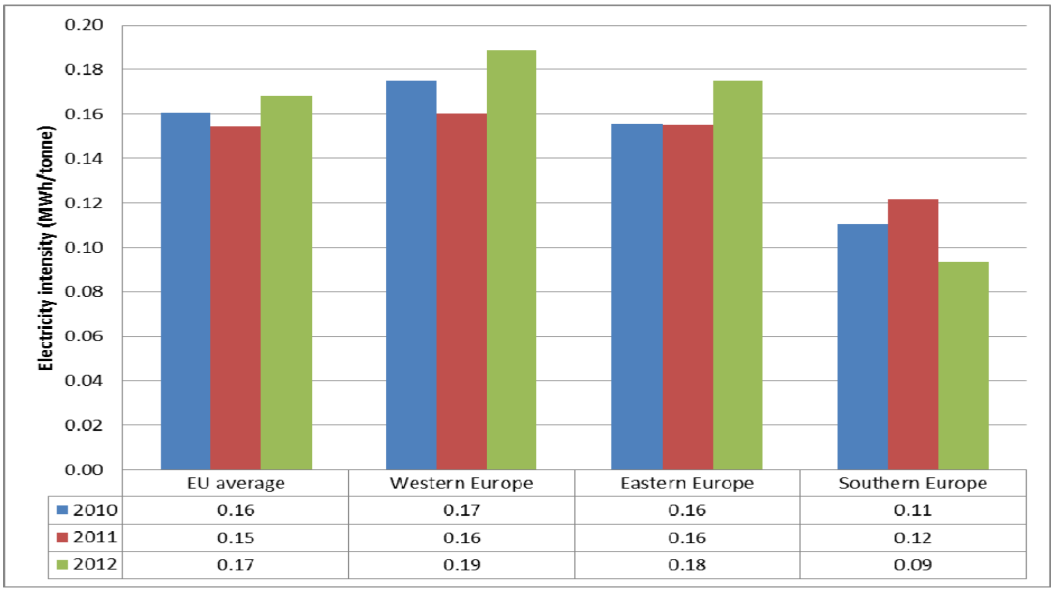
Figure 98. Energy intensities of 10 float glass producers in the EU (natural gas and fuel oil) in terms of physical output, weighted average, MWh/tonne



	EU average	Western Europe	Eastern Europe	Southern Europe
2010	2,51	2,50	2,38	2,76
2011	2,37	2,31	2,30	2,73
2012	2,49	2,55	2,31	2,49

Source: CEPS

Figure 99. Electricity intensities in terms of physical output, weighted average, MWh/tonne



	EU average	Western Europe	Eastern Europe	Southern Europe
2010	0.16	0.17	0.16	0.11
2011	0.15	0.16	0.16	0.12
2012	0.17	0.19	0.18	0.09

Source: CEPS

2.2.3.4. Ammonia

The EU chemical industry is characterised by extreme complexity, integration and inter-connection of processes. For this reason, the examination of key chemical sectors such as ammonia and chlorine in this study needs to be considered in the context of the entire chemical value chain. A large part of the industry's energy inputs, used as either fuels or feedstock, are consumed within these sectors. In terms of downstream applications, the chemical industry is very diverse and stretches over nearly all sectors of the economy.

Ammonia (NH3) is a compound composed of one nitrogen (N) and three hydrogen (H) atoms. It is usually found as a gas.

Being released from the natural breakdown of organic waste matter, ammonia occurs naturally throughout the environment. However, naturally produced ammonia occurs in very low quantities, making it necessary to manufacture significant amounts of this substance. Ammonia is one of the most largely produced industrial chemicals. It is employed in a diverse set of industrial sectors, although about 80% of global production is consumed by the fertilizer industry.

Global ammonia production has been constantly growing in the last decades and in 2012 reached a historic peak of 137 million tonnes. China is the largest producer of ammonia, with a share of 32% of global production, followed by India (9%), US (7%) and Russia (7%). EU-28 production is spread over 17 different Member States and a total of 42 plants. Five Member States make up around 64% of total EU capacity (Germany, Poland, the Netherlands, Romania and France). Production capacity in Europe has decreased significantly over the past decade (from 19.2 million tonnes in 2000, to 15.7 million tonnes in 2010).

According to Potashcorp (2013), about 88% of ammonia produced globally is consumed close to where it is manufactured. The physical properties of ammonia make transport expensive (due to the necessity of high-pressure containers); despite this - according to Fertilizers Europe and IFA - ammonia is widely traded. Its trade intensity for Europe is 35%, according to Fertilizers Europe. The downstream products associated with ammonia - most importantly urea and ammonium nitrate - are also highly traded.

In the EU ammonia production costs are characterized by one major cost driver: natural gas price. More than 90% of ammonia in the EU is produced using natural gas steam reforming. In contrast, in China coal is still the most used feedstock. Other feedstock can be heavy oils and naphtha[124].

Natural gas is favoured over other feedstock due to its availability and ease of delivery as an inexpensive feedstock in some regions, its high hydrogen content, and the relative simplicity and low operative costs of plants designed for natural gas. Natural gas is usually employed both as feedstock (approximately 2/3) and as fuel (approximately 1/3). While energy savings can be sought on fuel part, there is a theoretical minimum amount needed for feedstock which does not allow for savings.

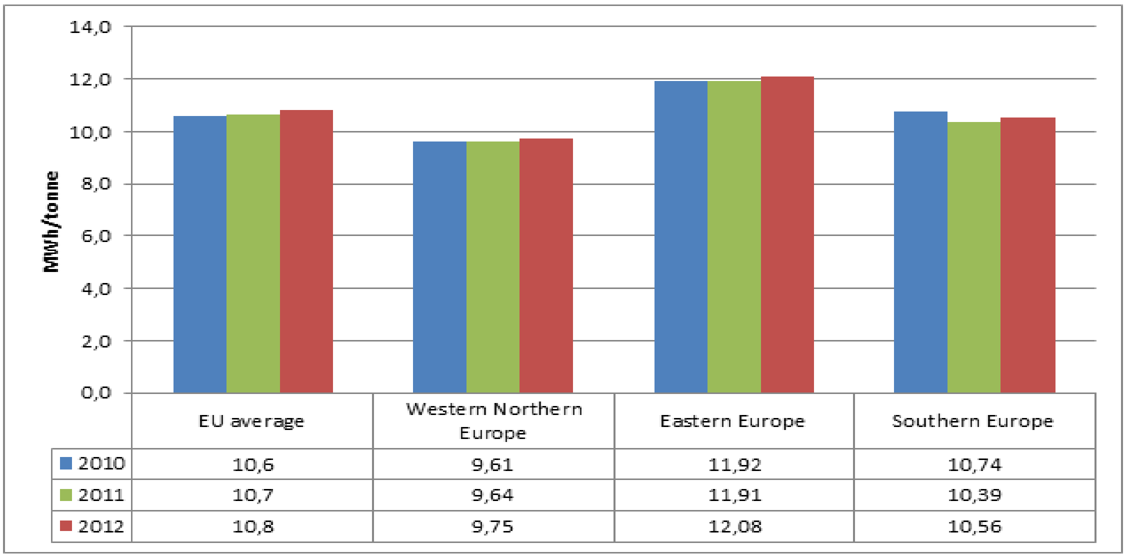
The price of natural gas makes up 70 to 85% of ammonia production costs[125]. Other energy inputs are represented by electricity and steam; their impact on overall production costs is

[124] CEPS case studies
[125] IEA.

limited. There have been large gains in energy efficiency for ammonia production since the 1970s[126], particularly in Europe.

Production capacity in the EU decreased from 19.2 million tonnes in 2000 to 15.7 million tonnes in 2010.

Figure 100. Natural gas intensity of EU ammonia producers (MWh/tonne)



Source: European Commission estimates based on CEPS studies

[126] IEA

2.2.3.5. Chlorine

Chlorine is one of the most common chemical elements in nature although due to its high reactivity it is usually found bound with other elements.

Production of chlorine is one of the major activities within the global chemical industry and plays a fundamental role within the chemical value chain. Chlorine is co-produced with caustic soda and hydrogen in an electrolytic process. Chlorine has a broad set of applications: from the production of polyvinyl chloride (PVC) – accounting for about 30% of total chlorine demand – to multiple uses within traditional sectors like construction, the automotive industry, IT and packaging.

Being linked to a vast array of industrial activities, the demand for chlorine is highly pro-cyclical. As a commodity chemical business, the chlor-alkali industry tends to be cyclical, with years of low profitability followed by periods when margins are sufficiently high to justify reinvestment.[127]

The chlorine value chain is highly vertically integrated insofar as there is not a proper market for chlorine as raw material and transport costs are high. In practice, chlorine is almost exclusively an intermediate product which implies that downstream industries (e.g. PVC producers) produce themselves the chlorine they need as input in their production processes.

The European chlor-alkali sector is exposed to intense international competition from both the US and the Middle East, who benefit from low-cost energy and feedstock availability in comparison to EU manufacturers. In 2012, European chlorine production was 2.4% below 2011 levels and 9.3% below record figures in 2007.[128]

Due to its intrinsic characteristics little chorine is traded among economic regions, a fact that reduces exposure to international competition for producers. More than 94% of all chlorine manufactured in Europe is used or converted to other products on the same site. On the contrary, a considerable amount of chlorinated derivatives, such as Polyvinyl Chloride (PVC) and Ethylene Dichloride (EDC), are heavily traded, which increases the exposure of European producers to international competitive pressures.

Chlorine production is highly energy-intensive and, independent of the specific technology, electricity is the key raw material. Electrolysis of brine is at the basis of the production process. Electricity costs are therefore a crucial driver in chlorine production and a major factor affecting the sector's international competitiveness, together with other industrial activities**.**

Three main technologies are currently available for the industrial production of chlorine: 1) the mercury cell process; 2) the diaphragm cell process; 3) the membrane cell process.

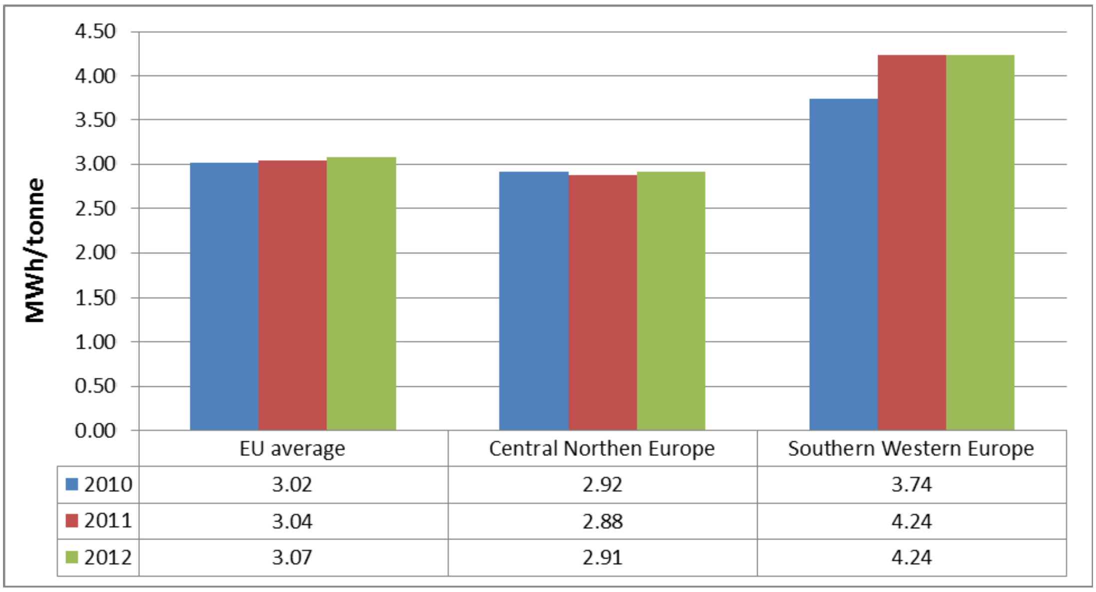
For the EU in 2012, approximately 55% of capacity was based on the most efficient membrane technology (against an average 67% worldwide), about 13% was based on diaphragm technology (22% at global level) and around 29% was still based on mercury technology (against 5% at global level).

[127] IHS, Abstract, Chlorine/Sodium Hydroxide

[128] Eurochlor, Chlorine industry Review 2012-2013, page 25.

In 2012 the EU represented an estimated 20% of total world production. Seventy-two production plants were spread across 19 Member States, of which six represented more than 80% of the chlorine production.

Figure 101. Electricity intensity of sampled EU chlorine producers (MWh/tonne)



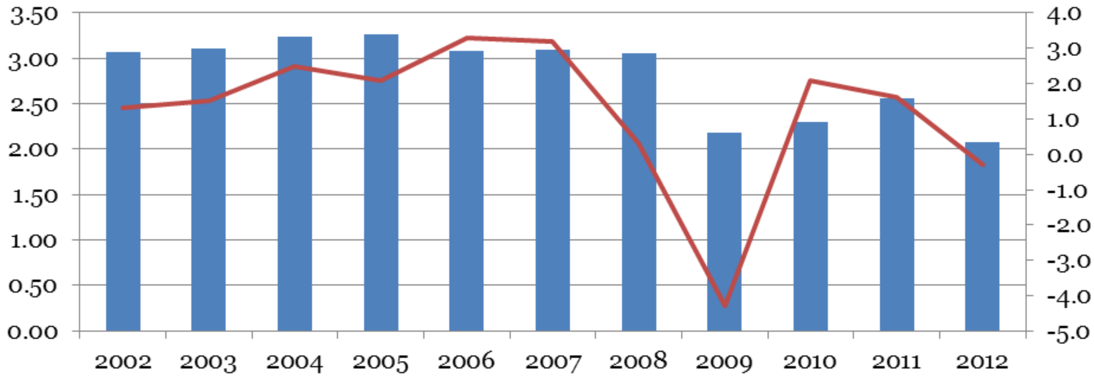
Source: European Commission estimates based on CEPS

2.2.3.6. Primary aluminium

Aluminium is the second most used metal in the world (after iron) and the most widely used non-ferrous metal. The EU's aluminium industry has a long history and currently employs around 250,000 people.

Aluminium primary production begins with the extraction of alumina from bauxite, followed by a very energy intensive electrolytic process that breaks the bonds between the aluminium and oxygen atoms in alumina. This second phase is much more costly and is generally performed close to the final user or cheap sources of energy, while the first is performed close to the mining site as bauxite is heavy and costly to transport. Significantly, aluminium can be recycled indefinitely with no loss of properties and with the use of only 5% of the energy required for primary production. However, growing demand and the trapping of aluminium in long-term uses such as in buildings mean that primary production is still necessary. Aluminium is a crucial input for a wide range of industries, including renewable energy, the automotive industry and building and construction.

Figure 102 Primary Aluminium production in the EU (millions tons, left axis) and EU27 GDP growth (right axis)



Source: CEPS, calculations based on EEA and Eurostat.

As shown on Figure 102 above, EU primary aluminium production recovered from the 2009 crisis but decreased substantially as a consequence of the closure of three smelters in 2011 and 2012. Since demand stayed strong, the difference was made up by imports, which in 2013 represented for the first time more than half of total consumption. If we take into account Iceland and Norway, two EEA member states, also applying the energy and climate legislation of the European Communities, aluminium production is also decreasing since its peak of 2008.

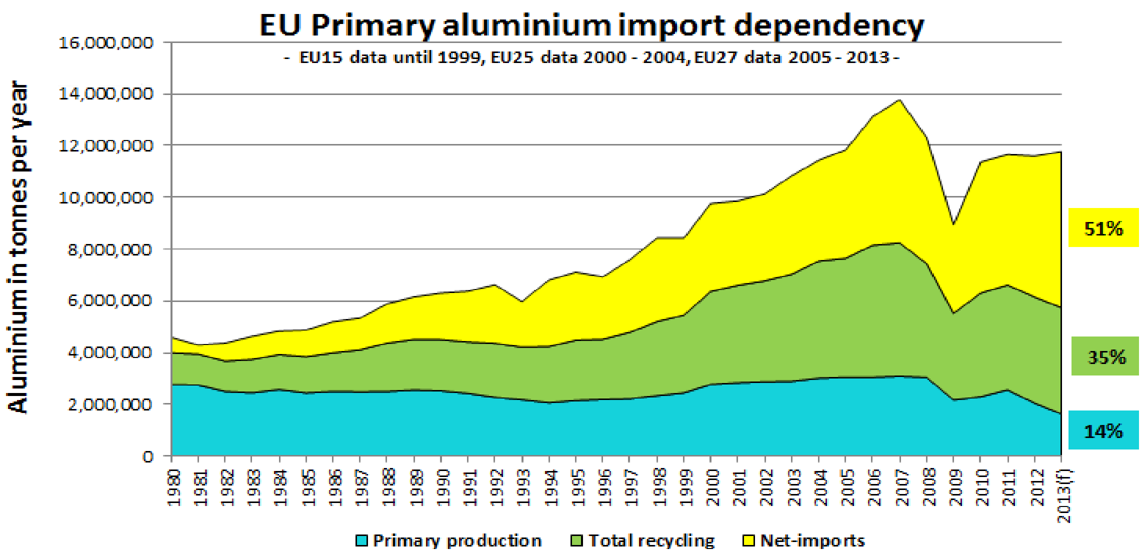
Table 42 Primary aluminium production in the EU, Norway and Iceland

Primary aluminium production (in kt)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU27 production	3,073	3,102	3,235	3,269	3,077	3,089	3,050	2,184	2,301	2,560	2,072
Iceland production	264	266	269	272	324	453	778	815	810	793	804
Norway production	1,046	1,190	1,321	1,388	1,379	1,368	1,358	1,117	1,090	1,107	1,129
total	4,383	4,558	4,825	4,929	4,781	4,911	5,186	4,116	4,201	4,460	4,005

Source: Eurostat

The EU, as shown in the graph below, has long been a net importer of aluminium, principally from Norway, Iceland (around 40% of the EU's aluminium imports are coming from these two countries), Russia, Mozambique and, increasingly, the United Arab Emirates.

Figure 103 EU primary aluminium import dependency



Source: EEA.

2.2.3.7. Steel

A growing share of the EU's crude steel is produced in electric furnaces. In 2011, BOF plants produced 57% of the EU's crude steel, while EAF plants accounted for 43%. However, given the different average size, fewer BOF facilities exist than EAFs (40 vs. 182).

After steady growth between 2002 and 2007 (12%), from 2007-2009 EU production of crude steel fell by 34%. The partial recovery in 2010 (24%) and 2011 (3%) was threatened by a fall in production in 2012 (-5%). The Compound Annual Growth Rate (CAGR) for the industry between 2002 and 2012 amounts to -1%. Trends are similar in both EU-15 countries and new EU Member States, with 10-year CAGRs of -1.1% and -0.8% respectively.

Nine Member States together accounted for more than 80% of total EU crude steel production. Overall, few Member States registered an increase in production over the period 2002-2012.

The steel industry's production trends have been subject to structural changes over the last twelve years, mainly due to increasing Asian production. In particular, compared to flat production rates in traditional centres such as the EU and the US, production in Asia and Oceania has increased rapidly, reaching almost 1 billion tonnes in 2012. The EU is the second biggest player, followed by North America and CIS.

Trade intensity for the EU27 is high although it has decreased over time, from 32.6% in 2005 to 26.1% in 2012.

Table 43 Trade intensity of crude steel

	2005	2006	2007	2008	2009	2010	2011	2012
Exports (€)	15.804.417.300	16.712.130.390	18.837.108.690	24.465.426.770	17.049.438.400	21.396.019.260	24.916.046.530	25.933.078.270
Imports (€)	14.362.544.110	19.519.956.320	28.359.886.880	35.082.688.560	13.285.267.800	20.705.431.150	27.332.270.350	20.906.146.200
Production (€)	78.310.323.186	94.004.152.511	102.544.123.778	184.085.225.132	108.452.499.621	143.217.482.483	166.646.958.648	158.451.248.867
Trade intensity (%)	32,6	31,9	36,1	27,2	24,9	25,7	26,9	26,1

Energy intensity differs from EAF to BOF; in this regard EAF is more energy intensive. Energy costs vary by production method. They are low compared to the overall cost of steel production for BOF producers, representing about 5% of total production costs in 2012. In the same year, for EAF producers they represented about 13% of total production costs.

Electricity intensity must be calculated differently for different steel products and processes. BOF production is coal-based, and uses limited quantities of other energy sources. The EAF route is much more electricity intensive, as steel scrap is melted through electric arcs. As for the BOF route, natural gas is mainly used for pre-heating, and in the rolling mill.

Table 44 Descriptive statistics for electricity and natural gas intensity for sampled steel plants in 2012 (MWh/tonne)

		Electricity	Natural gas
BOF	Crude steel	0.175	0.135
	Hot Rolled Coil	0.103	0.182
	Cold Rolled Coil	0.164	0.122
EAF	Crude Steel	0.553	0.151
	Wire Rods	0.121	0.383

Source: CEPS

Note: 11 plants in the sample for gas intensity and 14 in the sample for electricity intensity

Textbox 3. Estimated indirect emission costs

Indirect emission costs refer to increases in electricity prices resulting from the inclusion of the costs of greenhouse gas emissions due to the EU ETS. For instance, the EU ETS allowance price is dealt with by electricity producers either as opportunity costs or as real cost and the rational expectation would be to pass this cost over to consumers in the electricity price. With only few exceptions, this component cannot be identified as normally it does not appear in the final electricity bill. Therefore, an attempt has also been made to estimate the average CO_2 indirect costs in most of the case studies presented by sector and region. The results are only meant as indicative of the impact of the CO_2 component, which is considered to be *already implicitly included* in the other price components reported in the production costs.

In order to estimate CO_2 indirect costs, the average electricity intensity of the sampled respondents in each sector and region has been calculated and associated to regional CO_2 emission factors for electricity production as well as to assumptions in terms of CO_2 price pass-on rate from producers to final consumers. Regional CO_2 emission factors mainly depend on the electricity intensity of the marginal electricity producer in a given region. Pass-on rate indicates the proportion of direct costs faced by utilities (disregarding the effects of free allocation and possible multi-year contracts) that they pass on electricity consumers. Two different pass-on rates were calculated: 0.8 and1.0. These two pass-on rates are the results of an indicative estimation, assuming the difference between the extent of passing on the costs impacts on the final prices. Under normal circumstances it is reasonable to assume that most of the direct costs will be passed on the final consumers, at least in the long run. If it is not the case, one could expect negative impact on the profitability of the utilities. Prices are sticky on the short run; pass-on rates express the impact on short term cost evolutions. These two assumptions are exemplary and must be read in the context of the indirect costs calculations which are clearly reported as estimated and indicative.

The evolution of the indirect costs for the sample of a total of 78 plants in the energy intensive sectors studied in this report are presented in the following table. For the sampled plants the magnitude of indirect costs appears very different: across regions and across industries. Indirect costs in a given industry and in a given region[1] showed decreasing trend between 2010 and 2012, mainly in the consequence of decreasing carbon prices (as EUA emission allowances went down from 14.5 €/tCO_{2e} to 7.5 €/tCO_{2e} on annual average between 2010 and 2012). Cross-industrial comparisons in the sampled plants also show that electricity intensity plays a key role in the importance of CO_2 related indirect costs. For example, the sampled plants in the chlorine industry have indirect costs that are 50-60 times as high as in the sampled producers of bricks and roof tiles. Basically, for the sampled plants these costs appear to have a larger role in the chemical industry than in ceramic industries. In the case of the aluminium industry data are only available for 2012 and instead of having geographical regions the sample of the aluminium plants are divided into two categories (methodological details in Chapter 2 and Annex 2).

Annex II of the Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 specify the sectors and subsectors within which an installations needs to be active in order to be eligible for state aid for indirect emission costs. These include: aluminium production; mining of chemical and fertiliser minerals; manufacture of other inorganic chemicals; lead, zinc and tin production; manufacture of leather cloths; manufacture of basic iron and steel and of ferro-alloys, including seamless steel pipes; manufacture of paper and paperboard; manufacture of fertilisers and nitrogen compounds; copper production; manufacture of other organic basic chemicals; spinning of cotton-type fibres; manufacture of man-made fibres; mining of iron ores; some subsectors within the manufacture of plastics in primary forms (see Guidelines) and mechanical pulp (from manufacturing of pulp sector).

Bricks and roof tiles: indirect emission costs by region (€/tonne; sample of 11 plants)						
	Central Europe		Northern Europe		Southern Europe	
Pass-on rate	*0.8*	*1.0*	*0.8*	*1.0*	*0.8*	*1.0*
2010	0.74	0.93	0.65	0.81	0.44	0.55
2011	0.67	0.84	0.55	0.69	0.42	0.52
2012	0.37	0.46	0.29	0.36	0.24	0.29
Wall and floor tiles: indirect emission costs by region (€/tonne; sample of 10 plants)						
	South-Western Europe		Central and Northern Europe		South-Eastern Europe	
Pass-on rate	*0.8*	*1.0*	*0.8*	*1.0*	*0.8*	*1.0*
2010	1.02	1.27	2.17	2.72	1.22	1.53
2011	0.97	1.21	2.00	2.51	1.11	1.39
2012	0.56	0.70	01.03	1.29	0.59	0.74
Float glass: indirect emission costs by region (€/tonne; sample of 10 plants)						
	Western Europe		Eastern Europe		Southern Europe	
Pass-on rate	*0.8*	*1.0*	*0.8*	*1.0*	*0.8*	*1.0*
2010	1.26	1.58	1.90	2.37	0.76	0.95
2011	1.18	1.18	1.76	2.20	0.81	1.01
2012	0.81	1.01	1.09	1.36	0.33	0.41
Ammonia: indirect emission costs by region (€/tonne; sample of 10 plants)						
	Western-Northern Europe		Eastern Europe		Southern Europe	
Pass-on rate	*0.8*	*1.0*	*0.8*	*1.0*	*0.8*	*1.0*
2010	1.94	2.43	2.11	2.64	1.02	1.28
2011	2.12	2.66	2.15	2.68	0.97	1.21
2012	0.94	1.17	1.13	1.41	0.52	0.65
Chlorine: indirect emission costs by region (€/tonne; sample of 9 plants)						
	Central Northern Europe		Southern Western Europe		EU average	
Pass-on rate	*0.8*	*1.0*	*0.8*	*1.0*	*0.8*	*1.0*
2010	25.69	32.11	32.95	41.19	28.11	35.14
2011	24.02	30.03	34.91	43.64	27.65	34.56
2012	13.42	16.78	21.30	26.63	16.05	20.06
Steel: indirect emission costs by technology (€/tonne; sample of 17 plants)						
	EAF-CS	EAF-WR	BOF-CS	BOF-HRC	BOF-CRC	
Pass-on rate	*0.8*	*0.8*	*0.8*	*0.8*	*0.8*	
2010	4.53	5.52	1.63	2.43	2.94	
2011	4.31	5.25	1.55	2.31	2.8	
2012	2.36	2.88	0.85	1.27	1.54	

Aluminium: indirect emission costs (€/tonne; sample of 11 plants) , 2012			
Pass on rate	Sample	Subsample 1	Subsample 2
0.8	59.99	0	90.50
1	73.53	0	110.92

2.2.3.8. Main findings from the case studies

Although energy costs make up a significant part of the overall production costs, **brick and roof tile** products are less exposed to international competition coming from extra-EU trade, given the relatively high transportation costs. However, as gas firing is predominant among energy costs, high gas prices can reduce the competitiveness of domestic tile manufacturing in EU Member States located close to countries with relatively low energy prices and significant tile manufacturing facilities. The large share of SMEs in the sector makes plant relocation costlier, having beneficial impact on the overall employment compared to those industries which have high concentration of large enterprises.

Energy costs have a share of about one third in the total production costs in the case of **wall and floor tile** products in the EU. During the last decade domestic EU production was on a decreasing trajectory amid dwindling consumption. Nevertheless, exports and imports rose, resulting in increasing trade intensity. Asian markets, mainly China, emerged as import sources, mainly because of cheap raw material prices keeping production costs low. Relatively high gas prices in the EU might also have contributed to this trend. Further decrease in domestic EU production could result in decreasing activity and employment in the sector, given the high share of SMEs.

Raw materials and energy costs are the two principal cost drivers in **float glass** manufacturing and energy costs are mainly related to natural gas. However, natural gas and fuel oil are interchangeable during the melting process, even if energy intensity and price considerations limit this option. Trade intensity is higher in the regions having access to water transport (longer distance of economic limit of transportation). Increase in trade intensity at EU level is mainly due to domestic production still lower than the pre-crisis (2007) level. Being highly capital-intensive, float glass manufacturing is concentrated among large industrial players, leaving limited room for smaller actors.

Natural gas price is a predominant cost driver in **ammonia** production, affecting around 70-90% of the production costs. Natural gas is both feedstock and energy source in the production process. Although almost 90% of the ammonia production is used locally (due to high transportation costs), ammonia itself and its downstream products (materials for fertilizers) are widely traded. The US, Russia and the countries in the Middle East are import sources for ammonia downstream products to the EU, with relatively lower prices for natural gas and subsequently lower production costs in comparison to the EU.

Electricity price is a crucial driver for **chlorine** production costs, affecting the competitiveness of the industry. As electricity prices in the US and in many countries in the Middle East are substantially lower than in the EU, domestic chlorine industry faces competitive pressure from import sources. This is the main reason why domestic chlorine production is decreasing in the EU. Although the majority of chlorine production is consumed locally, derivative products, such as PVC, are widely traded among different global regions, increasing the exposure of EU producers to international competition.

Primary aluminium production costs largely depend on electricity prices, up to half of total production costs can be attributed to electricity costs. As electricity prices are lower in a number of countries outside the EU, domestic aluminium production follows a downward trend and external aluminium import dependency of the EU is increasing. Aluminium manufacturing plants, which concluded long term electricity purchase contracts before the energy market opening and the introduction of the EU ETS might still enjoy preferential

electricity prices for a few years. The primary aluminium sector is highly capital intensive; and large enterprises might intend to further relocate their activities outside the EU, implying additional negative employment effects.

Both electricity and gas play an important role in the energy consumption of **steel** manufacturing, though other energy sources, such as coking coal and other raw materials are also important in different production technologies. Despite the domestic production in the EU is still under the pre-economic crisis levels, Europe still remains the second largest manufacturer of steel, though emerging markets, such as Asia, and China in particular, are rapidly catching up. Although trade intensity did not show a significant increase in the past decade, if competition outside from the EU is to continue to increase, highly capital intensive steel manufacturing might consider further geographical relocation in the future.

2.3. Chapter conclusions

- This chapter finds that spending on household energy, covering heating and lighting needs, has risen over the last decade and represented between 3.5 and 10% of the disposable income of households in 2010/2011. This share was 0-2.5 percentage points higher than a decade earlier.

- Lower income households tended to spend more on electricity, gas and heating than higher income ones, where a greater proportion of income is spent on transport fuels. The lack of timely and harmonised data on household budget statistics on European level makes cross-country comparisons on spending on energy products more difficult, especially when it comes to combination of the spending on energy with income distribution analysis.

- Improved energy efficiency has offset but not entirely compensated for the increase in household energy costs. In most of the Member States where energy costs are above the EU average, households have generally responded by reducing their consumption. Overall energy intensity is highest in the economies of Member States which have most recently joined the EU, suggesting potential for savings through efficiency.

- Recent years have seen a reduction in energy intensity in most EU economies and a reduction in industrial electricity and gas consumption. For many industries between 2008 and 2011 this coincided with a reduction in gross value added, as economic performance lagged behind pre-crisis levels. In various industrial sectors, however, reductions in electricity and gas consumption could be attributed to decreasing energy intensity as energy efficiency improvements were made and restructuring towards higher value-added products occurred.

- Between 2008 and 2011, some industries where electricity and gas are significant factors in the cost structure and which are exposed to international competition were affected by rising energy costs, especially in the case of electricity. Low profit margins, combined with a high share of electricity and gas costs point to sensitivity to changes in energy costs and a likely impact on those industries' global competitiveness.

  In some energy intensive industries high concentration of large enterprises can be observed, however, in many sectors the role of smaller and medium-sized enterprises (SMEs) is of particular importance. As higher energy costs might make the operators of production facilities to think to relocation as an option, the role of SMEs is important from the angle of employment, given that they are more closely bound to the local economy.

3. Energy prices in a global context

This chapter discusses the role of energy in cost competitiveness from a global perspective. It provides analysis of recent developments in global oil and coal markets as well as regional developments in the wholesale prices of electricity and gas in some of the EU's major economic partners. The chapter looks into retail price levels of electricity and gas and their evolution over time, providing estimates of the breakdown of electricity and gas prices and indications of energy price subsidies in some major economies.

In the case of electricity and natural gas, price differences in regional prices across regions have always existed, but the last few years have seen widening price gaps, in particular the price of natural gas in the US, Europe and Asia. This process has been driven by factors such as the shale gas boom in the US, the impact of oil-indexation on gas price dynamics in the EU, and sharply increased gas demand in Japan in the aftermath of Fukushima.

It discusses the significance of energy prices and costs for the competitiveness of different sectors of the economy, looking into the role of the EU in global export markets for energy intensive goods.

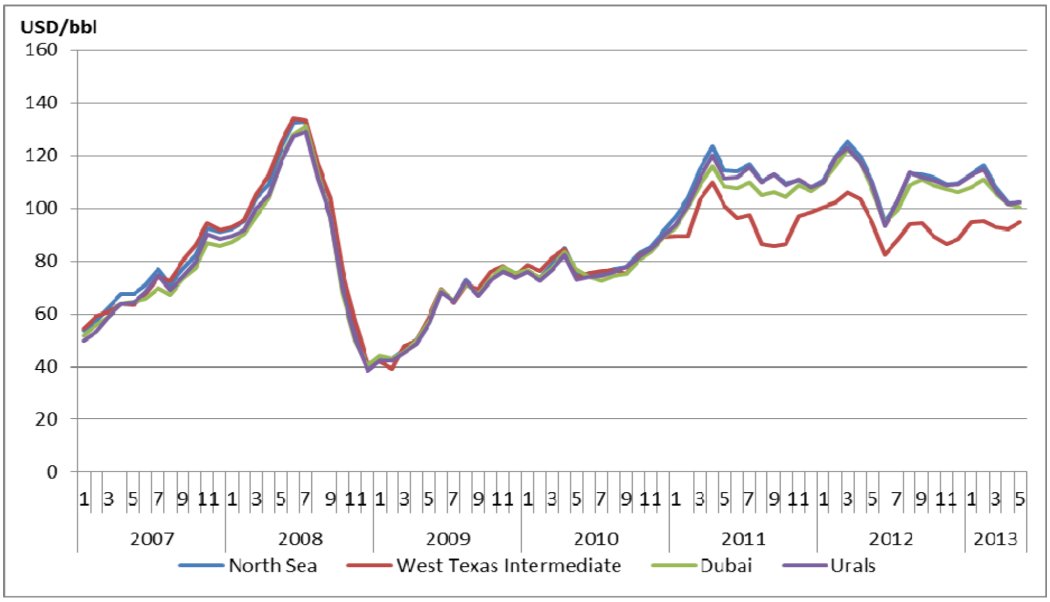
3.1. Global energy commodity and wholesale prices

Energy commodity prices vary across global regions - the degree of variance partially depends on the existence of highly liquid global markets and may reflect factors such as degree of competition, production or import costs and contractual terms, cost of transportation, as well as taxes and subsidies.

3.1.1. Crude oil, coal and uranium

Crude oil is the most commonly traded energy commodity with major price markets for the world trade in crude oil moving largely in step (Figure 104). The presence of highly liquid international markets and relatively low costs of transporting crude oil and petroleum products explain the modest differences in prices across countries and regions (Figure 106). The peak of crude oil prices in 2008 was followed by a fall in 2009 and recover to levels exceeding 100 USD/bbl in early 2011. Crude oil spot market prices have remained volatile since 2011 despite a recent drop to the lowest level since July 2012. Spot prices for West Texas Intermediate (WTI) and North Sea Brent crude oil benchmarks neared parity in mid-2013. By contrast, the average Brent-WTI price spread in 2012 was about 19 USD/bbl and exceeded 20 USD/bbl in February 2013. Since spring 2013, prices for these benchmarks have moved much closer together, as WTI increased in relation to Brent as a result of new US crude oil transport infrastructure and US refineries running at near-record levels.

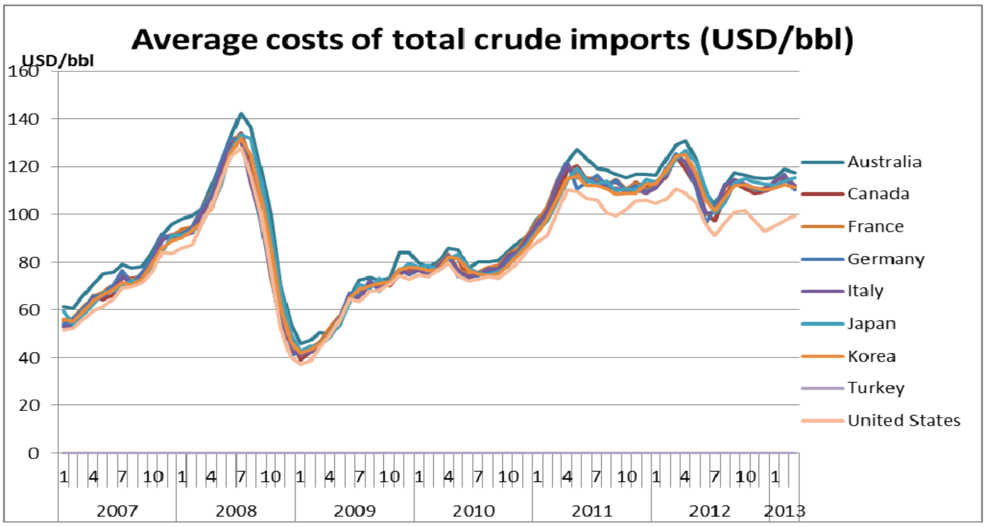
Figure 104. Evolution of global crude oil prices 2007-2013



Source: IEA 2013. Note: North Sea on this graph is set by the lowest of the Brent, Forties, Oseberg and Eko-fisk components.

Average crude oil import prices are affected by the quality of the crude oil that is imported into a country. For a given country, the mix of crude oils imported each month affects the average monthly price. Analysis of the IEA shows that over the first quarter of 2013 crude oil import costs increased over fourth quarter 2012 levels in all major IEA member countries except the United States. Year on year, average import costs in IEA member countries fell by 5.5%, with the United States (-9.2%) and Korea (-5.6%) reporting the largest decreases.

Figure 105. Evolution of average import costs of total crude imports



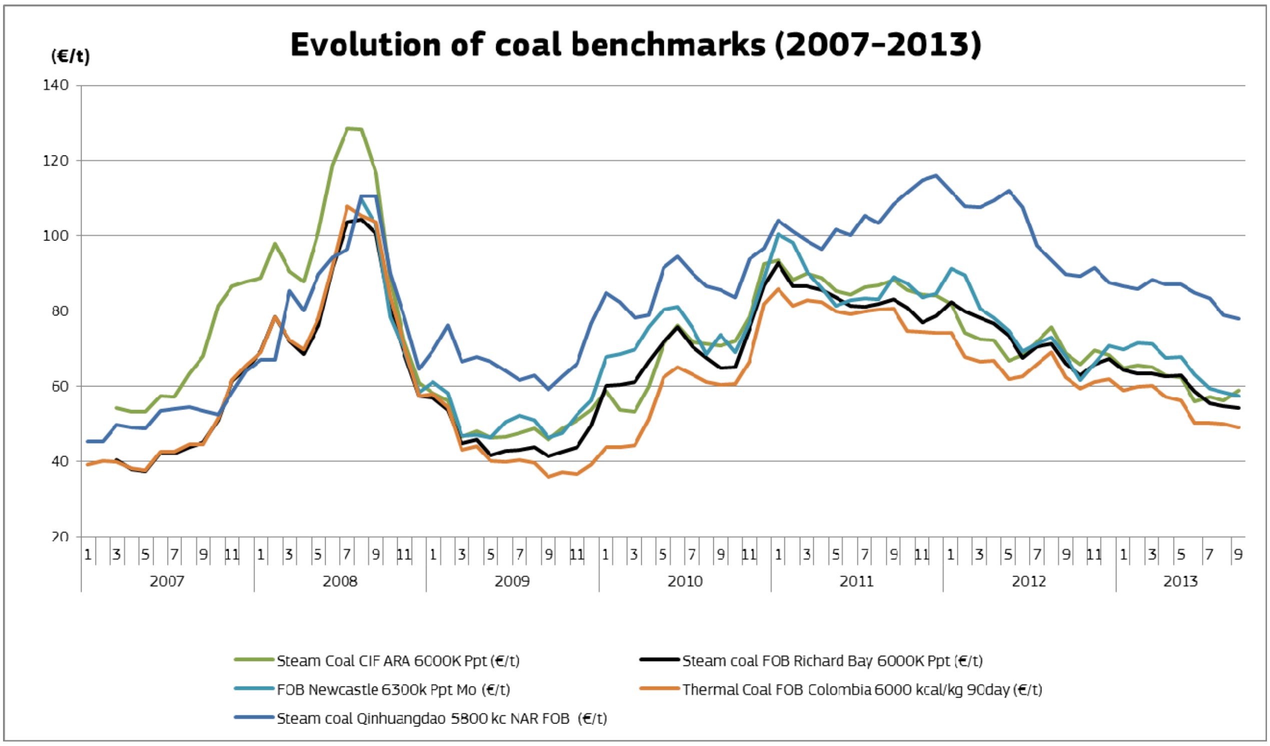
Source: IEA 2013. Energy Prices and Taxes, 2nd quarter 2013.

Unlike oil, which is widely traded internationally, the world **coal** market is predominantly supplied by domestic production with internationally traded coal accounting for a relatively small part of the market (around 20%). Internationally traded steam coal is split into two

major markets; the Atlantic basin (focussed on the Amsterdam-Rotterdam-Antwerp, ARA hub) and the Pacific basin (focussed on the Newcastle hub). Europe is increasingly an import led coal market and international prices act as leverage to negotiate price contracts with domestic coal producers. The Atlantic market for steam coal is made up of the major utilities in Western Europe and the utilities located near the US coast, with major suppliers being South Africa, Colombia, Russia and Poland; the share of US coal in total coal imports to the EU has increased from 12% in 2008 to 17% in 2012 [129] [130]. The Richards Bay port in South Africa plays an important role in constraining price divergence across the two basins.

Coal prices can differ due to differences in coal quality and transportation costs. In recent years the spreads between the major coal benchmarks for internationally traded coal to the Atlantic market have been edging ever lower. China became a significant net importer of coal in 2009, since when prices of Chinese coal imports have risen above those in Europe and have remained at a price premium of up to 50% (see figure below).

Figure 106. Evolution of coal price benchmarks



Sources: Platts and Bloomberg

The uranium spot market typically exhibits low levels of liquidity and can deviate significantly from the term market depending on the shorter term supply/demand balance of market participants[131]. There is no formal exchange for uranium. The most liquid traded form

[129] Nalbandian, H. and Dong, N. 2013. Coal and gas competition in global markets. IEA Clean Coal Centre.

[130] The Pacific market is made up of the utilities in Japan, South Korea and Taiwan, as well as increasing trade going into China and now India; Australia, Indonesia, and recently Vietnam, have been the main suppliers to this market

[131] Uranium price indicators are developed by a small number of private business organizations, like The Ux Consulting Company, LLC (UxC), that independently monitor uranium market activities, including offers, bids, and transactions. Such price indicators are owned by and proprietary to the business that has developed them. The Ux U3O8 Price® indicator is one of only two weekly uranium price indicators that are accepted by the uranium industry. The Ux U3O8 Price® is used as the settlement price for the NYMEX UxC Uranium U3O8 Futures Contract (UX).

of **uranium** is U308 in the form of yellowcake (uranium concentrate powder) for shipping to nuclear power stations.

Figure 107. Uranium prices 2009-2013

Source: Timera Energy 2013

3.1.2. Natural gas

The physical properties of gas make it more expensive to transport than other energy commodities. Historically, as gas was produced and consumed locally or regionally, international trade in gas was quite limited. Therefore, in contrast with the relatively narrow price range of other global energy commodities such as crude oil and coal, there are pronounced inter-regional price differentials in **natural gas** traded across the globe that have increased over recent years. The convergence or divergence of prices differs in periods of tight supply or surplus relative to demand; these are also determined by pricing mechanisms (gas-on-gas competition or oil-indexation). Development of price signals, growth in the LNG spot market and expansion of infrastructure may over time reduce global gas wholesale price differentials. The growing LNG market is expected to also have an impact on price convergence as is the liquidity and transparency of gas trading in regional markets.

Analysis by the International Gas Union points to different drivers of spot gas prices across different regions[132]. *North America* is a market where gas prices are driven by demand and supply fundamentals and gas is traded at the liquid and transparent Henry Hub. Current Henry Hub spot price levels reflect the impact of a surge in shale gas production over the last 5 years.

Northern Europe is also a market driven by liquid hub prices, primarily at the UK NBP, Dutch TTF, the German NCG and Gaspool and the Belgium Zeebrugge. In 2012 about 70% of gas in North-West Europe[133] was priced on a gas-on-gas basis. Yet, unlike North America, marginal price dynamics at European hubs are influenced by oil-indexed pipeline contract prices.

[132] IGU 2013. Wholesale Gas Price Survey - 2013 Edition. A global review of price formation mechanisms 2005 -2012

[133] In the survey of IGU North-West Europe is defined as UK, Ireland, France, Belgium, Netherlands, Germany, Denmark

Southern Europe seems increasingly influenced by the larger and more mature Northern European market. The Italian market has largely converged with European hub prices and the relative isolation of the Iberian peninsula is expected to decline with the development of new interconnection with France. In contrast, *Eastern Europe* has not yet developed a liquid gas trading hubs and is yet to benefit from liquid markets where long-term contracted gas is complemented by short-term and spot deals[134].

Asia is the key driver of LNG market growth, with most gas delivered under long term oil-indexed contract prices, typically at a substantial premium to US and European hub prices. Even though *South/Central America* is a relatively small gas market by volume, buyers in countries such as Argentina, Brazil and Mexico can have an impact on global spot pricing with spot price levels typically trading within a band of Asian spot prices – and indeed at premium in the second quarter of 2013.

Figure 108 illustrates the continuing variation among global wholesale prices for natural gas and indeed the volatility of prices in the period 2007-2013.The gap between regional gas prices has started widening in 2010 and reached its highest level in April 2012, when the day-ahead price on the National Balancing Point (NBP) in the UK – the most liquid and traditionally lowest price gas hub in the EU – was 4.2 times the price buyers paid at Henry Hub in the US; in the same month the German border price was 5.8 times the price at Henry Hub. For comparison, in 2010 spot prices at NBP were twice as high as these at Henry Hub and a year earlier were at only 50% above those at Henry Hub.

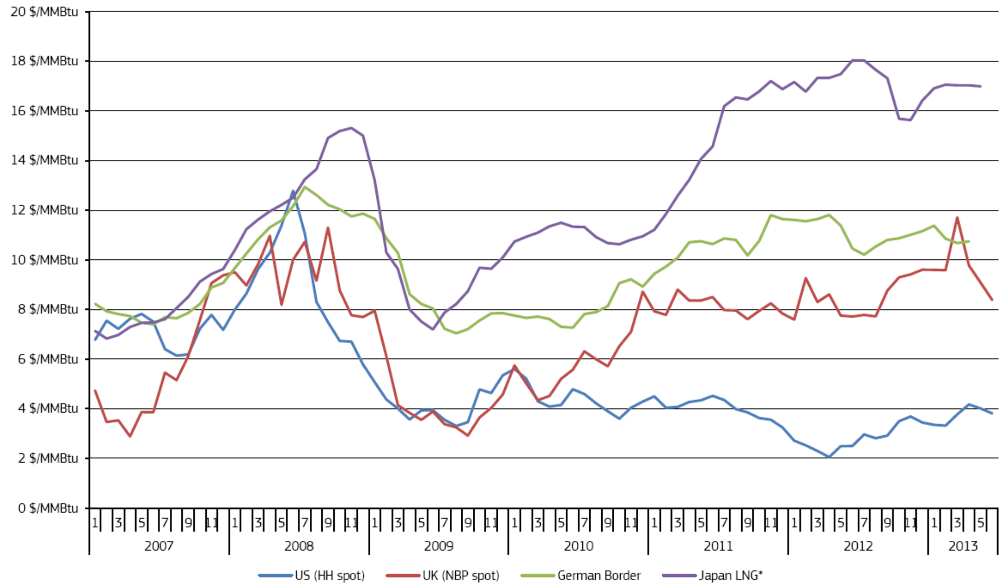
Over the course of 2012, wholesale buyers at the NBP (UK) paid over 3 times as much for gas as buyers at Henry Hub (US). Over the course of 2012 the German border price was around 4 times greater than the price paid by US wholesale buyers at Henry Hub. This trend is explained mostly by the surge in US shale gas, which has driven prices down to historical lows. At the same time, high oil prices have exerted upward pressure on gas prices in Europe and Asia Pacific, which are mostly linked to oil[135].

The beginning of 2013 saw spot prices at Henry Hub double from their historical lows of April 2012. The decline in international oil prices of early 2013 contributed to the stability or slight reduction of gas prices outside of the US.

[134] In December 2012 a gas exchange was launched on the Polish Power Exchange (PolPX) and in January 2013 a gas exchange was launched in Hungary.
[135] As indicated on

Figure 59, data from the 2012 annual survey on wholesale price mechanisms by the International Gas Union shows that 44% of gas consumption in Europe was priced on a gas-on-gas competition basis, as opposed to 51% which was still oil-indexed. The share of oil-indexed volumes has gone down from representing almost 80% of consumption in 2005 to 51% in 2012. Yet, strong regional differences persist in price formation mechanisms with about 70% of gas in North-West Europe (defined in the survey as UK, Ireland, France, Belgium, Netherlands, Germany, Denmark) priced on a gas-on-gas basis in 2012, compared to less than 40% in Central Europe (Austria, Czech Republic, Hungary, Poland, Slovakia and Switzerland)..

Figure 108. Evolution of wholesale gas prices: US, UK, Germany and Japan (USD/mmbtu)

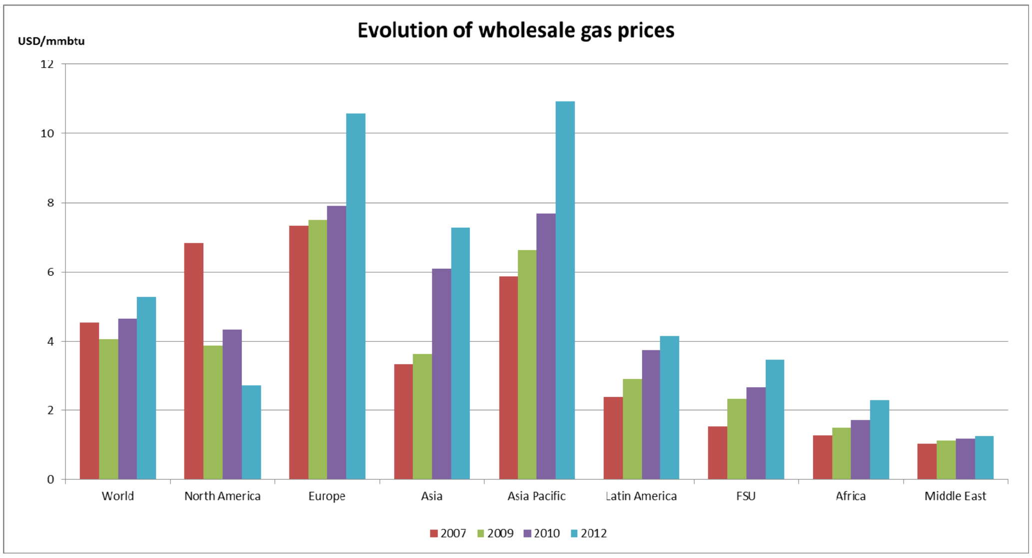


Sources: Platts, Thomson Reuters, BAFA. For Japan: simple average price of LNG from Qatar, Malaysia, Indonesia and Nigeria

Between 2007 and 2012 wholesale gas prices in Europe and Asia Pacific – two regions where oil-indexation remains an important pricing mechanism – rose, cementing their position as the two regions with highest priced wholesale gas.

Globally, analysis by the International Gas Union shows that since 2007 wholesale gas prices have increased consistently in all regions except North America. There have been wholesale gas price increases in China and India, owing to greater import levels and increases in regulated domestic prices. Latin America has also seen a doubling of wholesale gas prices and in the former Soviet Union average prices have more than doubled, largely due to the rise in regulated prices in Russia as they move towards the netback value from Europe. In Africa, where over 85% of prices are effectively subsidised, there have also been price increases and in the Middle East prices have risen slowly, with a significant increase in 2012 over 2010 as a result of regulatory changes in Iran (IGU 2013).

Figure 109. Evolution of wholesale price levels by world region (2007-2012)



Source: International Gas Union and Nexant. Wholesale Gas Price Survey - 2013 Edition

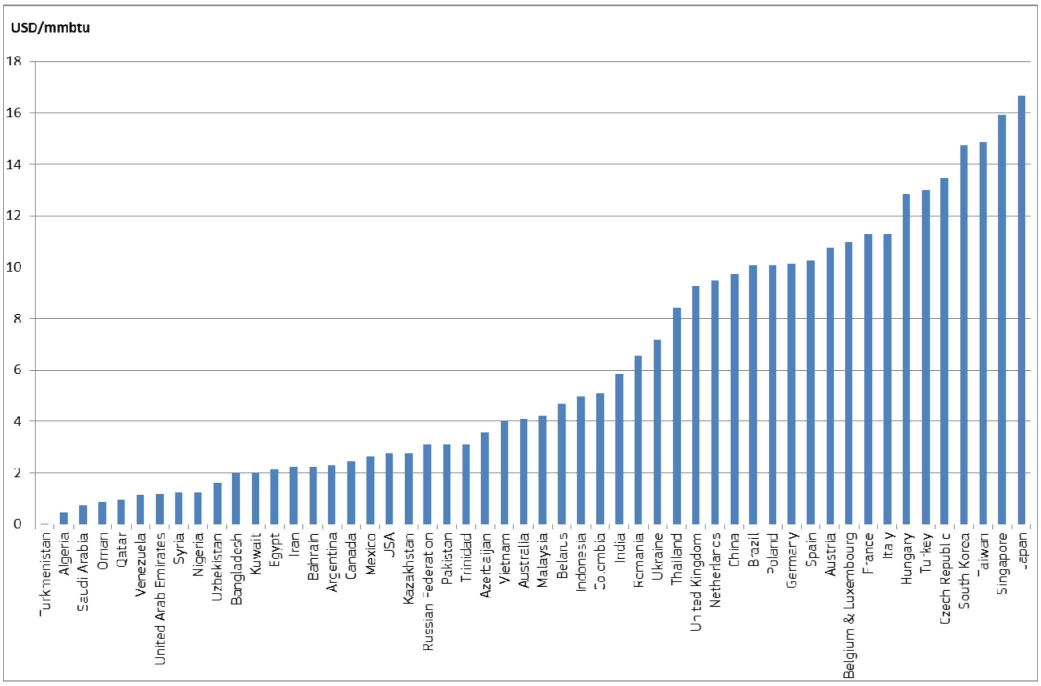
Note: Comparisons of wholesale price levels need to be treated with caution. The wholesale price can cover different points in the gas chain – wellhead price, border price, hub price, city-gate price – so the comparison of price levels is not always a like for like comparison. Most of the regions are defined along the usual geographic lines, although the IGU includes Mexico in North America, and divides Asia in two: a region including the Indian sub-continent plus China, called Asia, and another region including the rest of Asia plus Australasia which is called Asia Pacific.

IGU's analysis also shows that the combination of falling prices in North America and rising prices in Asia, Latin America and the former Soviet Union, has led prices in the latter regions to overtake those in the former. Only in the Middle East and Africa, where prices are often restricted to the cost of production or below as a subsidy, are average prices lower than in North America.

The widening of regional gas price differentials has come against a backdrop of a number of important global trends: from the surge in oil and gas production in the US due to exploitation of shale gas [136] and other unconventional resources to opening up of new hydrocarbon provinces in Africa and elsewhere and a shift in the energy balance towards renewables in the EU (IEA, WEO 2013).

[136] See textbox and ECFIN 2013. Energy Economic Developments in Europe.

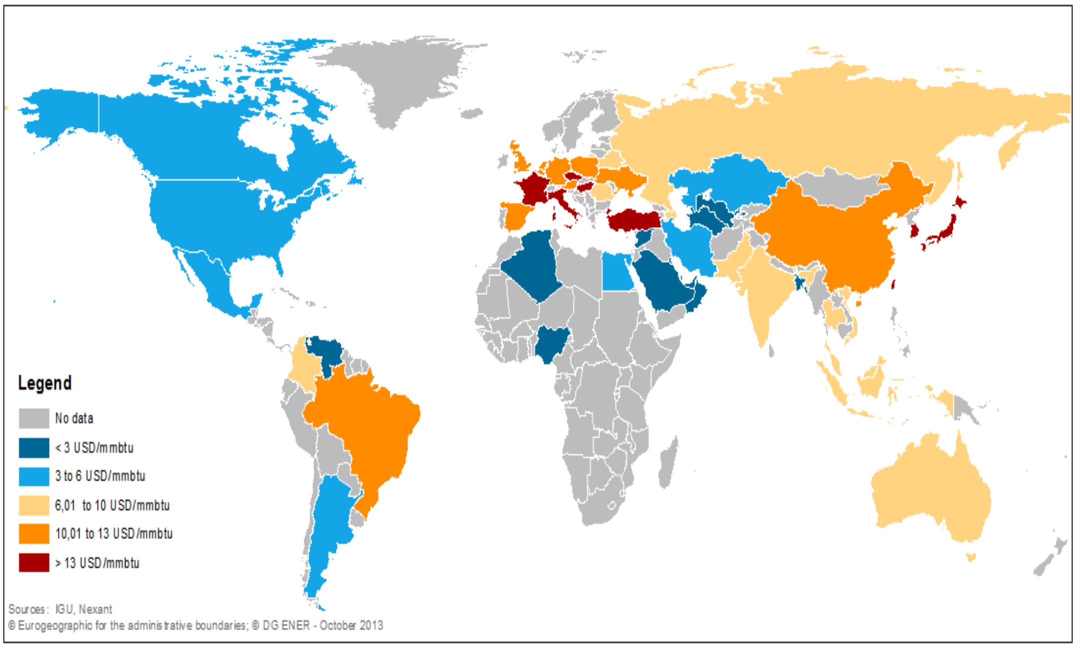
Figure 110. Wholesale prices gas prices globally (USD/mmbtu, 2012)



Source: International Gas Union and Nexant. Wholesale Gas Price Survey - 2013 Edition

Figure 111. Average wholesale gas prices in 2012 (USD/mmbtu)

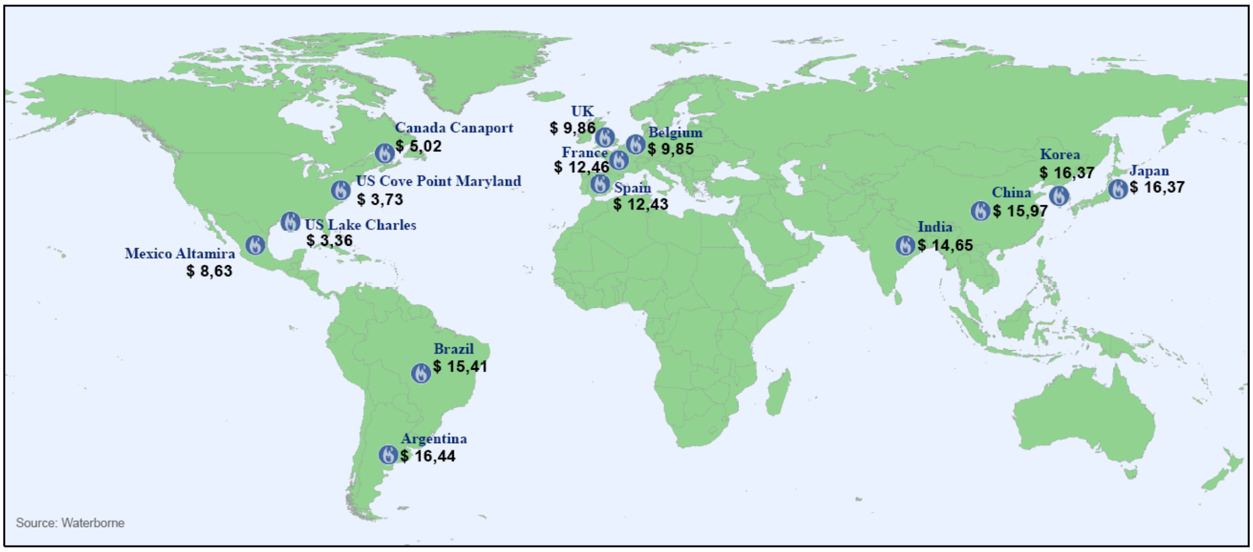
Source: International Gas Union and Nexant. Wholesale Gas Price Survey - 2013 Edition



Note: In the definition of the International Gas Union, gas wholesale prices can cover a wide range: from hub prices in fully liberalised traded markets to border price in case of internationally traded gas and to wellhead or city-gate prices in producer countries.

Looking at LNG price levels confirms once again that Asia Pacific, along with some EU countries, remains at the high end of LNG import prices. It also shows that Latin America is starting to pay dearly to satisfy its increasing appetite for LNG supply, due to falling indigenous production coupled with growing gas demand for electricity generation. Traditionally LNG has been traded under long-term contracts, mostly indexed to oil, with spot markets starting to emerge at the turn of the 21st century and exceeding 30% of global LNG trade in 2012[137]. In 2012 LNG accounted for 19% of gas needs in Europe, as opposed to 46% in Asia and 21% in Latin America[138], with Europe's share of global LNG demand down against increased competition from coal, availability of renewables and higher pipeline gas imports.

Figure 112. Overview of global spot gas prices for LNG in the first half of 2013 (USD/mmbtu)



Source: Thomson-Reuters Waterborne

From a competitiveness point of view, future US LNG exports have been in the primary focus, in particular when evaluating whether US LNG is cheap vis-à-vis alternative sources of supply such as Australia and East Africa. From the perspective of potential importers, equally if not more important is the fact that the structure of US supply contracts is fundamentally different to that of conventional LNG supply: US LNG supply is hub indexed and inherently flexible. As a result, the possible ramping up of US exports may have a significant impact on global LNG pricing dynamics.

[137] The worst drought in decades depleted hydroelectric reserves in Brazil and increased its LNG imports by a factor of three in the first four months of 2013 as compared to the same period in 2012.

[138] Regional weighted averages. Significant differences among LNG importers in the EU with Spain meeting around 60% of its gas demand by LNG and Italy around 10%. Source: International Gas Union. World LNG Report - 2013 Edition

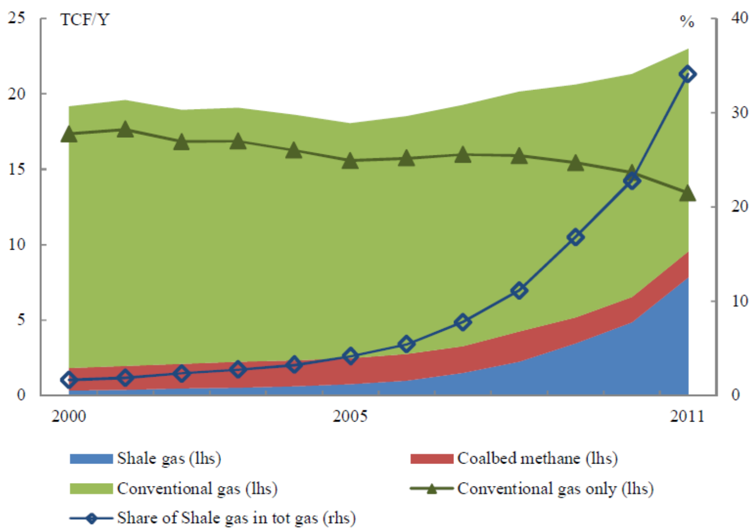
SHALE GAS PRODUCTION IN THE US[1]

Shale gas production became significant in the US only from 2007/2008 onwards. In 2011 shale gas constituted more than one third of total natural gas production in the US – compared to only around 5% in 2005. The EIA estimates that in 2013 the US is set to overtake Russia and Saudi Arabia and become the world's largest producer of petroleum and natural gas.

Shale gas has revived otherwise declining natural gas production in the US and therefore its impact on the overall energy mix of the country should not be overstated. The share of natural gas share in the US energy mix increased by only 2% between 2000 and 2011. A more significant increase could be observed in the electricity mix where the gas share went from 18% to 25%.A similar pattern can also be observed in the EU where the share of gas in the energy mix increased from 23% to 25% over the same period while it went from 17% to 24% in the electricity mix.

The implications for energy dependence have been profound. Since the US has been able to source most of its increased natural gas consumption domestically, the country's overall import dependency has fallen to a record low of 18% in 2011, down from about 25% in 2000. In contrast the EU's total energy import dependency has increased from 47% to 54% in the same period (and from 49% to 67% in the case of natural gas).

Natural Gas Production in the US and share of shale gas in total gas production



Source: Energy Economic Development in Europe, DG ECFIN

3.1.3. Electricity

Electricity is not a global commodity: the need for proximity between electricity plants and customers makes it a regional industry. Differences in energy mix and generation portfolios determine regional variances between wholesale electricity prices. At the same time markets in generation technology are global. Regional differences in wholesale prices for electricity appear to be far less pronounced than in the case of spot gas prices: over the second quarter of 2013 prices at the major wholesale markets in Europe, the US and Australia all traded in the range 30-50 Euro/MWh.

The US has many regional wholesale electricity markets. Wholesale electricity prices are closely tied to wholesale natural gas prices in all but the centre of the country. EIA analysis shows that average on-peak, day-ahead wholesale electricity prices rose in every region of the

US in first-half 2013 compared to first-half 2012[139]. The most important factor was the rise in the price of natural gas in 2013 compared to 10-year lows in April 2012; spot natural gas prices at the major hub in the US increased from 2.4 USD/mmbtu in the first half of 2012 to 3.7 USD/mmbtu in the first half of 2013.

The increase in electricity prices was not uniform across regional electricity markets in the US. Prices in the wholesale electricity market of Texas increased less than much of the rest of the nation, largely because of the mild weather this spring[140].

Analysis of the Australian Energy Regulator shows that electricity spot prices fell steadily from 2010 until the introduction of carbon pricing on 1 July 2012, with prices at the National Electricity Market at or near record lows in 2011-2012. Following some initial market volatility, the introduction of carbon pricing caused an uplift in electricity spot prices of around 21%, in line with expectations[141]. The Australian Energy Market Commission states that nominal wholesale prices rose nationally by 14% from 2011-2012 to 2012-2013, in part reflecting the impact of the carbon price[142]. In New South Wales wholesale energy prices rose by almost 30% between 2012 and 2013.

In Europe, falling coal prices since the beginning of 2011, low carbon prices and the increasing share of renewables have led to relatively stable electricity wholesale prices over 2012 and early 2013 and sharply decreasing prices in the second quarter of 2013 (see Figure 18). Regional wholesale electricity prices showed a higher degree of convergence than in the last couple of years with the exception of the UK and Italy, two markets in which electricity usually trades at a premium in price to most continental peers due to high dependence on natural gas and reliance on imports. In the Central Western Europe (CWE) region, renewable electricity generation in Germany and nuclear availability in France were important determinants of wholesale electricity prices. A jump in the levels of renewable generation helped to drive regional prices down in both the CWE and CEE regions to four-year lows by the end of Q2 2013.

---

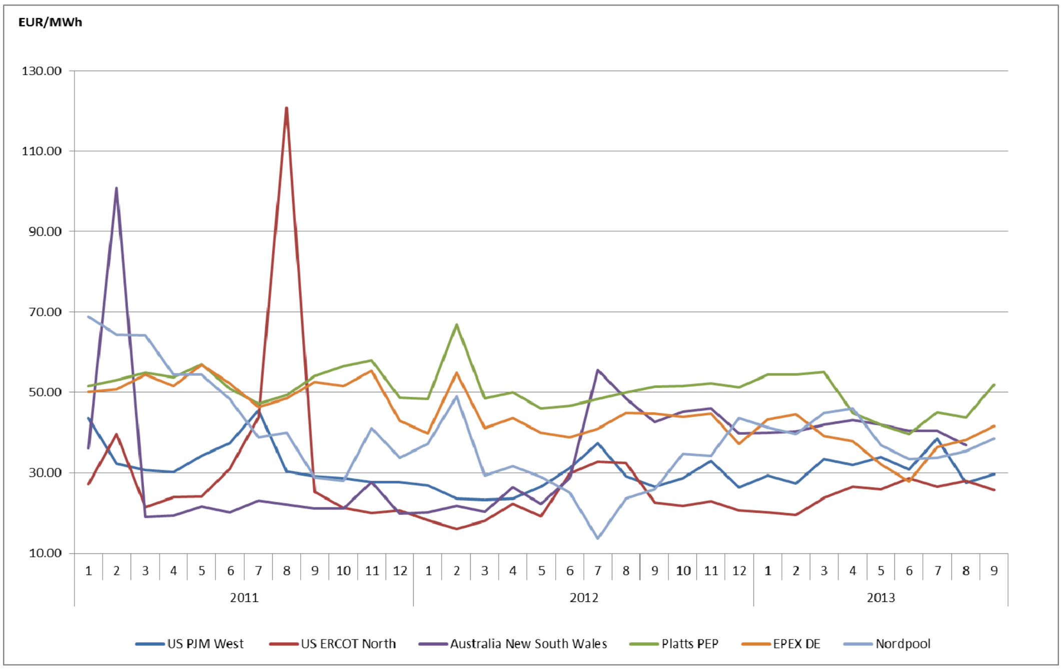
[139] Refers to the lower 48 state, e.g. to the US states located on the continent of North America south of the Canadian border, which excludes the states of Alaska and Hawaii. Washington D.C., is also included when the term is used.

[140] In April 2012, wholesale prices in Texas spiked because of a sharp increase in temperature near the end of the month.

[141] Australian Energy Regulator. State of Energy Market 2012.

[142] On 13 November 2013, its first working day, the new Government of Australia introduced the package of bills to repeal the carbon laws, including the emissions trading scheme.

Figure 113. Electricity wholesale prices in Europe, US and Australia (2011-2013)



Source: Platts, Energy Information Administration, Australian Energy Market Operator

Note: The PJM Interconnection's Western Hub in the US stretches from southern Maryland north to Washington D.C. and northwest to central and western Pennsylvania. The PJM price is a weighted average between on-peak price (on-peak hours: hour-ending 8 through 23) and off-peak hours (hour-ending 1 through 7 and 24); this gives a good proxy of baseload price. ERCOT North is one of the five zones operated by the Electric Reliability Council of Texas. The ERCOT North price is weighted in the same manner as PJM West to give a proxy of baseload. The Australian National Electricity Market (NEM) interconnects five regional market jurisdictions (Queensland, New South Wales, Victoria, South Australia and Tasmania). West Australia and Northern Territory are not connected to the NEM. New South Wales is the largest among the five regional markets. All electricity in the National Electricity Market (NEM) is traded via a gross pool which is settled on a half hourly basis. Each jurisdiction or state settles their own pool price, known as the Pool Price or Regional Reference Price (RRP).

3.2. International comparison of retail prices of electricity and gas[143]

This chapter compares the level of retail prices for electricity and gas for medium-sized industrial consumers and households in the EU with those in major global economies. Unless otherwise specified, comparisons are made for 2012 and all prices are converted into Euro/MWh using the annual exchange rate of the ECB (average of period).

One major caveat when dealing with international comparisons is the lack of a common harmonised data source for retail prices for electricity and gas. A wide variety of reputable sources of data have been used and validated as far as possible (see sources and explanatory notes under each chart). Nevertheless, different countries apply different reporting standards and conventions, inter alia with regard to categories of consumers. In addition, industrial retail prices can vary significantly within countries and industrial sub-sectors – both in the EU and in other economies.

This chapter does not take into account exemptions and preferential prices - neither in the EU nor in other economies as data is scarce and information difficult to quantify in a global

[143] Data as of September 2013. The comparison is made after converting all prices in EUR/MWh using 2012 annual exchange rate of the ECB.

comparative context. Wherever possible, industrial prices are presented net of recoverable taxes, while household prices include all taxes and duties. When it comes to large and very large consumers, the reported retail prices (by Eurostat and other international bodies and data providers) for electricity and gas may in fact be considered a conservative overestimate. This holds both for retail prices within the EU reported to Eurostat and for retail prices of other economies. Large consumers may purchase directly from wholesalers and be partially or completely exempt from certain network charges, taxes and levies that are nevertheless reported as non-recoverable in general electricity and gas retail price statistics.

Due to the considerable divergence in levels of retail prices paid by industrial and residential consumers across the EU, in international comparisons three retail prices are presented for each consumer group in the EU: weighted average, highest and lowest. This is done because the difference between the highest and the lowest priced country in the EU is often in the order of magnitude of 3-4: beyond 4 in the case of residential gas (incl. all taxes) and below 3 in the case of industrial gas prices (ex. VAT and other recoverable taxes).

3.2.1. Electricity retail prices

In 2012, in 18 EU Member States industrial electricity prices (ex. VAT and other recoverable taxes) were below the EU weighted average. The prices reported for the EU refer to medium-size industrial and household consumers[144].

In 2012 industrial electricity prices levels for medium-size industrial consumers in the 18 Member States below EU weighted averages were comparable to those reported for industrial consumers in economies like Norway, Turkey, China, Brazil, Ukraine and Mexico. In the remaining Member States prices were comparable to those in Japan (or higher, in the cases of Cyprus and Italy). Industrial consumers in countries such as New Zealand, India, Russia, Indonesia, US, Saudi Arabia and UAE paid prices below – in some cases well below - these in the lowest priced EU Member State.

On average in 2012, across the EU and denominated in Euro, medium-size industrial consumers in the EU paid before exemptions about 20% more than companies based in China, about 65% more than companies in India and more than twice the price for electricity as companies based in the US and Russia. Industrial electricity prices in Japan were 20% higher than those faced by average industrial European consumer.

Middle East countries such as Saudi Arabia and UAE have by far the lowest prices: industrial consumers in Europe pay more than 3 times as much as industrial consumers in these countries.

In 2012 industrial retail prices in China were almost twice as high as those in the US. The IEA points out that China's industrial electricity prices have increased significantly in recent years, largely because of rising coal prices and cross-subsidies in favour of residential consumers (IEA, WEO 2013).

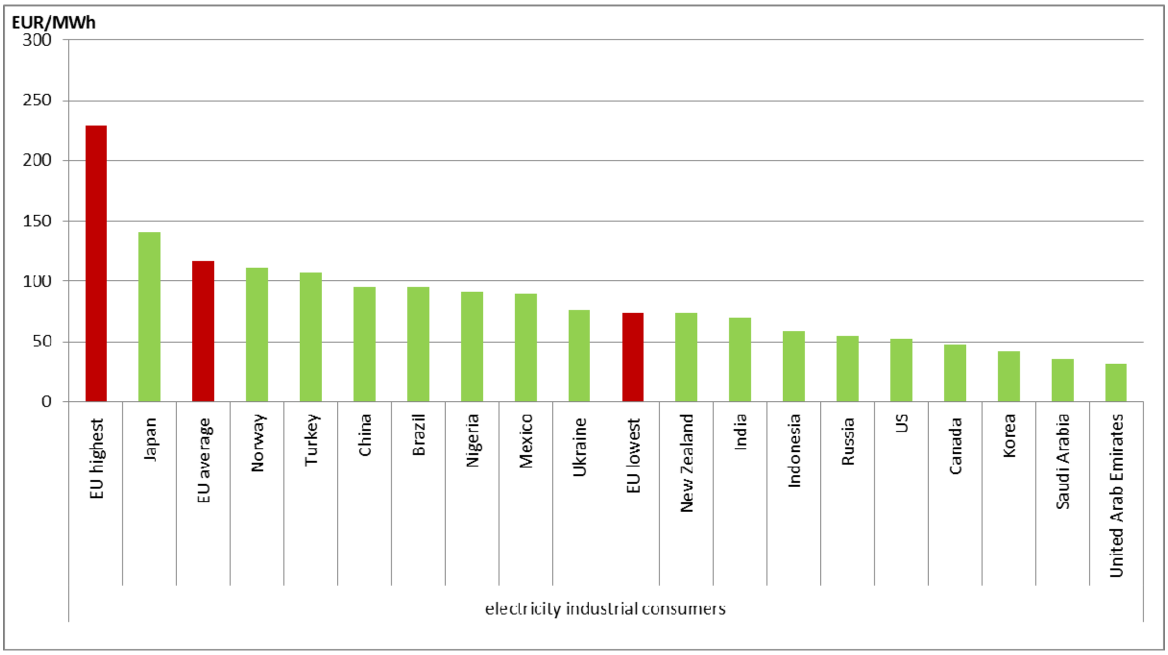
Data from the energy intensive case studies presented in chapters 1 and 2 supports the retail price level data. A comparison of 2 EU-based brick and roof tile producers shows that in 2012 on of these plants paid 42% more for electricity than the Russian plant with comparable

[144] Electricity industrial: 500-2000 MWh annual consumption (Eurostat band IC), electricity household: 2500 – 5000 KWh annual consumption (Eurostat band DC), gas industrial: 10 000 - 100 000 GJ (Eurostat band I3) and gas household: 20 – 200 GJ (Eurostat band D2).

characteristics, while the other EU-based plant paid almost twice as much as the Russian plant. Comparison of two EU-based brick and roof tile producers in 2012 shows that one of these paid for electricity 2.7 times as much as a US-based plant, while the other paid 10% more than the US-based competitor. The Russian brick and roof tile producer paid 54 Euro/MWh in 2012, while the US-based brick and roof tile producer paid 69.1 Euro/MWh (ENTR, CEPS).

In the case of wall and floor tiles, electricity prices paid by two EU-based producers were 2.2 to 2.6 times these in the plant in the US. The price gap between one Russian plant and the two EU-based plants is in the range of factor 8.5 to factor 10. A comparison between the price paid by the Russian-based brick and roof tile producer and the Russian-based wall and floor tile producer shows that the former paid for electricity 54 Euro/MWh, while the latter only 9 Euro/MWh, which suggests preferential treatment of the wall and floor tile producer used in this comparison. A comparison between the electricity prices paid by three steel producing plants in the US (one BOF, one EAF, and one rolling mill) and EU-based steel makers points that in 2012 EU-based plants paid twice as much for electricity as US-based ones. Annex 4 illustrates these comparisons.

Figure 114. Retail prices of electricity in 2012: industrial consumers

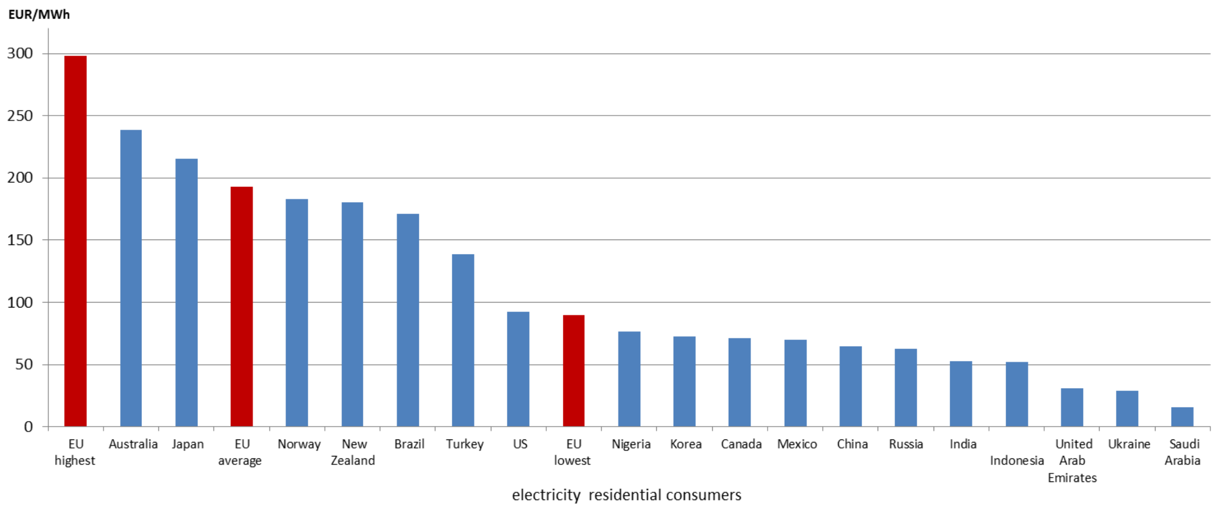


Note: EU electricity prices for industry refer to consumption band IC, exclusive of VAT and other recoverable taxes. Electricity prices for industry for Canada refer to 2010 and for Korea to 2009. ECB annual exchange rates have been used. Industrial prices exclude taxes as reported by ERRA for Nigeria, Russia and Ukraine, by ANEEL for Brazil, by the IEA for Japan, Canada (2010) and New Zealand. IEA reports zero taxation of industrial prices for Mexico; ERRA reports zero taxation for Saudi Arabia and UAE. No data on taxation of industrial prices in South Korea (IEA); until 2009 natural gas prices reported by South Korea indicated 12-14% taxation of industrial natural gas prices. Prices reported by CEIC for China are actual averages of industrial use electricity prices in 36 cities; no consumption taxation on industrial retail prices in China, but prices include production tax (17% for electricity, 13% for gas, note that these are production taxes). Australian values are exclusive of general sales tax (GST). EIA numbers for the US include state and local taxes; electricity consumption is not taxed at the federal level in the United States, but it is taxed in some states.

Sources: Eurostat (EU, Turkey and Norway), CEIC (China), ANEEL (Brazil), ERRA (Russia, Saudi Arabia, Nigeria, Ukraine and United Arab Emirates, data provided in Euro), Ministry of Finance of India (India), IEA (Japan, Korea, Canada, Mexico, New Zealand, Canada), EIA (USA), Australian Energy Market Commission (residential prices in Australia).

Households in the EU on average paid prices comparable to those in Norway, New Zealand and Brazil. On the other hand, European households on average paid more than twice as much as US households.

Figure 115. Retail prices of electricity in 2012: residential consumers



Note: EU, Turkey and Norway household prices refer to consumption band DC, including all taxes. Residential prices include all taxes and levies, as reported by the respective sources. ECB annual exchange rates used.

Sources for the two electricity retail price charts: Eurostat (EU, Turkey and Norway), CEIC (China), ANEEL (Brazil), ERRA (Russia, Saudi Arabia, Nigeria, Ukraine and United Arab Emirates, data provided in Euro), Ministry of Finance of India (India), IEA (Japan, Korea, Canada, Mexico, New Zealand, Canada), EIA (USA), Australian Energy Market Commission (residential prices in Australia).

3.2.2. Gas retail prices

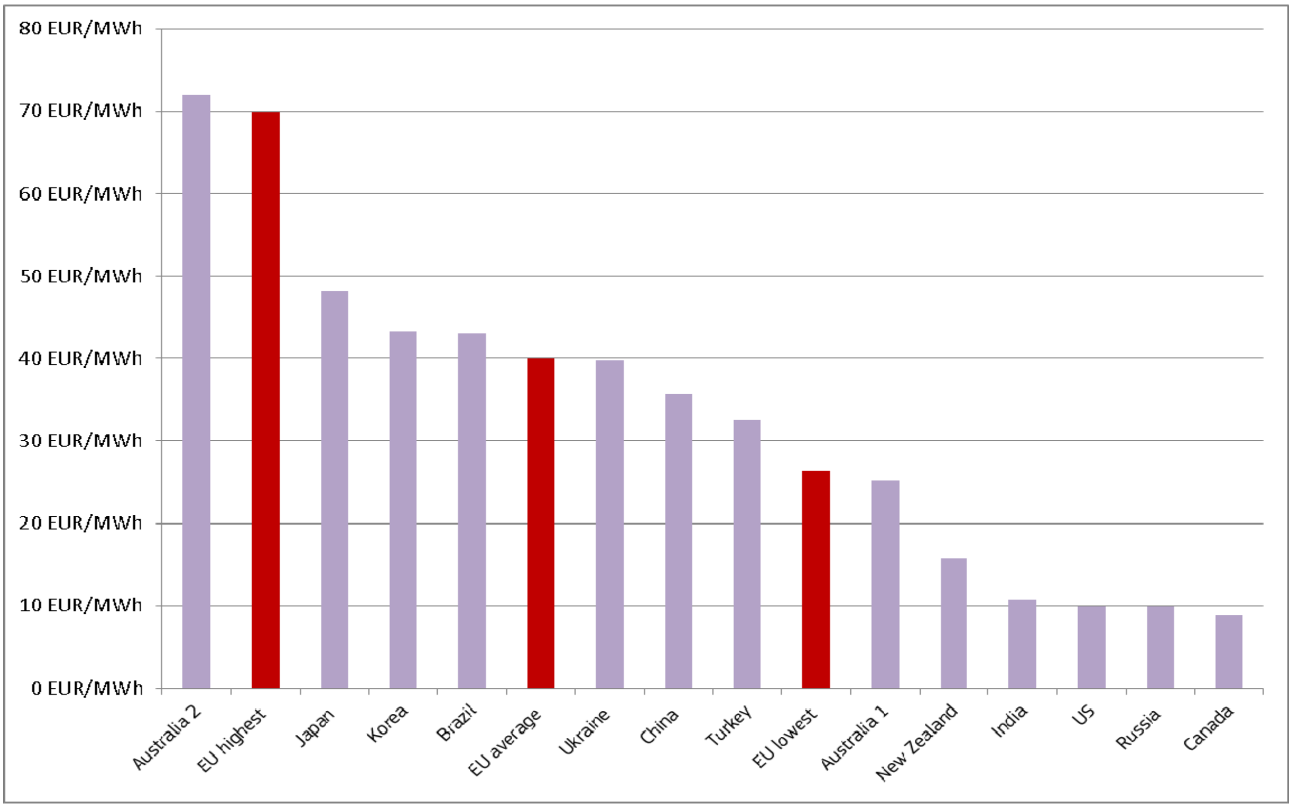
On average and denominated in Euros, in 2012 medium-sized industrial consumers in the EU paid four times as much for gas as industrial consumers in the US, Canada, India and Russia and about 12% higher retail prices than those in China. Prices in the 10 Member States where industrial prices were below the EU weighted average paid prices comparable to those in Ukraine, China and Turkey. Industrial gas prices in Brazil and Japan were above the EU weighted average.

In the case of households, EU average prices were 2.5 times higher than these faced by households in the US and Canada, but were half the level of gas prices faced by households in Japan and 30% below those in New Zealand. Households in 14 Member States paid less than the EU weighted average in 2012, putting their prices at levels comparable to these in South Korea, Turkey and the US.

This is indeed re-confirmed by the case study data from two EU-based bricks and roof tile producers that pay about 3.7-3.9 times as much for gas as a similar plant in Russia. The comparison of two other EU-based plants producing bricks and roof tiles point that these pay for gas 2.8-3 times as much as a similar US-based plant. A of two wall and floor tile

producers in the EU point to a difference in the range of 3-4 times with natural gas prices paid by a Russian plant. A comparison between two EU-based wall and floor tile plants and a US-based plant point to a natural gas price difference in the range of 3.6-3.7 times. A comparison of prices paid by three steel-making plants in the US (one BOF, one EAF and one rolling mill) with the prices paid by EU-based steel makers in the sample (see Annex 2) also point that EU-based producers paid four times as much for natural gas than the three US-based plants. In the case of ammonia, the steep fall in natural gas price in the US transformed it from a marginal producer to one of the lowest-cost producers in the world. Annex 4 illustrates these comparisons.

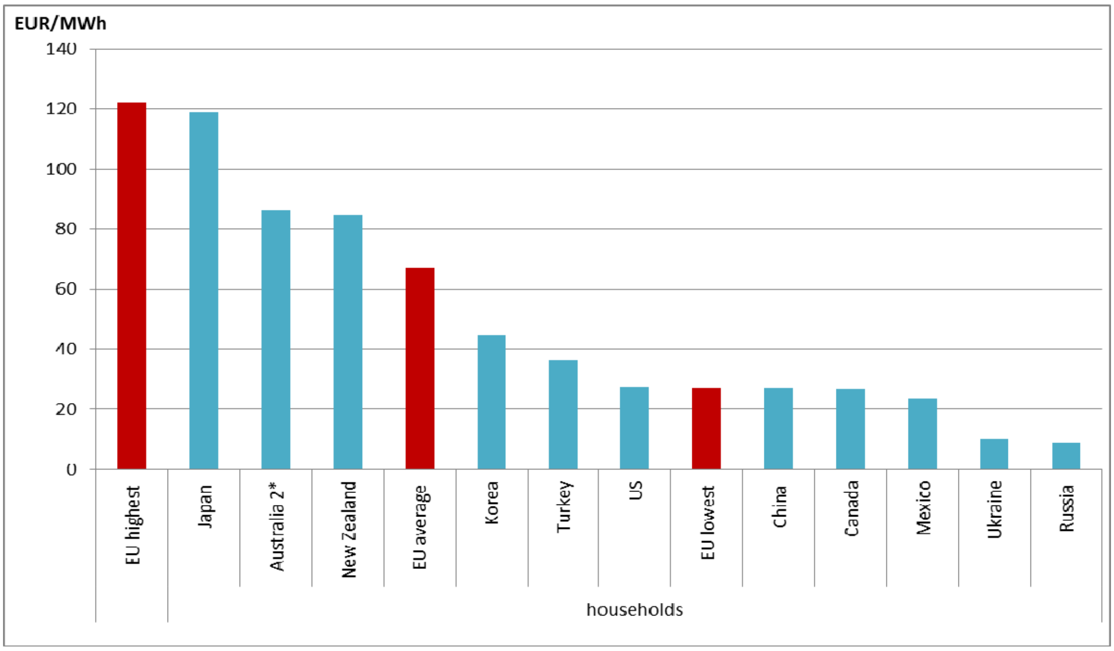
Figure 116. Retail prices of gas in 2012: industrial consumers



Notes: Australia 1 refers to prices paid under new contracts by large industrial consumers; Australia 2 means prices paid by small business consumers and by households, respectively and is based on information on standing offers (default tariffs, exclusive of general sales tax). Prices for Korea and Japan refer to 2011. Prices for Japan, Ukraine, China, Turkey, New Zealand, Russia, Canada and the EU exclude VAT (in the case of EU and Turkey also other recoverable taxes, if any). Prices for Korea (2011) and the US include taxes. No data on taxation in India. The price for Brazil includes federal taxes as PIS and COFINS (social contribution taxes) and state taxes such as ICMS (tax on circulation of goods and services; no value-added or general sales tax in Brazil) which has different rates for each state. In June 2013 the government of India approved a new pricing formula for gas proposed by the Rangarajan Committee, which is expected to double natural gas prices starting from April 2014.

Sources: Eurostat (EU and Turkey), CEIC (Brazil, China), ERRA (Russia, Ukraine), IEA (Japan, Korea, New Zealand, US, Canada), KPMG (India), Australian Industry Group (Australia 1 = large industrial consumers, new contracts) and Office of Tasmanian Economic Regulator (Australia 2 = small business consumers)

Figure 117. Retail prices of gas in 2012: household consumers



Note: Data for Korea and Japan refers to 2011. Prices include all taxes.

Sources: Eurostat (EU and Turkey), CEIC (China), ERRA (Russia, Ukraine), IEA (Japan, Korea, New Zealand, US, Canada, Mexico), Australian Energy Regulator (household consumer prices)

3.3. Retail price evolution[145]

Looking at the evolution over time of the real index of industrial electricity prices, one can see that between 2008 and 2009 industrial consumers in OECD Europe faced an increase in electricity prices of about 10%. In real terms the index of industrial electricity prices stayed fairly stable between 2009 and 2012. All in all, between 2008 and 2012 industrial consumers in OECD Europe faced an increase in electricity prices of almost 10% in real terms[146].

In comparison, the real index of industrial electricity prices is down by 10% in 2012 in comparison to 2008, with the biggest drop coming in the period 2010-2012.

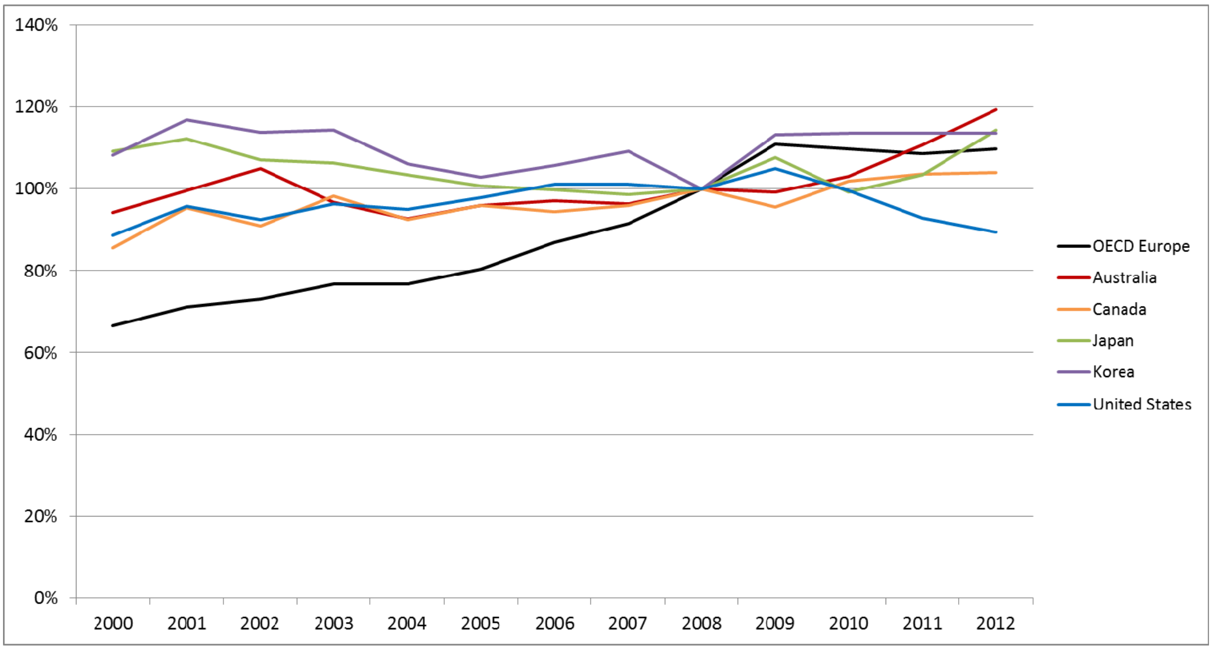
Between 2008 and 2012 the respective national indices of industrial electricity prices increased by 4% in Canada, 14% in Korea and Japan, at 19% in Australia.

Year on year in the first quarter of 2013, the IEA reports that the real price index of industrial electricity prices went up by most in Ireland (+20.3%), Italy (+13%) and Turkey (+10.9%), while the biggest drop across OECD countries was in Poland (-4.9%).

[145] Arguably, over time exchange rates of national currencies, as well as inflation levels, may account for a certain level of fluctuation if one looks at price levels. Here we present IEA industrial price indices in real terms (deflated with PPI) calculated in national currencies. Therefore these figures are not affected by fluctuations in exchange rates.

[146] IEA publishes retail price evolution data for OECD Members only. OECD Europe excludes Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Romania.

Figure 118. Index of real electricity prices for industrial end-users (2008=100)



Source: IEA, European Commission calculations

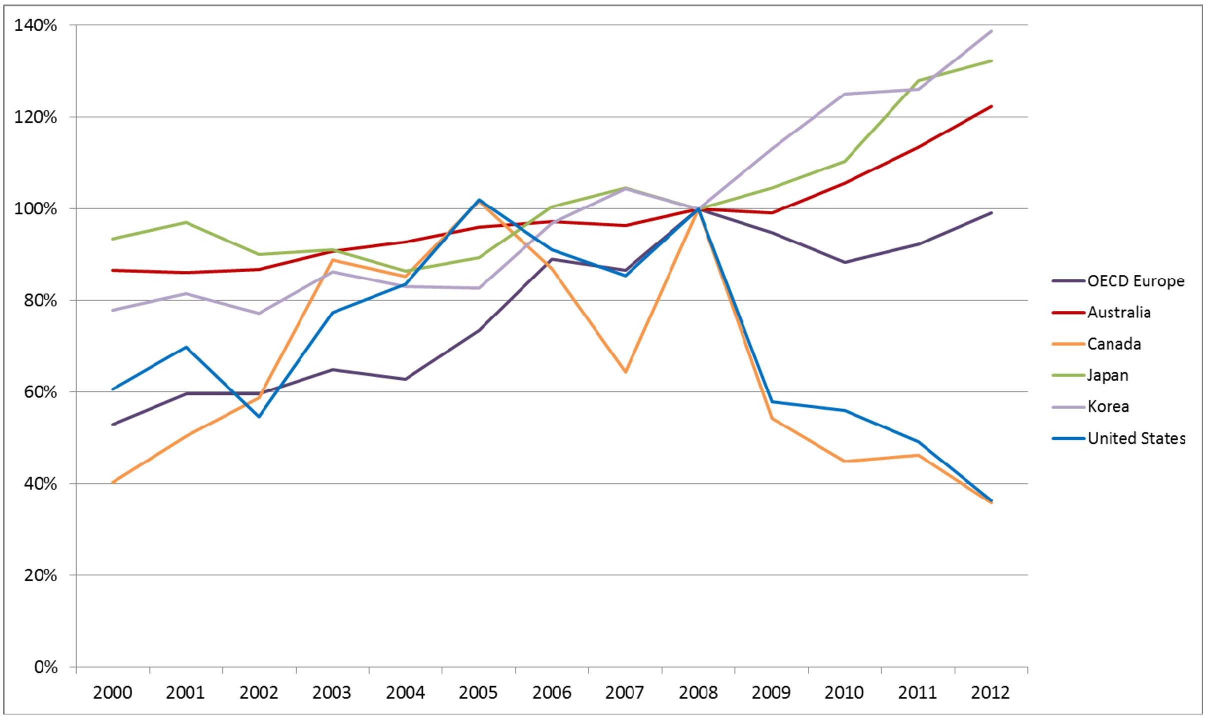
Note: The indices have been re-referenced (re-based) to year 2008 from the original calculation of the IEA that uses 2005 to fit the overall timeline of the price analysis (2008-2012). The IEA computes the real price index from prices in national currencies and divided by the country specific producer price index for the industrial sector and by the consumer price index for the household sector.

The divergence in the evolution paths is even greater when it comes to industrial prices for natural gas. Industrial gas price indices show that users in Canada and the US are now benefiting from prices comparable in real terms to those in mid-90s (in the case of US) and late 90s (in the case of Canada) which decreased by more than 60% between 2008 and 2012.

In 2012 the index of real natural gas prices for industrial users was at its level of 2008. Industrial users in Japan and Korea saw the steepest growth in gas prices, with 2012 prices standing 32% and 39% above their respective 2008 levels.

IEA analysis shows that in the first quarter of 2013 year on year the real price index of industrial end-use prices for gas rose most in Turkey (+30.5%) and New Zealand (+18.9%) and fell most in Slovenia (-15.3%) and the Slovak Republic (-5.6%).

Figure 119. Index of real natural gas prices for industrial end-users (2008=100)



Source: IEA, European Commission calculations

Note: The indices have been re-referenced (re-based) to year 2008 from the original calculation of the IEA that uses 2005 to fit the overall timeline of the price analysis (2008-2012). The IEA computes the real price index from prices in national currencies and divided by the country specific producer price index for the industrial sector.

3.4. Retail price composition: examples

Below we attempt to decompose retail prices for electricity and gas in some major economies. Ideally the aim was to decompose retail prices into the same components as the ones used in our decomposition analysis of European retail prices. In reality this is not always feasible as different countries provide profoundly different degrees of disaggregation.

The comparison of **household electricity prices** shows that the energy component in Germany and especially in the UK tends to be at levels much higher than in the US, Australia and Turkey. The network component in Germany and France is higher than in the US, while in the UK and Turkey it is lower than in the US. Australia stands out as a country with exceptionally high network costs as well as other charges. Estimates based on data from the Australian Energy Regulator show that more than a fifth of the household electricity bill comes from retail and energy scheme costs - including the 'shop front' for a consumer's electricity supply and costs from schemes for energy efficiency and renewables, as well as carbon costs.

Table 45. Breakdown of household electricity prices

	US (2011)	Australia	Turkey	Germany	France	UK
	Eurocent/kWh					
energy	5.8	7.6	8.3	8.5	5.3	13.4
network	4.2	11.0	3.4	5.9	5.0	3.6
taxation	n.a.		3.0	12.4	4.2	0.9
other		5.2				
Total	10.0	23.9	14.7	26.8	14.5	17.8

Source: Eurostat for Germany, France, UK and Turkey, second half of 2012. Notes: United States: electricity - 2011 data from EIA Annual Energy Outlook 2013. Transmission accounts for 1.1 Eurocent/kWh, distribution accounts for 3.1 Eurocents/kWh. No data on taxation. Australia: European Commission calculations based on data on household price levels published by the Australian Energy Market Commission (Electricity Price Trends Report 2013) and breakdown of household bills by the Australian Energy Regulator (State of the Energy Market 2012). Other costs: in the case of electricity in Australia these include carbon costs, green costs and retail costs.

In the case of prices of natural gas for households, the energy component in Germany, France and the UK is much higher than in the US and Australia[147]. The network component in Germany, France and the UK is much higher than in the US, but much lower than in Australia.

Table 46. Breakdown of household gas prices

	US	Australia	Germany	France	UK
	Eurocent/kWh				
energy	0.7	2.0	3.6	3.4	3.6
network	0.9	4.5	1.7	2.4	1.5
taxation	0.1		2.2	1.1	0.5
other	1.1	2.1			
Total	2.8	8.6	7.4	6.8	5.6

Source: VaasaETT for Germany, France and UK, prices in capital cities in 2012. United States: European Commission calculations based on data on household price levels by the EIA and breakdown of household bills by the American Gas Association. Other costs: in the case of Australia these include retail costs and carbon costs. In the case of the US these include net interest, other and net income, depreciation and amortisation, administrative and general, customer accounts, bad debt.

When looking at the share of network charges in EU retail electricity prices, it is worth noting that in a ranking of 144 countries undertaken by the World Economic Forum on quality of electricity supply, 5 of the top 10 positions are occupied by EU Member States. There remain differences between Member States, with 15 EU Member States in the top 30 (NL, DK, AT, UK, FR, FI, SE, BE, LUX, CZ, IE, DE, SK, PT, SI, ES) , while the remaining 13 rank lower down the list with RO and BG in positions 88 and 95 respectively.

[147] This holds also in case one assumes that some – or even all – of costs classified under 'Other' should be included under the energy component.

Table 47. Quality of electricity supply globally

2.07 Quality of electricity supply

How would you assess the quality of the electricity supply in your country (lack of interruptions and lack of voltage fluctuations)? [1 = insufficient and suffers frequent interruptions; 7 = sufficient and reliable] | 2011–12 weighted average

RANK	COUNTRY/ECONOMY	VALUE
1	Netherlands	6.8
2	Iceland	6.8
3	Hong Kong SAR	6.8
4	Switzerland	6.8
5	Denmark	6.8
6	Singapore	6.7
7	Austria	6.7
8	United Kingdom	6.7
9	France	6.7
10	Qatar	6.6
11	Finland	6.6
12	Sweden	6.6
13	Belgium	6.6
14	Canada	6.6
15	Luxembourg	6.6
16	Czech Republic	6.5
17	Norway	6.5
18	Ireland	6.5
19	Germany	6.4
20	United Arab Emirates	6.4
21	Saudi Arabia	6.3
22	Oman	6.3
23	Bahrain	6.3
24	Barbados	6.3
25	Slovak Republic	6.3
26	Portugal	6.3
27	Australia	6.3
28	Taiwan, China	6.3
29	Slovenia	6.2
30	Spain	6.1
31	Bosnia and Herzegovina	6.0
32	Korea, Rep.	6.0
33	United States	6.0
34	New Zealand	6.0
35	Malaysia	5.9
36	Japan	5.9
37	Uruguay	5.9
38	Italy	5.8
39	Jordan	5.7
40	Hungary	5.7
41	Lithuania	5.6
42	Costa Rica	5.5
43	Panama	5.5
44	Thailand	5.5
45	Brunei Darussalam	5.5
46	Georgia	5.5
47	Poland	5.5
48	Israel	5.5
49	Croatia	5.4
50	Trinidad and Tobago	5.4
51	Cyprus	5.4
52	Namibia	5.4
53	Chile	5.4
54	Sri Lanka	5.3
55	Seychelles	5.3
56	Morocco	5.2
57	Greece	5.2
58	Estonia	5.2
59	China	5.2
60	Iran, Islamic Rep.	5.2
61	Puerto Rico	5.1
62	Colombia	5.1
63	Kuwait	5.0
64	Macedonia, FYR	5.0
65	Latvia	5.0
66	Mauritius	5.0
67	Guatemala	5.0
68	Brazil	4.9
69	Armenia	4.9
70	El Salvador	4.9
71	Albania	4.8
72	Malta	4.8
73	Serbia	4.8
74	Peru	4.8
75	Azerbaijan	4.7
76	Montenegro	4.6
77	Turkey	4.6
78	Ukraine	4.6
79	Mexico	4.6
80	Algeria	4.5
81	Kazakhstan	4.4
82	Egypt	4.4
83	Jamaica	4.4
84	Russian Federation	4.3
85	Libya	4.3
86	Moldova	4.3
87	Rwanda	4.2
88	Romania	4.2
89	Gambia, The	4.1
90	Ecuador	4.1
91	Suriname	3.9
92	Swaziland	3.9
93	Indonesia	3.9
94	South Africa	3.9
95	Bulgaria	3.9
96	Côte d'Ivoire	3.8
97	Bolivia	3.8
98	Philippines	3.7
99	Mauritania	3.7
100	Nicaragua	3.7
101	Lesotho	3.7
102	Kenya	3.6
103	Mongolia	3.6
104	Botswana	3.6
105	Cambodia	3.6
106	Honduras	3.6
107	Zambia	3.5
108	Argentina	3.5
109	Mali	3.5
110	India	3.2
111	Mozambique	3.2
112	Vietnam	3.1
113	Ethiopia	3.1
114	Liberia	3.0
115	Paraguay	3.0
116	Ghana	3.0
117	Guyana	3.0
118	Timor-Leste	2.9
119	Kyrgyz Republic	2.9
120	Cameroon	2.8
121	Sierra Leone	2.6
122	Benin	2.5
123	Gabon	2.5
124	Tajikistan	2.3
125	Burkina Faso	2.3
126	Pakistan	2.3
127	Madagascar	2.2
128	Malawi	2.2
129	Uganda	2.2
130	Dominican Republic	2.1
131	Venezuela	2.0
132	Tanzania	1.9
133	Burundi	1.9
134	Senegal	1.8
135	Cape Verde	1.8
136	Bangladesh	1.8
137	Zimbabwe	1.7
138	Nigeria	1.7
139	Haiti	1.6
140	Chad	1.5
141	Guinea	1.5
142	Yemen	1.4
143	Nepal	1.4
144	Lebanon	1.2

SOURCE: World Economic Forum, Executive Opinion Survey

3.5. Energy taxation

Globally, countries differ in the way they tax energy in terms of the range of products taxed, definitions of tax bases, tax rate levels and rebates and exemptions. There are often substantial differences in the way in which different forms, uses and users of energy are taxed. While EU industry generally pays lower rates of taxation on energy products in comparison to households, the share of tax in the total energy price for industrial users remains high in some EU countries, especially in the case of electricity. This in many cases is moderated by various exemptions and preferential tax treatment of industrial consumers meeting certain criteria[148].

In a global comparative context, EU Member States tax electricity and natural gas more heavily than other global competitors and also more heavily than other economies that face high energy prices, such as Brazil and Japan. For example, the share of tax in industrial electricity prices in Germany is five times as high as in Japan and more than double than it is in Brazil (Table 48). On the other hand Brazil and China tax natural gas for industrial use more heavily than Germany and France.

Table 48. Share of tax in industrial energy prices in selected countries, 2012

	Electricity	Heavy fuel oil	Natural gas	Steam coal
Germany	33	4	10	9
Brazil	26	n.a.	22	n.a.
China	15	20	15	18
France	15	3	4	6
Japan	7	8	6	11
India	n.a.	22	n.a.	16
United States	n.a.	5	n.a.	n.a.

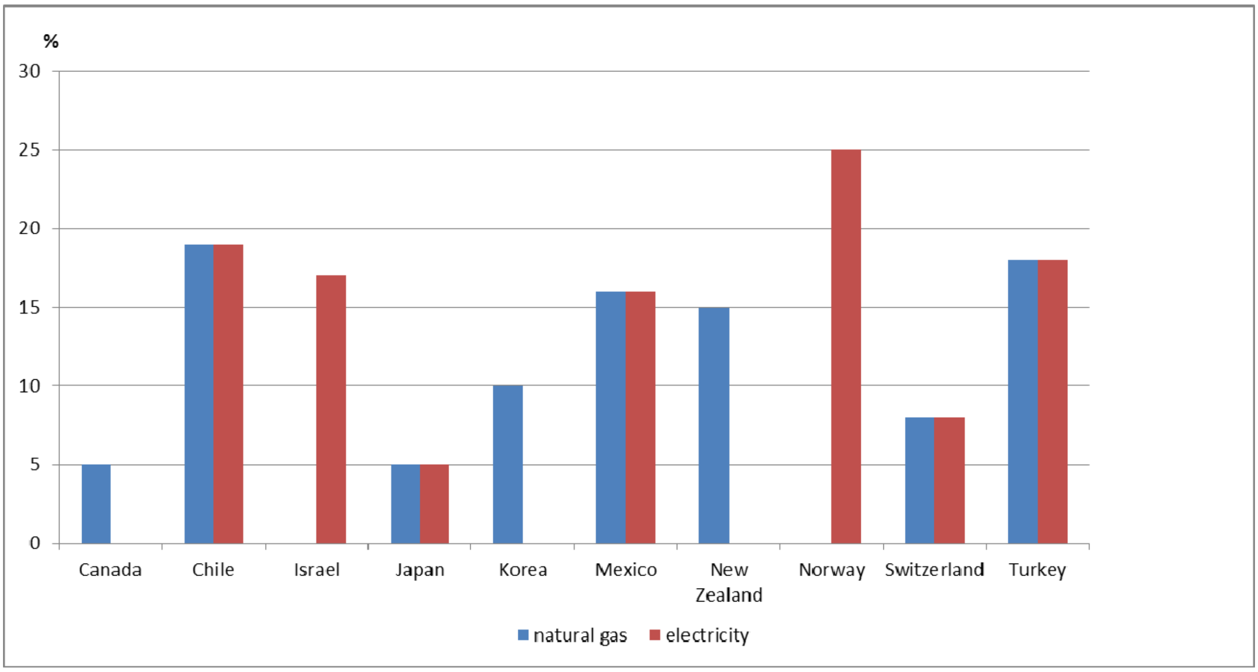
Notes: In most cases value-added tax is refundable for EU industry; hence, taxes reported mainly reflect excise duties or other taxes. In Germany, most energy-intensive industries are exempt from the renewables levy and electricity tax, while coal and gas use is also exempt from taxes for most industries. In France and Germany, the tax shares on heavy fuel oil apply to low sulphur fuel oil. Data for China varies depending on product and sector specification. In the United States, taxes on gas and electricity mostly refer to general sales taxes levied by the states (between 2-6%), although their national average is unknown; similarly for coal the national average of various taxes is unknown.

Source: IEA WEO 2013 and sources therein.

Some major economies have lower consumption-based taxes on electricity and gas (VAT, general sales tax): for example Japan has a 5% VAT on electricity and gas and South Korea has a 10% rate on electricity. General sales taxes levied by the states in the US are in the range 2-6%. In comparison, in the EU VAT rates for electricity and gas range from 6% in Luxembourg to 27% in Hungary.

[148] Data on excise duty special regimes in the EU available here regiuhttp://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_ii_energy_products_en.pdf

Figure 120. VAT rates on natural gas and electricity



Source: IEA Energy Prices and Taxes, 2013Q2

The OECD has looked into the effective tax rates on electricity and natural gas across all OECD members[149]. In Australia the consumption of electricity is not taxed. Most electricity producers are required to pay the carbon price (set at AUD 23 per tonne of carbon emitted and rising 2.5 per cent per annum in real terms[150]). Natural gas for heating and process use is untaxed (OECD 2013).

In Canada the consumption of electricity and fuels used to produce electricity is not taxed federally except where the electricity is used primarily in the operation of a vehicle. Natural gas is not taxed at federal level (only British Columbia has a tax on natural gas) (OECD 2013).

Japan taxes the consumption of electricity taxed at a rate of 375 JPY/MWh (less than 4 Euro/MWh). In addition, fuels used for electricity production are taxable under the petroleum and gas tax. For energy used for heating or process purposes, natural gas and petroleum gases are taxed at 1,080 JPY/tonne (about 10.5 Euro/tonne) (OECD 2013).

South Korea taxes fuels used to generate electricity, but not the consumption of electricity. An individual consumption tax is applied to LPG and natural gas (including liquefied forms) on a per kilogram basis. An education tax also applies to LPG (butane gas) on the same basis.

Electricity consumption is not taxed at the federal level in the United States but is taxed in some states (OECD 2013).

Due to the generally lower tax burden on energy consumption outside the EU, it can be expected that the importance of energy-related tax exemptions is much smaller.

[149] OECD. 2013. Taxing energy use in OECD countries. In: Taxing Energy Use: a Graphical Analysis. OECD Publishing. The OECD report covers taxes such as excises levied directly on a physical measure of energy product consumed and excludes general taxes, such as VAT. The OECD methodology "looks through" taxes on electricity consumption to calculate upstream the implicit tax rates on the primary energy used to generate electricity.

[150] In November 2013 two years after Australia's carbon price passed parliament and almost 18 months after the initial fixed-price carbon tax took effect, the House of Representatives has voted to repeal it. The fate of the4 repeal now rests with the Senate.

3.6. Energy price subsidies

Increasing global competition and integration of production chains are developments with far-reaching social, political and economic consequences. Various stages of production may be offshored to countries with less stringent or unenforced regulations or ones that subsidise energy.

At the global level, much remains to be done to phase out inefficient fossil-fuel subsidies that encourage wasteful consumption. Even though the large part of fossil fuel subsidies are focussed on oil and petroleum products, the IEA's 2013 World Energy Outlook quotes the results of a survey of 40 countries, showing that in 2012 subsidies to natural gas and coal consumed by end-users amounted to 124 billion USD and 7 billion USD respectively, while subsidies to electricity stood at 135 billion USD[151]. Iran, Saudi Arabia, Russia, India, Venezuela and China are the countries with the highest levels of subsidy to fossil fuels.

Significant subsidies to natural gas and electricity in major economic partners for the EU, such as Russia, India and China, does little to establish a level-playing field to for consumers based in different parts of the world.

At the same time, the IEA signals that several major reforms to reduce or phase out fossil-fuel subsidies have been announced since 2012, increasing the momentum of recent years on this issue. These include reforms to energy pricing made by India and China. India has announced that power stations that need to buy imported coal will be able to pass on the extra costs to their customers[152]. India has also announced that prices of domestically produced natural gas will be adjusted on a quarterly basis from April 2014, to match the average of the prices of the LNG it imports and of gas on other major international markets. According to the IEA, this is expected to result in a doubling of domestic gas prices.

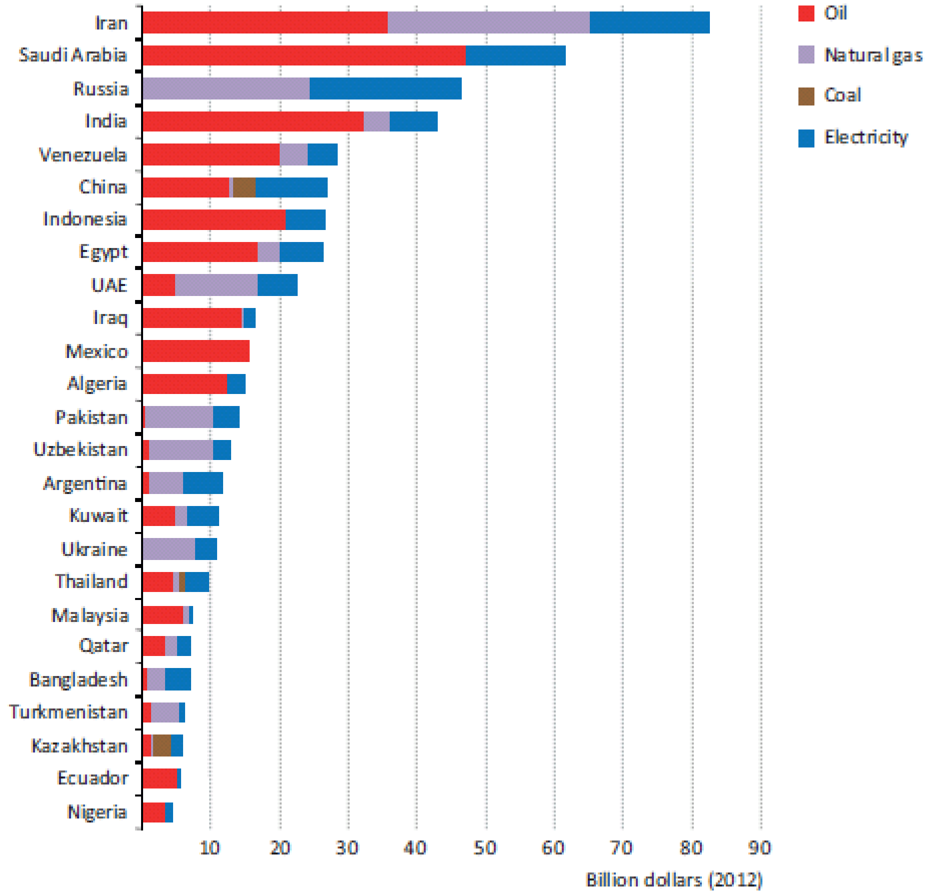
In 2013 China increased natural gas prices by 15% for non-residential users. In a move to ease electricity shortages, in July 2012 the country implemented a tiered electricity pricing system for households whereby customers who use more electricity will pay higher rates per kilowatt-hour than those who use less. Russia raised electricity and gas prices by 15% on average in July 2013 and plans to increase them further in July 2015.

---

[151] To estimate subsidies the IEA looks whether energy prices are set below reference prices, which are defined as the full cost of supply based on international benchmarks. The estimates cover subsidies to fossil fuels consumed by end-users and subsidies to fossil-fuel inputs to electricity generation, but do not cover subsidies to petrochemical feedstock. For electricity, subsidy estimates are based on the difference between end-user prices and the cost of electricity production, transmission and distribution.

[152] Under the old system, tariffs could not be increased to reflect fuel prices, sometimes leaving generators with little incentive to increase generation to meet peak demand and causing frequent blackouts and rolling outages.

Figure 121. Economic value of fossil-fuel consumption subsidies by fuel for top 25 countries, 2012[153]



Source: IEA WEO 2013

3.7. Energy and cost competitiveness

The current difficult economic climate exacerbates concerns about loss of competitiveness. Competitiveness is a broad macro-economic concept related to quality of living and different from the notion of cost competitiveness. For example, the 2012-2013 Global Competitiveness Index (GCI) of the World Economic Forum ranks 144 economies on a set of 12 pillars of competitiveness grouped in three sub-indexes: basic requirements, efficiency enhancers and innovation and sophistication. Global competitiveness implies a comparison of performance with trade partners and market shares in world markets. In contrast, cost competitiveness applies more specifically to input factors.

Many factors drive productivity and competitiveness, from macroeconomic environment, infrastructure and institutions to health and education systems, goods and labour market efficiency, market size, technological readiness and innovation[154].

[153] Given that currently no comprehensive database is available in all EU Member States on energy subsidies, based on a uniform methodology, European Commission is going to prepare and publish an in-depth study on energy costs and various subsidies in the energy sector in 2014.

[154] See, for example, the pillars of competitiveness in the Global Competitiveness Index of the World Energy Forum

The price of energy – together with cost of labour, capital and raw materials – affect overall production costs and the profitability of economic actors. Rising energy prices and volatility are a factor with direct impact on businesses' production costs, their economic activity, external accounts and competitiveness.

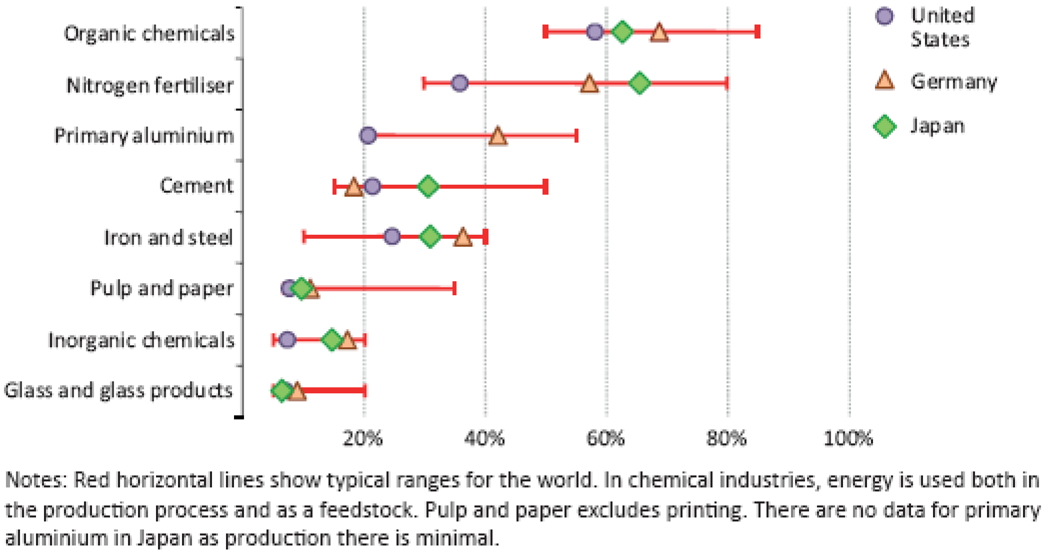
A comparison of the cost-competitiveness of different geographical locations needs to take into account the cost elements that vary between those locations. One of the major drivers of energy costs is energy price; the price of energy commodities like gas and (to a lesser extent) electricity differs substantially across locations. For this reason, regional disparities among energy prices are often centre stage in debates about competitiveness, even more so in countries and regions dependent on imports.

The extent to which a country is vulnerable to energy price increases, relative to other economies, depends on the structure of its economy, in particular its share of energy intensive manufacturing, the energy efficiency of its manufacturing sectors and sub-sectors and its degree of energy dependence.

The significance of energy to competitiveness also varies between industries, segments and sub-segments of the global value chain, depending among other things on the energy intensity of manufacturing processes and the degree to which manufactured products are globally tradable (ease and cost of transportation).

Energy costs are particularly important for the international competitiveness of energy intensive industries, which often have a strategic position in the economic value chain. Energy costs as a share of total production costs vary significantly by sectors and region. For example, the IEA shows that the share of energy costs in the production of organic chemicals varies between approximately 50% and over 80%, with the share in Germany and Japan higher than that in the US. In other cases, such as glass and glass products, the share of energy costs in total production costs ranges up to 20%, with German and Japanese manufacturers in the lowest band of this range.

Figure 122. Share of energy in total production costs by sub-sector, 2011



Source: IEA WEO 2013 and sources therein. Note: To calculate the share of energy in total production cost, IEA has used official sources for the USA, Germany and Japan for all industrial sub-sectors apart from primary aluminium in Germany (estimated based on the US data accounting for differences in electricity prices and specific energy consumption).

As of 2011 the **EU dominates the export market for energy-intensive goods**, accounting for more than two-thirds of export value, which makes it the largest export region for energy intensive goods.

The effects of energy prices on the EU's international competitiveness differ by product and trading partner; they are difficult to isolate from the effects of other cost factors and to quantify on the basis of statistical time series. In addition it may be difficult to empirically establish and monitor global industrial shifts related to regional energy price disparities, due to the lead times associated with production and investment decisions and time lags with statistical data on manufacturing output, trade flows, employment statistics and retail prices of energy.

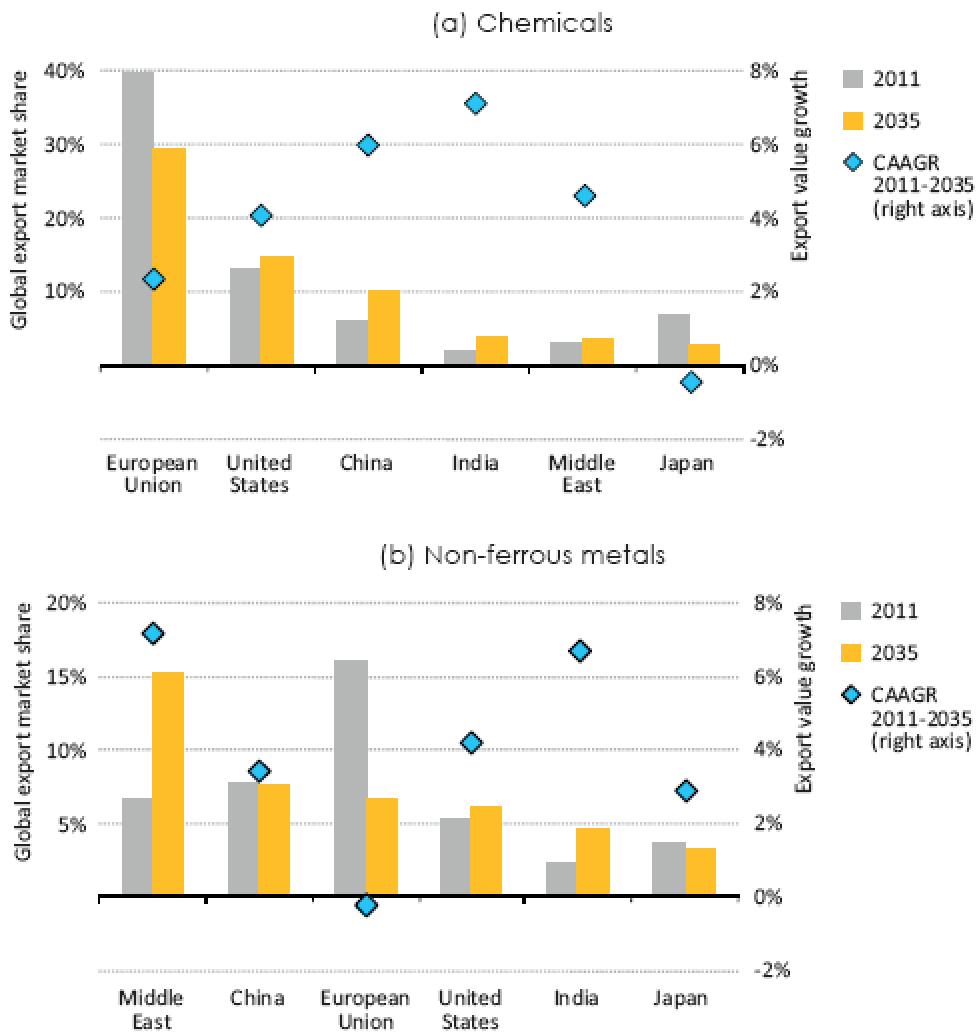
Despite these analytical challenges, one can expect that **regional price disparities increase the risk of reduced production levels and investment in higher priced countries and bring changes in global trade patterns, in particular affecting industries that have a high share of energy costs and are exposed to international competition** because their production is easy and relatively cheap to transport[155].

This is supported by analysis undertaken by the IEA in the 2013 World Energy Outlook, which shows that **persistently high energy price disparities can lead to important differences in economic structure over time and have far-reaching effects on investment, production and trade patterns**. For example, IEA projections to 2035 point to marked

[155] With increasing competition and integration of global production chains offshoring - the decision by European manufacturing firms to move their production to locations abroad – has gained momentum and attention. The European Competitiveness Report 2012 refers to data from the European Manufacturing Survey for two periods - mid-2004 to mid-2006 and 2007 to mid-2009 – covering firms from four industrial sectors and showing that cost reduction is the dominant motive for relocating production activities abroad, with factors such as vicinity to customers and expansion of markets the next most important motivation for offshoring.

differences in production and export prospects for the energy-intensive sectors across regions determined by their stage of economic development – with strong domestic demand for energy intensive goods in some emerging economies – but also by energy price levels, particularly through relative energy costs among developed countries. Projections show that in 2035 the EU will remain the leading exporter of energy-intensive goods, exporting more than the US, China and Japan together, but that **in 2035 market shares in global export markets for energy intensive goods of the EU decline** - by 10 percentage points in the case of chemicals in the EU and by 9 percentage points in the case of non-ferrous metals - as opposed to developing Asia that is projected to increase its export market share to a level equal to that of the EU. A combination of factors drive this trend, including energy prices, relatively high wages and longer shipment distances to growing consumption centres in Asia (IEA WEO 2013).

Figure 123. Regional shares of global export market and growth in export values in the chemicals and non-ferrous metals sectors, New Policy Scenario of the IEA (2011-2035)

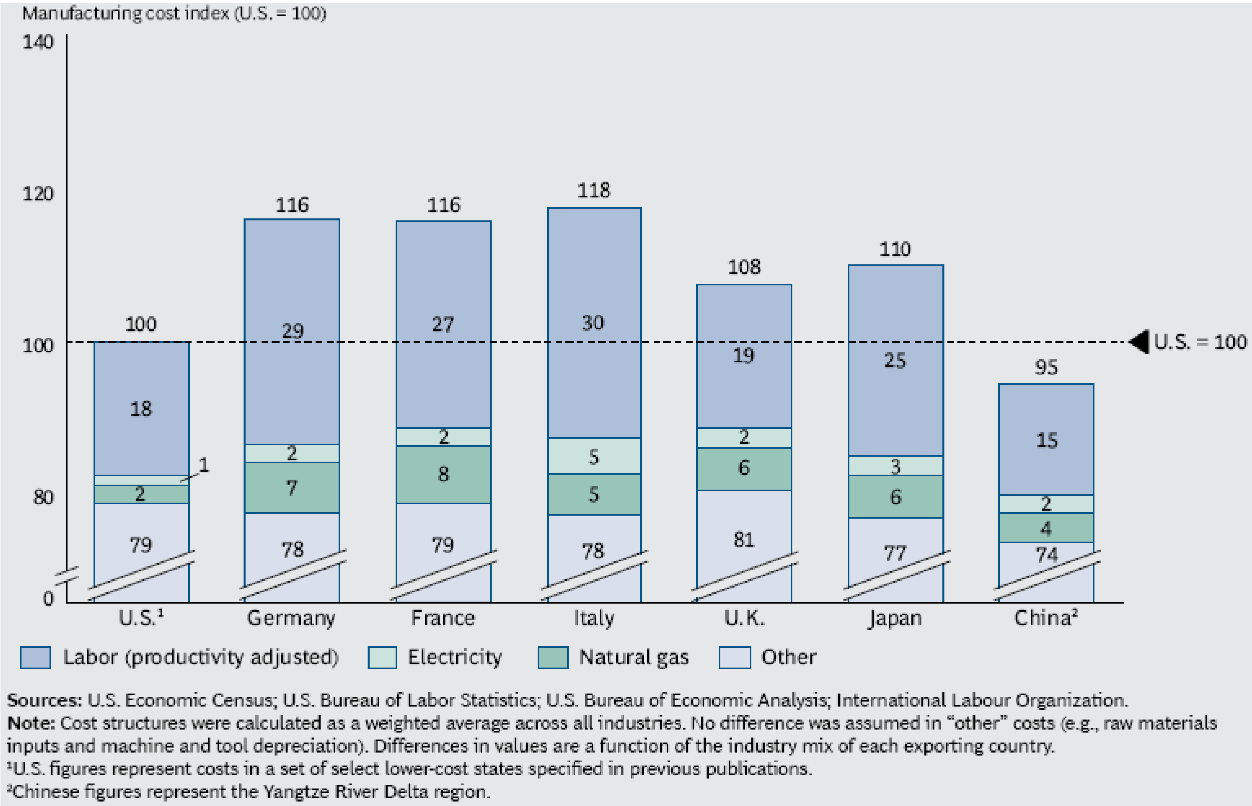


Notes: CAAGR is compound average annual growth rate. Chemicals include base chemicals (*e.g.* petrochemicals), specialty chemicals, pharmaceuticals and consumer chemicals. Non-ferrous metals include aluminium, copper, lead, nickel, tin, titanium, zinc and alloys such as brass. Intra European Union trade flows are excluded. Sources: OECD ENV-Linkages model and IEA analysis.

Source: IEA WEO 2013

A recent study by the Boston Consulting Group (BCG) indicates that the US already has a production costs advantage compared with other developed economies that are leading manufacturers[156]. Due to three factors – labour, electricity and natural gas – by 2015 average manufacturing costs in the UK, Japan, Germany, France and Italy will be 8-18% higher than in the US. BCG's projection shows that by 2015 average labour costs in the US will be around 16% lower than in the UK, 34% lower than in Germany and 35% lower than in France and Italy. BCG expects that the gap between electricity and gas prices in the US and major European economies will remain or even increase by 2015.

Figure 124. Average projected manufacturing cost structures of the major exporting nations relative to the US in 2015



Source: BCG 2013

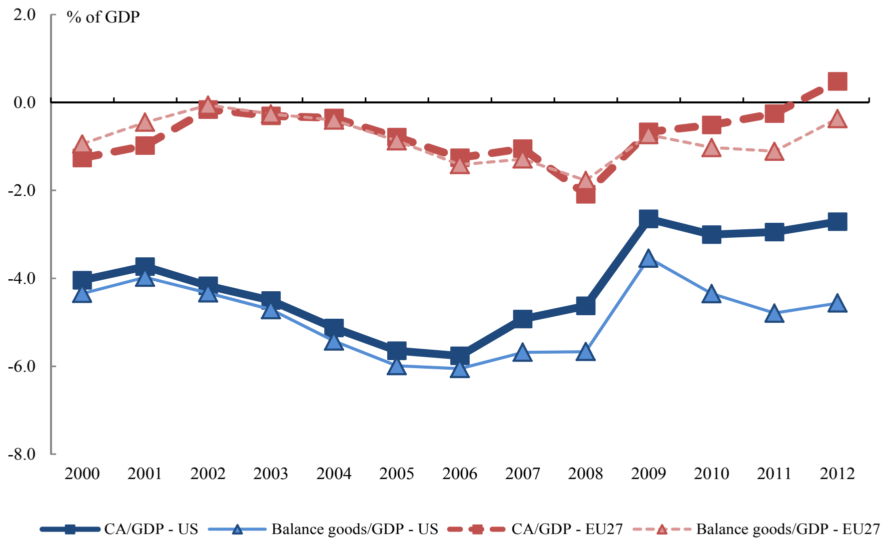
Impacts on US shale gas on trade[157]

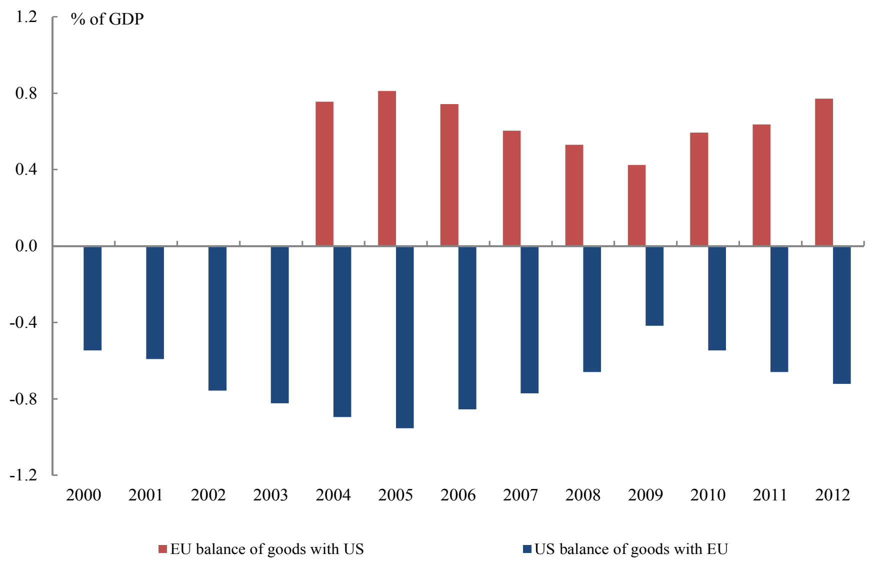
Besides its downward pressure on domestic gas and electricity prices, the most evident effect of shale gas development in the US has been a fundamental contribution to the sizeable reduction of the US energy trade deficit over the past few years (about 1%-point of GDP). While the US gas trade has tended to move closer to balance, the coal trade surplus has increased since its consumption has been displaced by cheaper natural gas. This means that the current energy trade deficit of the US corresponds only to its trade deficit for oil (about 2% of GDP). On the contrary, in the EU the trade deficits for natural gas, oil and coal kept on growing,.

[156] BCG. 2013. Behind the American Export Surge.
[157] DG ECFIN. Energy Economic Development in Europe.

The repercussion of the surge in shale gas production is less visible when looking at the overall current accounts of the two regions. The EU-US goods balance shows a persistent surplus for the EU without any clear sign of deterioration. This may indicate that until 2012 the EU-US energy price gap has not visibly affected the export capacity of the EU industry and their competitiveness vis-a-vis their US counterparts. In addition, the EU in 2012 had a current account surplus while the US ran a consistent deficit.

Figure 125. Current account balance, external balance of goods and bilateral balance of goods, 2001-2012 - US and EU





Source: DG ECFIN. Energy Economic Development in Europe.

While the surge in US shale gas has led to significant changes in the US energy sector, reducing the US energy trade balance in GDP terms and its energy dependency, the impact on the EU so far can be considered limited; no major shift in the EU-US goods trade balance has

been observed yet, nor are there any significant divergent trends in the overall production structure of manufacturing industry which can be ascribed to the shale gas revolution.

The resilience of the EU industry can be explained at least partially by better performance in terms of energy intensity, which may have helped to buffer the persistent energy price gap. However the relatively small decline in energy intensity sectors' share in total EU GVA signals that not all the industrial segments have been equally able to maintain their performances.

These observations should not however lead to complacency. Future developments will depend largely on how the energy price gap evolves. A reduction in price differences may come with the beginning of gas exports from the US and/or the depletion of the cheapest shale gas basins. At the same time, however, EU industry may have less margin for further energy intensity improvements, and US counterparts may be able to catch up in this respect. Reducing EU energy dependency would help to offset the effects of energy price fluctuation and security of supply risks. Finally, the pace of the EU's economic recovery will play a fundamental role in determining its capacity to withstand global competition.

Energy costs in a global comparative perspective[158]

To compare the role of energy in production processes globally and evaluate the role of energy in competitiveness, one needs to explore the interaction between energy costs, energy prices and energy intensity. One way to do this is by looking at the level and evolution of the so-called real unit energy cost, which measures the amount of money spent on energy sources needed to obtain one unit of value added.[159]

The level of real unit energy cost indicates the importance of energy inputs and sensitivity to energy price shocks – a greater increase in some countries/sectors than others can signal an increased vulnerability to energy costs in a particular sector, but could also indicate a restructuring of production towards more energy intensive production processes. It is therefore important to also analyse the drivers of real unit energy costs: energy intensity and the real price of energy (which measures energy inflation above sectoral inflation). A shift-share analysis can shed further light on the role of restructuring in energy cost developments.

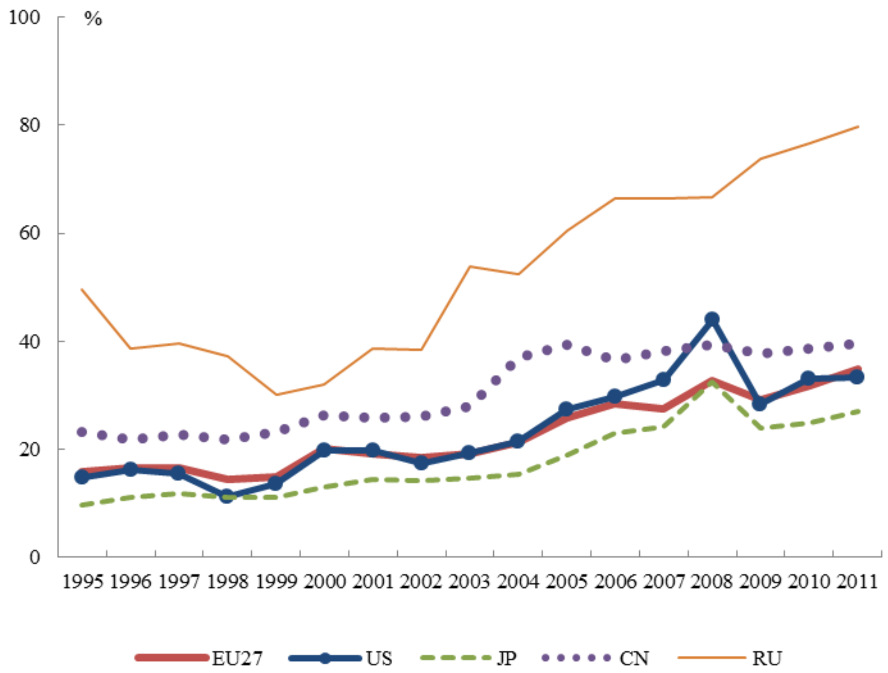
A global comparison of real unit energy costs in the manufacturing sector[160] shows that in the period **1995-2011energy costs increased not only in the EU but in the rest of the world as well.** The EU manufacturing sector as a whole enjoyed some of the lowest real unit energy costs together with Japan and the US. This means that to obtain 1 USD of valued added at the level of EU manufacturing as a whole, businesses spent less money on energy sources than counterparts in Russia or China.

Certain sectors in the EU however show a significant vulnerability in a global comparison, because of high real unit energy cost levels and/or growth rates, indicating elevated sensitivity to energy-cost pressures. For example, the **production of coke, refined petrol and nuclear fuel** is the sector that shows the worst performance in the EU, **with real unit energy costs several times above levels in the US, Japan, China and Russia** and increasing between 1995 and 2011 unlike any other country analysed (US, Japan, Russia and China).

[158] Energy Economic Development in Europe, DG ECFIN.
[159] Energy costs are defined here as the costs of all energy inputs (oil, petrol, coal, gas, electricity) used for production purposes including inputs used as feedstock.
[160] This analysis is based on the WIOD database (national accounts), whereby manufacturing refers to industrial manufacturing and includes refining. The analysis includes feedstock.

Energy prices in the EU and Japan are among the highest in a global comparison (see section 3.2 on price levels and 3.3 on price evolution), while the US and China experienced consistently lower energy prices throughout the period 1995-2009[161]. At the same time, the **EU manufacturing sector, together with Japan, showed the lowest energy intensity levels –** probably partially linked to the declining share of energy-intensive industry in total industrial output and to EU manufacturing specialising in low energy intensity and high value added production – which generally explains the low real energy unit costs observed in the EU. The US and China have been catching up in terms of energy intensity improvements but the difference in absolute levels remains substantial.

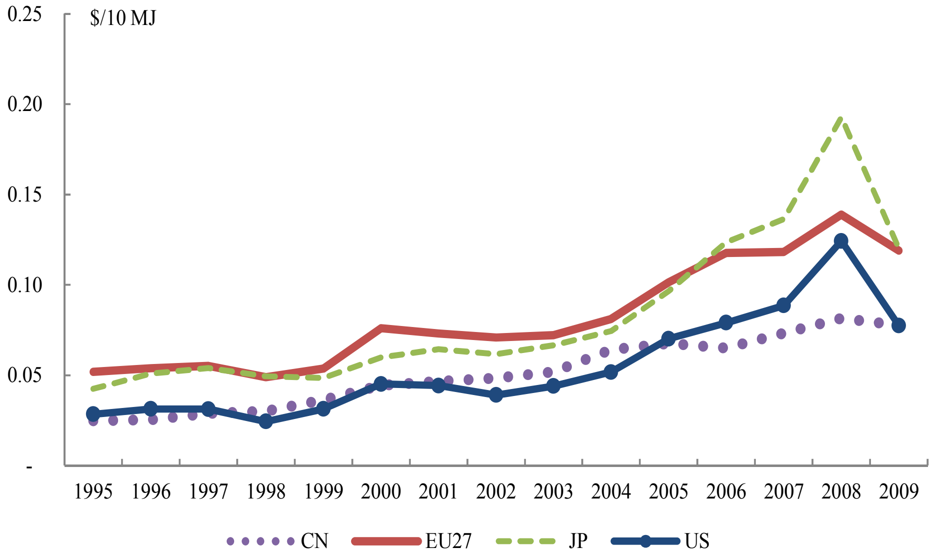
Figure 126. Evolution of real unit energy costs as % of value added, manufacturing sector (1995-2011)



Source: DG ECFIN. Energy Economic Development in Europe.

[161] Due to data limitations, figures for energy prices and energy intensity for the years 2010 and 2011 are not available.

Figure 127. Evolution of real energy prices in the manufacturing sector (1995-2009)



Source: DG ECFIN. Energy Economic Development in Europe.

Note: Real energy prices are defined here as the USD value of 1 unit of the **energy inputs** used by the manufacturing sector measured in 2005 USD.

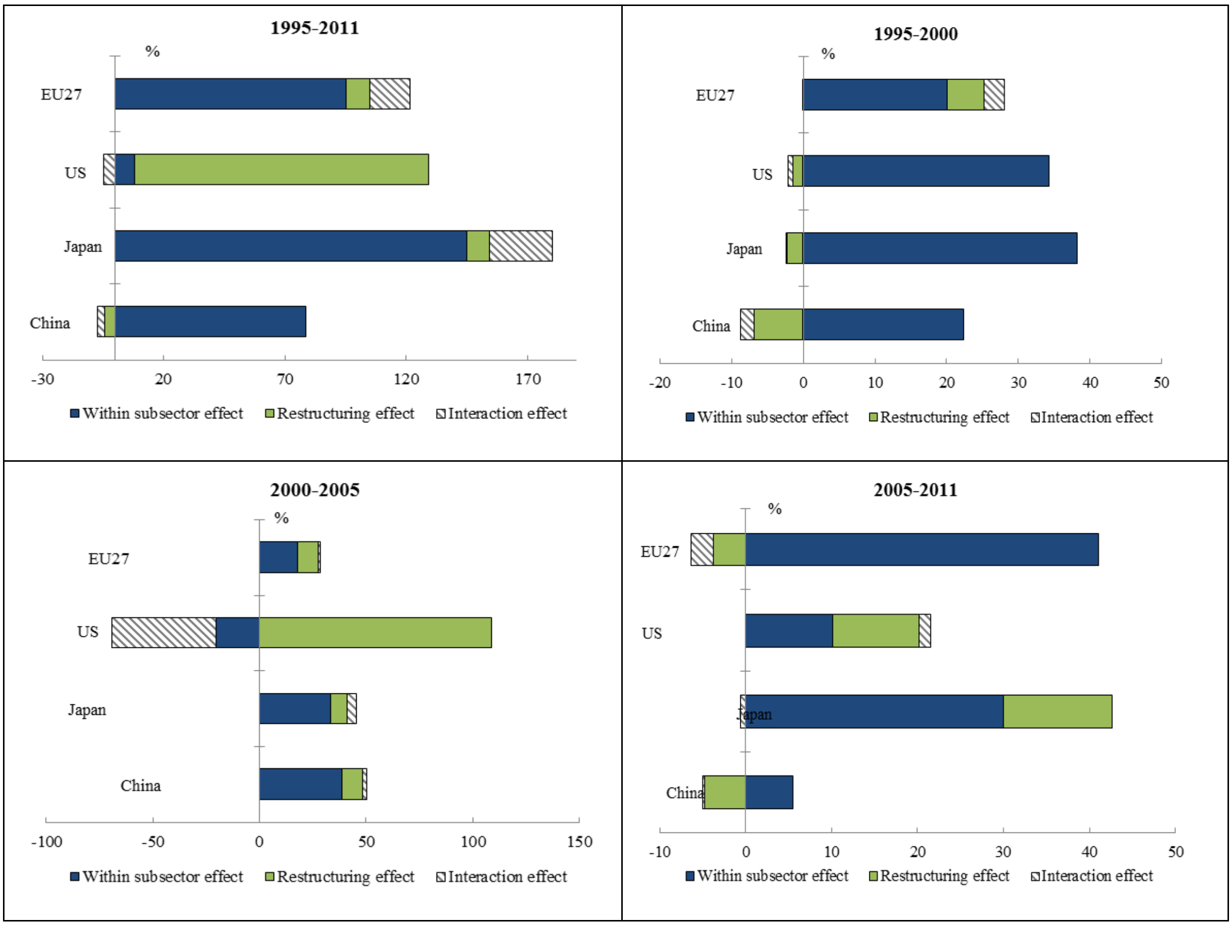
A shift share analysis of the evolution of real unit energy costs shows that in the period 1995-2011 increasing energy costs were driven by cost increases within manufacturing subsectors worldwide. The only exception is the **US, which experienced a significant restructuring towards high energy cost production**. The shift share analysis confirms that in **2005-2011** there is **evidence of EU industry restructuring away from energy intensive sectors. The increase in energy costs was the steepest in the EU** (relative to the other countries in the scope of the analysis) and this increase in energy costs was associated with EU industry restructuring towards low energy intensity. In comparison, in the US the energy cost increase was much less pronounced.

Between 2005 and 2011, EU manufacturing saw the highest increase in energy costs within subsectors in a global comparison. As a result of this unparalleled increase in energy costs within subsectors the EU witnessed a move towards subsectors with low energy costs. These developments follow similar trends in the period 1995-2000 characterised by a marked increase in real unit energy costs dominated by the within subsector effect - indicating pure energy cost pressure - in the EU, US and Japan. The period 2000-2005, however, was significantly different, with the US being the only country with a negative within subsector effect. At the same time the US showed a very large positive restructuring effect mitigated to some extent by a negative interaction term. **Overall this indicates that the US had already started specialising in high energy cost production in the period 2000-2005**[162]. Finally, the last period – 2005-2011 – includes the 2008 peak in oil prices and subsequent fall in 2009 and has brought a significant adjustment and restructuring on a global scale.

[162] This evolution could be explained by a domestic restructuring or investment of foreign companies in the US. The analysis here does not differentiate between these factors.

In the US, the increase in real unit energy costs during this period was due to a combination of considerable real unit energy cost growth within subsectors and a positive restructuring effect. The increase, however, has been significantly smaller in the US than in the EU. Japan saw a positive within subsector effect with a positive restructuring effect. Finally, China experienced positive but modest within subsector effect and a similarly modest negative restructuring effect.

Figure 128. Shift share analysis of real unit energy costs in the manufacturing sector (1995-2011)



Source: DG ECFIN. Energy Economic Development in Europe.

Note: The *within subsector effect* shows what would be the growth of real unit energy costs of the total manufacturing sector **if** the shares of the subsectors had stayed unchanged throughout the period of analysis. Therefore this effect shows the pure energy cost pressure filtering out the effect of restructuring. The *restructuring effect* measures the contribution of changes in value added shares of the different subsectors to overall manufacturing real unit energy cost growth keeping the real unit energy costs of subsectors unchanged. This component therefore shows the static restructuring effect. A negative restructuring effect could show that the share of industries with high energy costs has fallen. The *interaction effect* captures the dynamic component of restructuring by measuring the co-movement between real unit energy costs and value added shares. If it is positive, it signals that energy costs are rising in subsectors that are expanding, and/or they are falling in shrinking sectors, i.e. the two effects complement each other. If it is negative, then real unit energy cost growth is positive in shrinking sectors, and/or negative in expanding sectors, i.e. the two effects are offsetting each other. A negative interaction effect could signal that businesses in a country are reallocating resources from high to low energy cost sectors in response to rising energy costs.

If the refinery sector is excluded from the above calculation of the real unit energy cost[163], the levels decrease substantially (more than halved) and the ranking of the countries changes with the US displaying the lowest level of unit costs, followed by the EU and Japan. This result indicates the importance of the refining sector in the US and it also highlights the fact that in the other industrial sectors, less dependent on oil, the real unit energy cost level is somewhat higher in the EU than in the US. However, even excluding the refinery sector, the unit cost in the EU remains among the lowest in the world. While the restructuring observed in the shift-share analysis of the manufacturing sector seems to have been driven largely by developments in the refinery sector, the method does not capture any potential restructuring taking place at a lower aggregation level than the 2-digit NACE sectoral breakdown.

International energy efficiency trends

The importance of energy efficiency as a competitiveness factor is growing over time with globalisation. Energy prices and energy intensity are the two drivers of real unit energy costs. Increasing energy efficiency provides the means for economic actors to partially counterbalance the impact of increasing energy prices.

Analysis by the IEA in the 2013 World Energy Outlook points to diverging energy intensity developments by sector at a regional level.

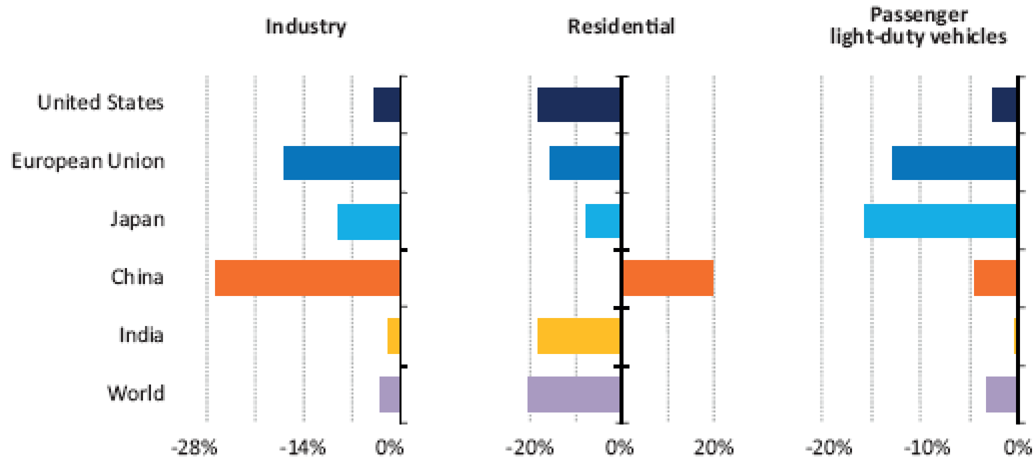
Industrial energy intensity in the EU saw a decline of about 15%, partially linked to the declining share of energy-intensive industry in total industrial output. Energy intensity levels in Japan's industry sector decreased by about 9% from 2005 to 2012, helped by structural changes in the economy away from energy-intensive sectors.

In the United States, energy intensity in industry as a whole decreased only slightly in the period 2005-2012, as efficiency improvements were almost fully offset by increased oil and gas production and increased activity in the chemicals industry which shifted the economy, to some extent, to more energy-intensive sectors.

In contrast, the bulk of China's decrease in industrial energy intensity can be attributed to energy efficiency gains. During the 11th Five-Year Plan (2006-2010) the share of energy-intensive industries in total industrial value added did not change significantly, due to strong growth in cement and steel production. Efficiency improvements were strongest in the cement and paper industries.

[163] See Appendix 3 of Energy Economic Development in Europe, DG ECFIN.

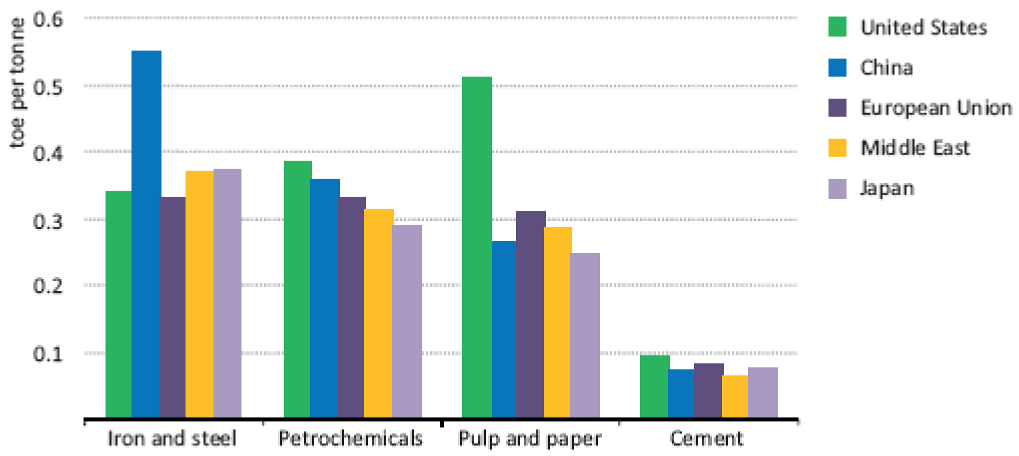
Figure 129. Energy intensity change by sector and region (2005-2012)



Source: IEA WEO 2013

The intensity of industrial sectors such as iron, steel and cement is lower in Europe than elsewhere, whereas for sectors such as petrochemicals and pulp and paper it is higher (Figure 130). Differences in energy intensity at sub-sectoral level are explained by efficiency improvements, along with differences in production processes and types of products.

Figure 130. Energy intensity by sub-sector and region, 2011



Note: Petrochemicals in this graph refers to ethylene production excluding feedstocks.

Source: IEA analysis.

Source: IEA WEO 2013

Projections from the IEA's World Energy Outlook point to a narrowing of the energy intensity gap between North America and Europe, with roughly half of global efficiency-related energy savings between 2011 and 2035 achieved in China, North America and Europe, with the largest savings coming from China (in particular due to a shift from energy-intensive industries to light industry and services) and North America (more ambitious energy efficiency policies in transport, industry and buildings).

3.8. Chapter conclusions

While Europe has never been a cheap energy location, in recent years the energy price gap between the EU and major economic partners has increased substantially. Over time manufacturing in the EU has undergone a restructuring towards lower energy intensity and higher value added production, while relatively high energy prices have incentivised improvements in energy efficiency. The extent to which a country is vulnerable to energy price increases, especially relative to other economies, depends on the structure of its economy. The share of energy intensive manufacturing in its economy, the energy efficiency of manufacturing sectors and sub-sectors and its degree of energy dependence all play a role.

- **Persistent regional energy price disparities cause changes in global trade patterns.** For industries with a high share of energy costs and exposed to international competition because products are easy and cheap to transport, they increase the risk of reduced industrial manufacturing growth or even in production levels and investment in higher priced countries.

- Between 2005 and 2011, EU manufacturing saw the highest increase in energy costs within subsectors relative to the US, China and Japan.

- The low energy intensity of EU manufacturing cannot be considered apart from its relatively high energy prices. The decrease in energy intensity can be attributed to **EU manufacturing specialising in low energy intensity and high value added production**.

- Certain sectors in the EU show significant vulnerability to energy price levels because of their high real unit energy cost levels and/or growth rates in a global comparison

- There is evidence of EU industry restructuring away from energy intensive sectors in the period 2005-2011; developments in the refining sector have had a very large impact on the restructuring observed.

- The level of real unit energy costs in the EU is somewhat higher than in the US[164]. The increase in real unit energy costs in the period 2005-2011 was the steepest in the EU relative to other countries in the scope of the analysis and this increase in energy costs was associated with EU industry restructuring towards lower energy intensity. Energy cost increase in the US was much less pronounced.

- **The importance of energy efficiency as competitiveness factor is growing over time with globalisation**. Despite their good efficiency performance, EU manufacturers have steadily improved their efficiency performance, converging towards Japanese levels. The US and China have been catching up even though the difference in absolute levels remain substantial.

- Europe is price-taker in **global hydrocarbon markets (**oil and coal).

- Unlike internationally traded commodity markets, in particular crude oil and coal, **natural gas** has disparate regional benchmark prices. Over the recent years the gap between regional gas prices has widen driven by diverging regional gas price drivers.

[164] Results excluding refining

- **In recent years wholesale gas prices** have increased in all world regions except North America. Europe and Asia Pacific remain the highest priced wholesale gas markets. This widening gap has been driven by factors such as the US shale gas boom, increases in oil-indexed gas prices in Europe and skyrocketing gas demand in Japan in the aftermath of Fukushima. Only in the Middle East and Africa, where prices are often held down to the cost of production or below as a subsidy, are average wholesale prices for gas lower than in North America.

- Even within the EU, the difference between the lowest and highest wholesale gas price remains significant. Member States with a diverse portfolio of gas suppliers and supply routes and well-developed gas markets reap the benefits by paying less for imports and generally having lower prices.

- **Similar though less pronounced is the case of regional electricity prices.** Regional differences in **wholesale electricity prices** are less pronounced than for gas, at least in major economies (data for US, Europe and Australia). The net effect of low US natural gas prices on the difference between US and EU electricity prices is mitigated by lower EU coal prices (as a result of cheaper gas in North America).

- **Retail electricity for industry**[165]: on average across the EU and denominated in Euro and in nominal terms (ex. VAT and recoverable taxes), in 2012 medium-size industrial consumers in the EU paid about 20% more than companies based in China, about 65% more than companies in India, more than twice as much as companies based in US and Russia and more than three times as much as Middle Eastern industrial consumers in e.g. Saudi Arabia and United Arab Emirates. Industrial electricity prices in Japan were 20% higher than these faced by the average industrial European consumer.

- **Retail electricity for households**: on average European households paid more than twice as much as US households for electricity and comparable prices to Norway, New Zealand and Brazil.

- **Retail gas for industry**: in 2012 medium-sized industrial consumers in the EU paid four times as much for **natural gas** as industrial consumers in the US, Canada, India and Russia and about 12% more than those in China. Industrial gas prices in Brazil and Japan (2011) were above the EU weighted average.

- **Retail gas for households**: EU average gas prices were 2.5 times higher than those faced by households in the US and Canada, but were half the levels of gas prices faced by households in Japan (2011) and 30% below those in New Zealand. Households in 14 Member States paid less than the EU weighted average in 2012, putting their prices at levels comparable to those in Turkey and the US.

- Between 2008 and 2012 European industrial consumers faced a **10% increase in real terms in electricity prices**.

- **Other parts of the world,** in real terms over the same period, **saw more pronounced growth in electricity prices for industrial consumers** (14% in Korea and Japan, 19% in Australia, in some cases from a higher starting point). In the US there was a 10% decrease in real terms.

---

[165] Price levels are nominal and converted in Euro using ECB XR. Price indices are in real terms (deflated) and calculated in national currencies (IEA methodology)

- This divergence was even greater for **industrial prices for natural gas**. Industrial users in Canada and the US are now benefiting from prices comparable in real terms to these in the mid- and late 90s. **Industrial users in European OECD countries are paying in 2012 prices comparable to 2008 levels in real terms.** Industrial users in Japan and Korea saw the steepest growth in gas prices, with 2012 prices 26% and 33% above their respective 2007 levels.

- In a ranking of 144 countries globally on **quality of electricity supply,** 5 of the top 10 positions were occupied by EU Member States.

- **EU countries tax natural gas and electricity more heavily** than some other major global competitors, such as the US and Canada.

- At global level much remains to be done to phase out inefficient fossil-fuel subsidies that encourage wasteful consumption.

4. Future high energy prices in the EU: macroeconomic consequences

The aim of the present chapter is to evaluate the macroeconomic and sectoral consequences of an increase in electricity and gas prices in the EU if such increases do not take place in non EU countries.

The approach is to quantify stylized scenarios in which hypothetical causes drive divergence of electricity/gas prices in the EU relatively to the non-EU world. By no means are such hypothetical causes related to concrete policies in the EU. The purpose of the study is purely analytical.

The Reference scenario projection of PRIMEs 2013[166] which mirrors adopted policies in the EU and in the Member-States assumes full achievement of EU objectives (2020 policy package), implementation of current legislation including the Energy Efficiency Directive and full implementation of the ETS Directive. In this policy context the Reference scenario projects increasing electricity prices in the EU until 2020 relative to 2010 levels and full stabilization of prices after 2020. The Reference scenario also projects average prices of gas imported in the EU to increase and remain at high levels, which contrasts with the recent gas price drop in the North American markets. In addition, persisting subsidization in several non-OECD countries and in the emerging economies explain low energy prices experienced in the domestic markets of those countries, as reported by the World Energy Outlook of the IEA (2012). Therefore, the Reference scenario projects price divergence of electricity and gas prices between the EU and the USA and between the EU and the emerging markets for different reasons.

Obviously it is worth to explore the macroeconomic and sectoral consequences on the EU economy of such a persisting price differential. The adopted approach preferred to build the analysis starting from the existing Reference (2013) scenario and assume further increases in the price differential for electricity and gas over a medium-term horizon. To quantify these consequences using a model it is necessary to assume which are the drivers of such an increasing price differential because depending on the driver the macroeconomic effects can be slightly different. For this purpose, different scenario variants have been conceived which lead to similar price differentials but differ in the assumed hypothetical causes.

For the assessment of impacts, we start from a quantification of a reference macroeconomic and sectoral projection of the world economy using the GEM-E3 model, split in many countries/regions including the individual EU28 member states. A short description of GEM-E3 is available in Annex 6. The reference projection includes all assumptions made for constructing the Reference[167] 2013 energy and transport projection and mirrors the specific energy, transport and environmental projections of Reference 2013. The geographic coverage of GEM-E3 is global whereas the scope of the Reference 2013 energy/transport projection is only European. So it was necessary to include assumptions about growth, energy and emissions for the non-EU world regions. For this purpose we have relied upon IEA and Prometheus model projections which has been also used to carry out projections for the world economy and energy for the purpose of projecting fossil fuel prices to the future considered as inputs to the Reference 2013 energy scenario.

[166] PRIMES is a European energy system and market model. PROMETHEUS is a world energy market model. See www.e3mlab.eu for further details.

[167] The main assumptions of the reference scenario include) GDP projections based on the report "2012 Ageing report: Economic and budgetary projections for the 27 EU member states (2010-2060)", by DG-ECFIN and GHG emissions, RES deployment and energy efficiency consistent with the EU Roadmap for moving to a low carbon economy in 2050.

To study the impacts of electricity and gas price increases in the EU we quantify alternative scenarios using GEM-E3 which include the price increases and we compare projections against the reference scenario from which we draw conclusions. As GEM-E3 is a fully comprehensive and global equilibrium model, we need to specify the cause or the driver of electricity and gas price increases. For this purpose we have quantified several variants of the price increase scenario in which we vary the assumptions about the driver of price change. We provide more details below.

As a computable general equilibrium model GEM-E3 cannot produce forecasts as it requires exogenously assumed productivity, population and technology progress trends. As usually done for such models, a reference projection is produced by dynamically calibrating model-based projections to a pre-defined (assumed) trajectory of aggregated figures such as GDP, emissions, current account, consumption over investment ratios, etc. The dynamic calibration depends on assumed productivity evolution for which the assumptions usually rely on independent statistical studies on trends[168]. The model serves to produce a projection with details by institutional sector and branch of activity ensuring consistent with the assumed growth of aggregated figures.

As is the case of all such models, GEM-E3 produces powerful results when comparing alternative scenarios to a reference, and so it evaluates the impacts of the changes mirrored in the alternative scenarios.

We distinguish between two scenario cases: firstly we quantify scenarios in which electricity and gas prices increase[169] in the EU and we distinguish between several drivers of such increases. Secondly we quantify a scenario in which electricity and gas prices decrease in all non-EU countries but not in the EU. So in both cases the EU electricity and gas prices increase relative to non-EU countries; this has consequences on EU production and consumption cost structure in all sectors and drives crowding out effects on non-energy activity, weakens foreign competitiveness and reduces the EU GDP.

While the modelling exercise covers the time period until 2050 in 5-year steps[170], the focus of this chapter is on developments up to 2020.

4.1. Scenario Description

Higher electricity and gas prices in the EU

For scenario definition purposes, end-user prices for electricity and gas increase in the EU by a pre-defined percentage per year relative to the reference scenario levels. The changes in energy prices relative to the reference are presented in Figure 131.

It is assumed that a temporary distortion in the electricity and gas markets drive prices above the reference level in the short to medium term. This distortion can be attributed to a number of factors i.e. changes in energy taxation, market power or changes in supply structure. Each cause has distinct effects on the economy through different channels.

[168] Labour productivity follows DG-ECFIN (2012) and autonomous energy efficiency improvements follows PRIMES 2013 Reference scenario.

[169] Energy price increases are projected by a number of studies including the WEO (2013) and EIA (2013). The main drivers of energy prices can be classified in the following categories: i) Activity level/Demand, ii) Reserves, iii) Production costs and iv) market power. Depending on the assumptions on the reserves and GDP growth made by each study the price increases differ. Here all variants that include energy prices higher than the reference are conceived only as stylized cases aiming at exploring the level of resilience of EU economy towards energy price changes and at studying the consequences depending on the cause of energy price rise.

[170] 2015 is the first projection year; the year 2010 is a projection in modelling terms because the database uses 2007 as base statistical year but the 2010 projection does not vary by scenario. The resolution of the model in terms of different sectors and countries is the largest ever produced with GEM-E3.

The price differential relative to reference reaches its maximum value by 2025, and reduces afterwards reverting back to reference price levels in the long term. Such drivers of price differentials can persist in the medium term but it is unlikely to last over long term because they rely on national policies which are obviously incompatible with well-functioning integrated global markets. So it is logical to assume that global market forces will prevail in the long term and the price differential will tend to decrease over time. The annual rates of price increases are assumed to be the same in all EU member states.

Figure 131: Electricity and Gas price EU28

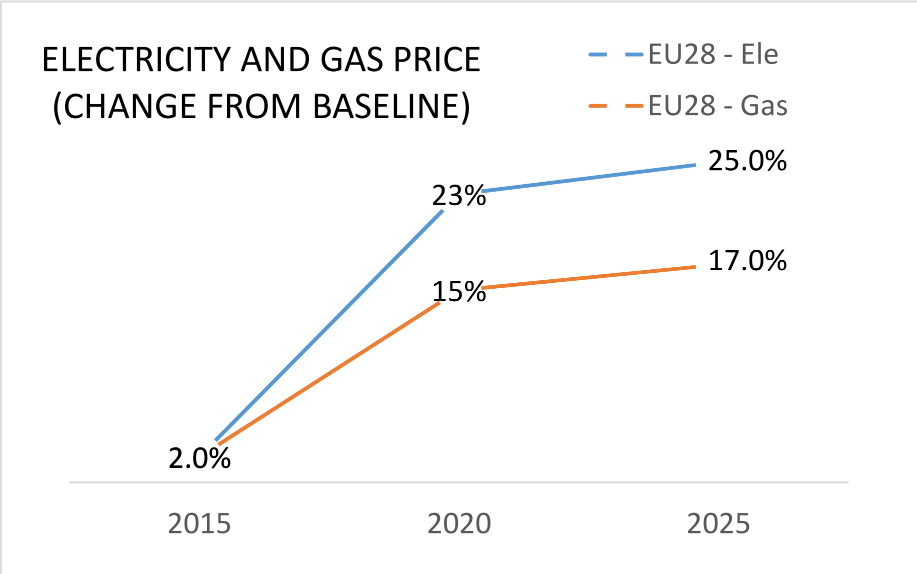
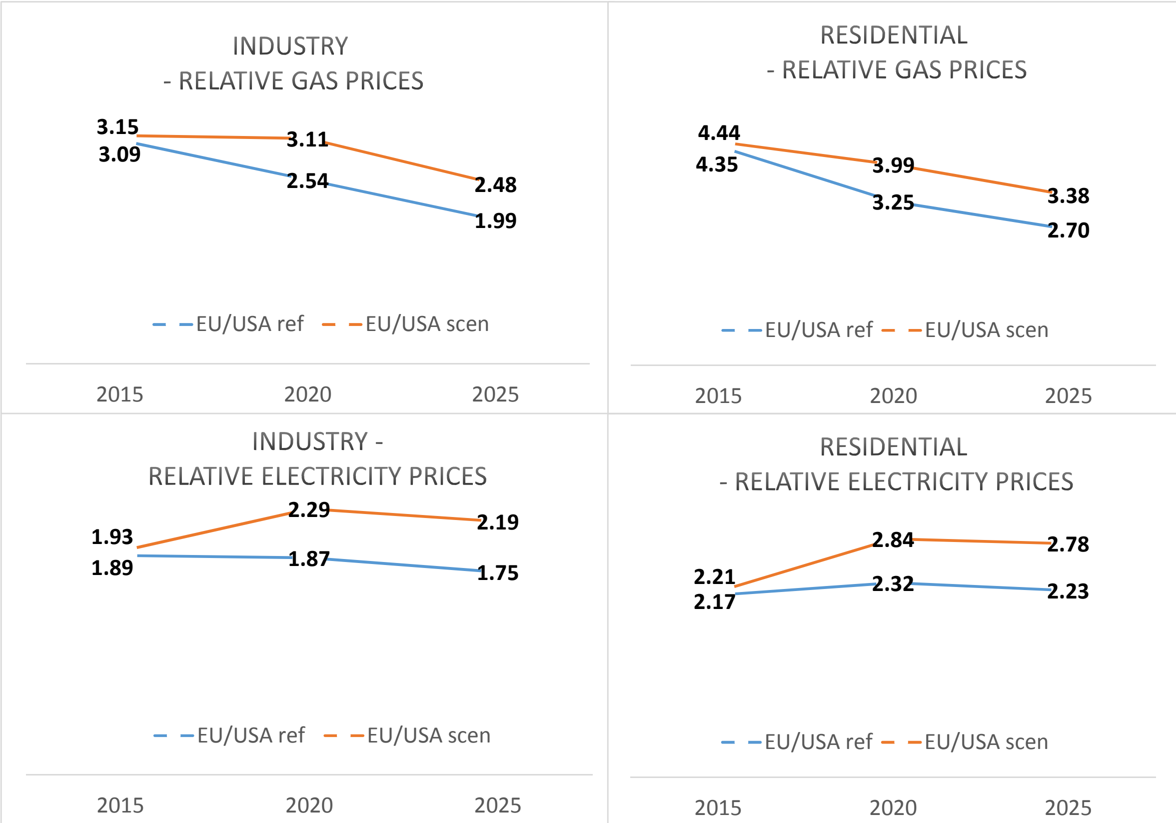


Figure 132 shows gas and electricity price differentials in the EU relative to USA prices in the scenario variants that project increasing prices in the EU. In these scenarios the price differentials are assumed to increase in the medium term and to decrease in the long term for the reasons explained above.

Figure 132: Relative energy prices expressed as ratios of EU over USA prices



The different drivers considered[171] as causes of electricity and gas price rise are the following:

- Rise of taxation applied on gas and electricity assuming application of excise taxes above reference levels; two distinct variants are considered regarding the way additional state revenues due to the energy tax are recycled back to the economy.
- Increase of profit margins in gas and electricity supply resulting from excessive market power
- Increased penetration of renewable energy sources at higher generation cost than in the reference.

These causes drive price increases only in the EU and not in non-EU countries though different channels.

Scenario B21: Taxation driving higher electricity and gas prices

In this scenario an indirect tax is imposed on end-user electricity and gas prices at levels calculated so as to obtain exactly the assumed price increases as presented in Figure 131. The additional taxation implies additional revenues for the state. To maintain public budget unchanged from reference, it is assumed that the rate of social security contributions of

[171] Depending on the choice of the driver the impact on the economy of the same price increase is different. Here a variety of drivers is selected in order to get a comprehensive picture of the different possible outcomes.

employers decrease; it is obviously assumed that the state recycles tax revenues back to the economy in an aim at reducing labour costs. This case is denoted as **B21a.**

An alternative assumption about recycling, which has been quantified for sensitivity analysis purposes, is to transfer additional state revenues of the energy taxation to households as a lump-sum transfer, which implies an increase in households' income. This case is denoted as **B21b**.

Scenario B22: Higher price mark-ups driving higher electricity and gas prices

In this scenario it assumed that the gas and electricity supply sectors experience excessive market power allowing higher profit margins than in reference. In the model this is achieved by increasing the cost mark-up so as to obtain the predefined electricity and gas price increases. The cost mark-up generates higher gross operating surplus which is a capital income. These revenues are distributed to the economic sectors according to their share of ownership. Roughly 80% of the revenues are allocated to households as additional income and 20% are allocated back to firms and are re-invested.

Scenario B24: Higher price only for electricity driven by generation mix

In this variant only electricity prices increase relative to the reference assuming that generation costs increase as a consequence of high penetration of renewable energy sources (RES) in the electricity generation mix.

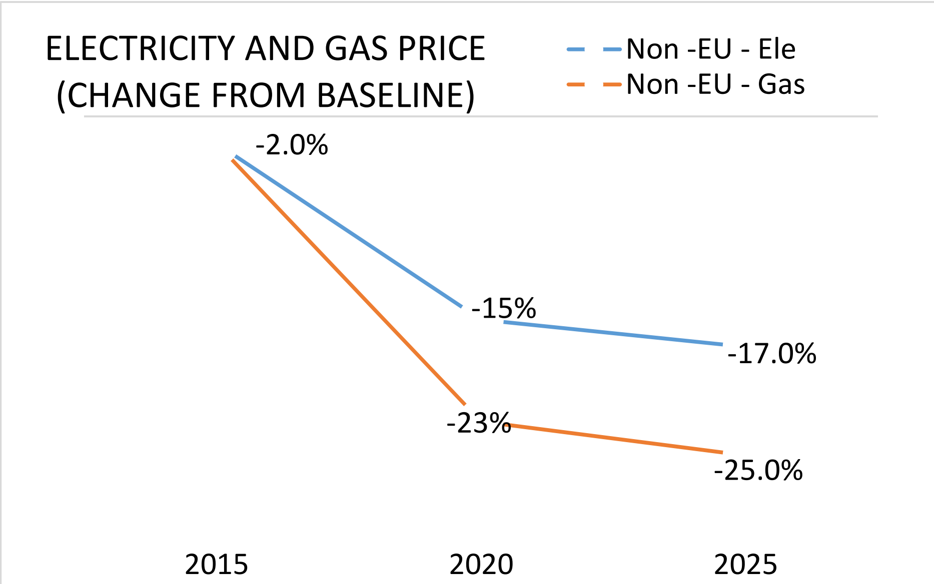
Scenario B23: Low electricity and gas prices in the non – EU countries

Price differential can also be due to causes occurring outside the EU. Cheaper and more abundant resources, or even subsidization, can drive reduction in electricity and gas prices in non-EU countries. For the purposes of the analysis it is assumed that the price reduction does not propagate in the EU. Certain geographical or market conditions can make this happen in reality. Therefore a scenario is defined which does not assume indigenous to the EU causes of price differentials bit instead assumes lower electricity and gas prices in the non-EU world driven by cheaper resources and further assumes that electricity and gas prices in the EU remain at reference scenario levels.

Electricity and gas prices in the non-EU countries as assumed in this scenario are shown in Figure 133. Gas prices in the non-EU countries are assumed[172] to decrease more than electricity prices relative to the reference scenario. The decrease in prices takes place mainly until 2025 where after prices revert back to reference scenario levels.

[172] This could be due to the discovery of new reserves.

Figure 133: Electricity and Gas price for non-EU countries



Modelling assumptions

The GEM-E3 model covers the global economy by distinguishing 46 countries/regions linked through endogenous bilateral trade flows. The model has been extended so as to include all the non-EU G20 countries in addition to representing the individual EU28 member states. Activity by sector is split in 22 sectors/products and electricity generation is split in 10 technology types. The industrial sector resolution covers 9 industrial sectors and has included maximum focus allowed by data availability on energy-intensive industries[173].

GEM-E3 is an open economy model for the EU and its current account can change by scenario. In all counterfactual scenarios quantified with the model it was assumed that the current account of the EU28 as a percentage of GDP will remain unchanged as compared to the reference scenario. This assumption is necessary to render the different scenarios comparable to each other. In fact, as the model does not include a mechanism to readjust exchange rates of countries through financial/monetary mechanisms, it would not capture adequately the effects of an eventual persisting current account deficit in a particular region. It would be unrealistic to assume that in a scenario such a persisting deficit would perpetuate without consequences on relative exchange rates. Instead of a monetary mechanism the GEM-E3 model uses relative interest rates as an equivalent balancing instrument. The EU wide interest rate re-adjusts endogenously in the model so as to keep the current account as a percentage of GDP unchanged. This is a good proxy of a current account re-balancing through exchange rate re-adjustment. For example interest rates may increase when changes of prices in the EU imply pressures towards current account deficit. From a modelling perspective the EU-wide interest rate is a closure instrument; alternatively the exchange rate could be an equivalent closure instrument but since the GTAP[174] original data are all expressed in dollars, GEM-E3 design has opted for using interest rates instead of exchange rates for closure purposes.

[173] The regional and sectoral aggregations of the model are summarized in the Appendix.

[174] The Global Trade Analysis Project (GTAP) is a global network of researchers and policy makers conducting quantitative analysis of international policy issues. GTAP is coordinated by the Centre for Global Trade Analysis in Purdue University's Department of Agricultural Economics.

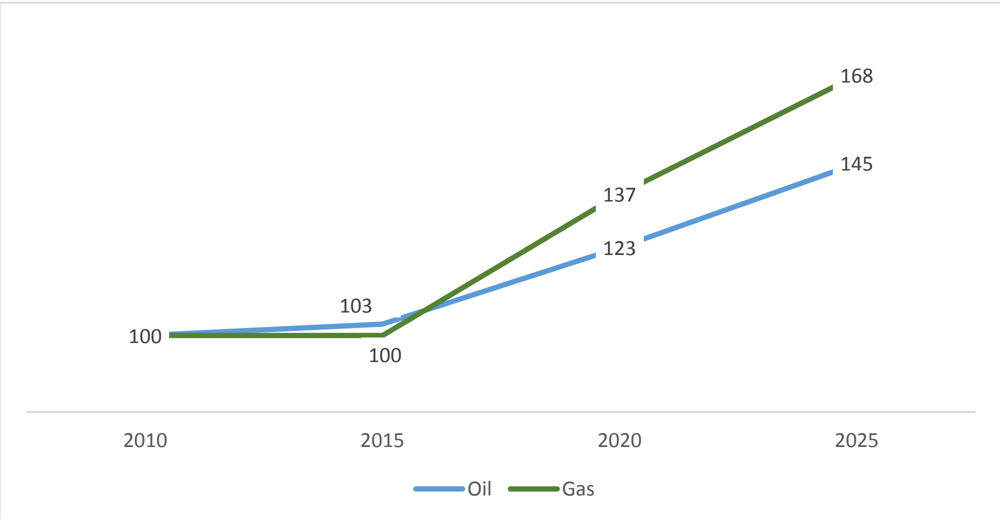
For the specification of the alternative scenarios we have made explicit assumptions on the causes of higher gas and electricity prices in the EU countries as mentioned in the previous section.

Reference scenario

Basic Assumptions

The GEM-E3 reference scenario is consistent with the PRIMES 2013 reference scenario for the EU. The growth and activity projections by sector and by EU Member-State are identical to the growth assumptions driving energy projections in the PRIMES 2013 reference scenario and the energy-related (consumption, electricity generation mix, prices) projections using the GEM-E3 model have been calibrated so as to be very close to energy projections of PRIMES 2013 reference scenario. As GEM-E3 is a global model, energy projections by PROMETHEUS model have to be used to calibrate GEM-E3 energy-related projections for the non-EU countries. For this purpose the PROMETHEUS 2013 reference scenario has been retained which is roughly consistent with the IEA World Energy Outlook New Policies scenario of 2012 and has also served to project world fossil fuel prices for the inputs of PRIMES 2013 reference scenario. Thus, the degree of consistency achieved between macroeconomic and fossil fuel price projections as assumed for the reference 2013 scenario is also fully ensured in the current GEM-E3 reference scenario. As PROMETHEUS has limited geographic resolution, the disaggregation of projections by country had to be complemented by using additional sources. For this purpose a 2012 MIT outlook[175] has been chosen because of the sufficient level of detail and also because the projections are roughly similar to IEA projections. Labour force and unemployment rate projections have been based on the Ageing report 2012 of DG-ECFIN for the EU member states and on the ILO for non EU countries. International fossil fuel prices are based on the PROMETHEUS 2013 reference projection. Figure 134 presents the trajectory for average fossil fuel prices in EU imports.

Figure 134: International fossil fuel prices in the Reference GEM-E3 scenario (2010 index)



Note: Fossil fuel prices are average import prices to the EU, not world average.

The international fossil fuels prices have been projected based on the PROMETHEUS (stochastic world energy model) model reference scenario for 2013.

[175] Available at: http://globalchange.mit.edu/Outlook2012

Oil prices increase continuously but the pace of price rise is slow due to high resource base, apart from uncertain (and temporary) effects of production capacity pressures in relation to demand evolution.

In the short term, high oil prices reflect the failure of productive capacity to grow in line with demand (fuelled by economic recovery and persistent growth in emerging regions).

The situation eases somewhat around 2020 before seeing declining global Reserves to Production ratios from 2030 onwards and result in a resumption of upward trends. For 2035 oil prices projected by PROMETHEUS are broadly in agreement with IEA-WEO 2011 New Policies.

Short term projections of natural gas prices (average prices of EU imports) show high increases owing to increasing demand from Asia (particularly Japan after Fukushima and China because of demand growth) which more than counterbalance reduced import demand in North America following shale gas exploitation. Asian gas import prices are mainly driving European LNG gas import prices in the short term while Russian gas prices for exports to the EU are mainly indexed to oil prices.

In the longer term the gas price pace diverts from the upward trend of the oil price, a major break with past price behaviour, due to the very large additional and currently unexploited resources including unconventional gas that is assumed to enter the global market in the decade 2020-2030 also in new regions, such as China, in addition to further growth in North America. As a consequence, natural gas prices tend to stabilize at a level that nonetheless is still high enough to ensure economic viability of unconventional gas projects.

China enters the global market for coal in 2008 and is assumed to remain a global player therefore causing coal prices to remain at high levels throughout the projection period. Coal prices increase at a rather slow pace in the 2025-2040 period due mostly to competition with gas in the electricity generation sector. In the longer term coal prices stand at levels that are above recent peaks (e.g. 2008).This is due to consistent demand growth in regions that undertake only limited GHG abatement policies after 2020 under reference case assumptions.

Overview of the GEM-E3 Reference scenario

Over the 2015-2050 time period the EU28 GDP is projected to grow annually by 1.5% on average. This rate is lower than the average world GDP growth rate which is 2.6% for the same time period. Table 49 presents the projection of GDP for the EU and a decomposition of GDP in large aggregated components. The projection is consistent with Ageing Report 2012 projection in the long term and with DG ECFIN short term projections 9as available in early 2013).

In 2010 the openness index[176] (trade to GDP ratio) of the EU economy is close to 30% which is assumed to be maintained until 2050, a trend which implies that exposure of the EU economy to foreign competition will increase in the long term. The reference projection assumes that the EU maintains a trade surplus over the projection period which is slightly below 1% of GDP.

The main trading partners of EU are the USA and China for exports[177] and the USA, China and Russia for imports[178]. The EU has currently a trade surplus in services, intermediate

[176] (Exports + Imports) / GDP. In this calculation exports and imports do not include intra-EU trade.
[177] These two countries represent nearly 30% of total EU exports
[178] These countries represent 33% of total EU imports

goods and equipment goods but a trade deficit in energy goods, metals and consumer goods. The reference scenario projects trade surplus to be maintained and even reinforced in services, to be maintained by weaken over time in intermediate goods but to gradually revert to a deficit in equipment goods. The projection involves continuation of trade deficits in energy and consumer goods. These trends reflect growth driven by a higher share of services sector and general reliance on growing contribution of knowledge capital in all sectors allowing activity to produce more high value-added commodities and less material-intensive ones. Foreign competition pressure are shown to increasingly intensify in the equipment and intermediate goods industries as a result of spill over of technology progress in these sectors towards emerging economies. Trade deficit of the EU is projected to persist in sectors depending on labour costs, such as consumer goods industry, and in sectors depending on resources costs, including intermediate commodities notably ferrous and non-ferrous metals.

Table 49: EU28 GDP growth and components in the Reference scenario

EU28	b$2010			Annual % changes		
	2010	2020	2025	2020	2025	2010-2025
Gross Domestic Product	16259	19169	20758	1.7	1.6	1.6
Investment	3178	3791	4111	1.8	1.6	1.7
Public Consumption	3421	3906	4235	1.3	1.6	1.4
Private Consumption	9463	11191	12114	1.7	1.6	1.7
Trade Balance (% of GDP)	1.2%	1.5%	1.4%			

Source: GEM-E3

Table 50: Rest of the World GDP growth in the Reference scenario

Gross Domestic Product	2010	2020	2025	2020	2025	2010-2025
Brazil	1266	1779	2067	3.5	3.0	3.3
Canada	1432	1784	2017	2.2	2.5	2.3
China	4492	9175	12463	7.4	6.3	7.0
India	1445	2686	3573	6.4	5.9	6.2
Japan	5366	6014	6439	1.1	1.4	1.2
USA	15696	20564	23134	2.7	2.4	2.6
Russia	1050	1494	1683	3.6	2.4	3.2
Rest of G20	4915	7137	8449	3.8	3.4	3.7
Rest of the World	6005	8835	10636	3.9	3.8	3.9

Source: GEM-E3

Table 51: EU28 Openness indicator

EU28	2010	2020	2025
Openess	26%	27%	28%

Source: GEM-E3

As mentioned the reference scenario projects a restructuring of the EU economy towards higher shares of services in the future and a shift towards higher value added and less resource intensive production. Energy intensive industries, which are mostly depending on energy costs, represent a small share in total value added (4% in 2010) which is projected to further decrease over time.

Table 52: EU28 trade balance (exports - imports) in commodities and services

Trade Balance (in b$ 2010)	2010	2015	2020	2025
Agriculture	-41	-51	-61	-64
Energy	-250	-262	-277	-299
Intermediate goods	37	133	170	176
Equipment goods	115	65	-12	-87
Consumer goods	-61	-118	-164	-206
Services	396	510	629	786
Total	198	277	286	307
Details about intermediate goods				
Metals	-48	-8	-9	-19
Chemicals	73	139	172	186
Non Metallic Minerals	-6	-7	-6	-8
Paper and Pulp	18	10	12	17
Details about equipment goods				
Electric goods	-154	-162	-169	-176
Transport equipment	102	108	96	99
Other equipment goods	167	118	62	-9

Source: GEM-E3

Table 52 shows a strong increase in the terms of trade for the services sectors. This result is linked to the on-going tertiarisation of the EU economy but may also be related to the assumption of a fixed current account.

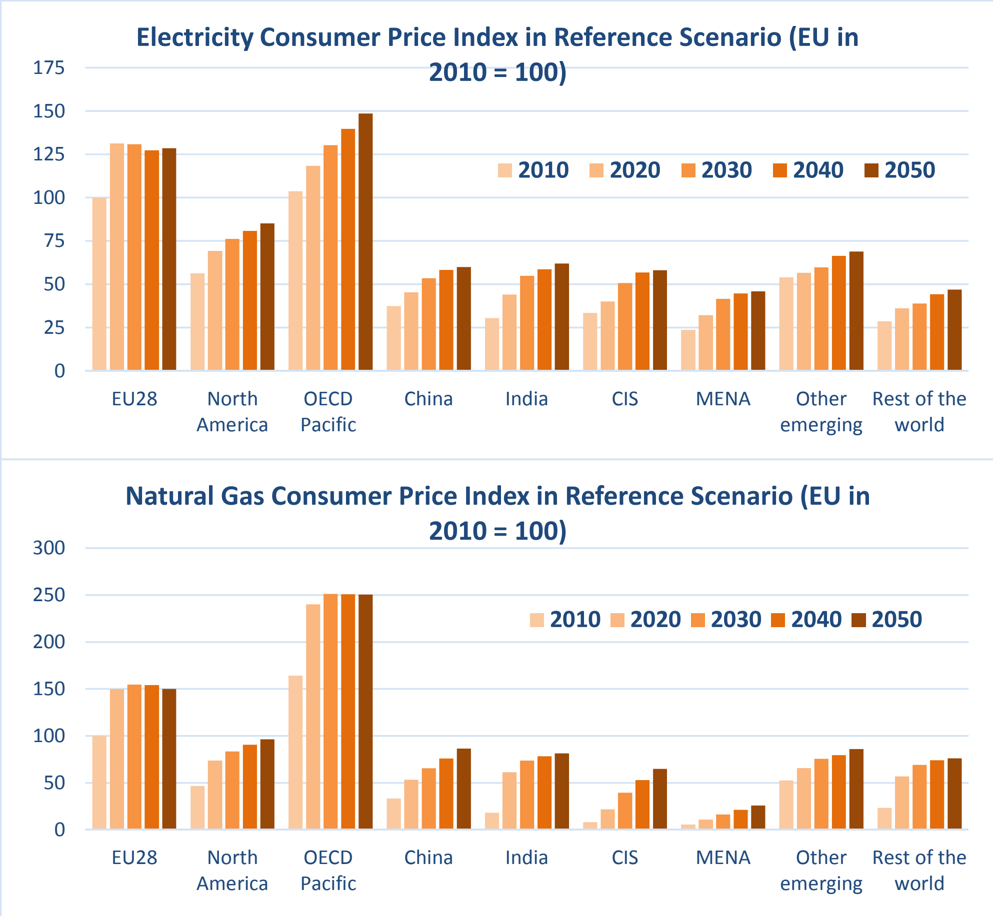
Table 53: Average EU electricity price in the Reference scenario

Annual growth rates	2011-2020	2021-2030	2031-2050
Average end-consumer prices	2.76%	-0.04%	-0.09%
Electricity generation costs	2.40%	-0.17%	-0.19%
of which fuel costs	1.36%	-0.78%	-0.49%
Grid and supply costs	2.35%	1.01%	0.57%
Taxation and ETS costs	22.02%	7.86%	0.93%
Recovery of RES support	22.57%	-4.70%	-23.45%

Source: GEM-E3 and PRIMES

The price of electricity is calculated on the basis of generation costs, the recovery of investment expenditures in grid infrastructure, the costs of renewable support schemes, the ETS auction payments and the applicable taxes. In the reference scenario electricity prices are shown to increase mainly until 2020 as a consequence of rising gas prices, assumed in the reference scenario context and the increased costs for renewables.

Figure 135: Electricity and gas consumer price index projections in the Reference scenario (based on PRIMES and PROMETHEUS models)



The rise of electricity prices is shown to stop after 2020. This is driven mainly by the projected decoupling of gas to oil prices and the modest increase of gas and coal prices after 2020. Productivity in electricity generation and supply also increases after 2020 as new power plants are massively committed in the system which embody technologies with higher efficiency.

Although the system has increasing needs to recover capital costs as replacement of old generation capacities increases after 2020, given the ageing of power plants in the EU, technology progress allows compensation of higher capital costs by efficiency and unit cost reduction gains. ETS carbon prices are projected to increase after 2025 and reach significant levels driven by ETS Directive implementation which provide for a linear annual decrease of allowances (EUA) at an amount calculated by applying 1.74% on base year emissions. ETS auction payments by electricity generators are assumed to be reflected onto retail prices.

Costs of renewable support schemes are projected to significantly decrease after 2020 as a result of gradually decreasing feed-in tariff schemes, as renewable development after 2020 is mainly driven by ETS carbon prices and is facilitated by investment cost decreases due to learning trends. The drop of renewables cost compensates the projected increase in costs driven by ETS.

The gap of energy prices between EU and other countries (mainly with USA, Japan and China) is assumed to remain throughout the simulation period and to reduce along a relatively low pace of convergence over time (see Figure 135). The low price countries see increasing prices in the future but price levels in the long term remain well below the EU levels. Increasing and diverse energy prices are also projected by a number of studies including

IEA's WEO (2013). The reason of persisting price divergence is subsidization in the non-OECD countries. For North America it is due to emergence of non-conventional hydrocarbons which has allowed for price drops already before 2010.

4.2. Modelling results

Macroeconomic impacts of price increase in the EU

Overview of results

An increase in the prices of gas and electricity, unilaterally in the EU and non in the non-EU world, affects economic activity through multiple channels setting in motion substitutions between production factors, changes in foreign trade, restructuring of production and demand towards less energy intensive goods and services, etc.

Because electricity and gas cannot be perfectly substituted by other commodities or services, the increase of their prices implies higher costs to be borne by end-consumers of energy (firms and households) and as the resources of the economy are limited, the price rise implies a crowding out effect affecting expenditures in other goods and services. For households, the share of energy expenditures to total expenditures has to increase, given that gas and electricity products are considered as essential inputs and cannot be perfectly substituted. Thus purchasing power of income weakens which implies lower demand for non-energy related goods and services.

Also because of lack of substitution, production costs of energy consuming producers of goods and services will see increased costs (1.2% on average in 2025 above reference). Consequently prices of domestically produced goods and services have to increase which drives lower domestic demand both by households and by other production sectors using domestically produced goods and services as input production factors (demand for energy intensive products decreases by 1.0% in 2025).

Although substitutions away from electricity and gas are difficult, the consumption and production structures adapt as much as possible to alleviate the cost impacts of price rise and the economy finds a new equilibrium in capital and labour markets at lower price clearing levels (return on capital and wage rates) in order to mitigate downwards pressures stemming from lower domestic demand. So the substitutions and the market re-adjustments reduce the cost impact of price rises at levels below cost impacts that would be suggested by the initial share of electricity and gas in total costs by sector.

The model results show that at the new equilibrium, with electricity price increases of 25% and gas price increases of 17% unit cost of total households' consumption increases moderately by 0.4% on average in 2025 (driven by 6% increase of unit costs of all energy forms consumed by households) and average production cost of firms increases by 0.35% in 2025 while costs increase by 1.5% in energy intensive industries, compared to reference. Consumer price index increase by 0.59% and GDP deflator by 0.20% compared to reference in 2025. The cost and price impacts reduce beyond 2025 while electricity and gas price increases diminish by assumption.

Driven by the price rise and the lower income due to lower demand for labour, the rise of electricity and gas prices cause private consumption to drop (Table 54). Expenditure for purchasing non-energy commodities and services also decrease, including for the purchasing

of equipment goods which use electricity or gas. Nevertheless, energy intensity of households' consumption reduces compared to reference, by 1.5% approximately in 2025, but this gain is not sufficient to overcome the effect of price rise on final consumption.

Table 54: Impacts on Private Consumption (EU28)

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
B21a - Taxation case	-0.21	-0.28	-0.24
B21b - Taxation case	-0.35	-0.49	-0.45
B22 - Price mark-ups	-0.51	-0.59	-0.35
B24 - Generation Mix	-0.79	-0.71	-0.51

Source: GEM-E3

Production of goods and services becomes more energy efficient in all sectors, as a result of electricity and gas price rise: energy intensity decreases by 2.4% (3.5% in energy intensive production) in 2025 compared to reference but this improvement is not sufficient to offset overall cost increases. The effects of price rise on domestic activity and demand exert downward pressures on capital and labour markets leading to lower capital return rates and lower real wages (-0.1% for capital costs and -0.87% for labour costs in real terms in 2025, compared to reference). However, despite cost reductions in using primary production factors, domestic production sees price increases, except in few high labour intensive sectors (services). Therefore the increased prices of domestically produced goods and services moderately impacts foreign competitiveness in these sectors. Imports tend to increase and exports tend to decrease (Table 55 and Table 56). The readjustment of interest rates driven by the capital market re-balances the current account as percentage of GDP but despite this the trade balance deteriorates as a consequence of electricity and gas price increases. The structure of exports also changes, shifting in favour of highly priced exported goods and away from low priced goods (e.g. materials) which is shown as a slight increase of terms of trade (average price of exports over average price of imports) compared to the reference.

Table 55: Impacts on Imports (EU28)

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
B21a - Taxation case	0.00	0.02	0.01
B21b - Taxation case	-0.06	-0.06	-0.07
B22 - Price mark-ups	-0.04	0.01	0.03
B24 - Generation Mix	-0.21	-0.14	-0.11

Source: GEM-E3

Table 56: Impacts on Exports (EU28)

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
B21a - Taxation case	-0.22	-0.25	-0.20
B21b - Taxation case	-0.32	-0.38	-0.33
B22 - Price mark-ups	-0.30	-0.30	-0.17
B24 - Generation Mix	-0.41	-0.39	-0.27

Source: GEM-E3

Private consumption decreases and because of rising EU production costs consumption shifts towards non-European goods, exports decrease and hence overall domestic production

decreases. The decline in the activity of sectors exerts a downward pressure in the demand for labour and capital which is partly offset by the substitution effects among production factors, induced by higher electricity and gas prices. Production shifts towards more capital and/or labour intensive methods of production because of substitution. Nevertheless the net effect for both the capital and the labour market is negative as the potentials for substituting energy with capital and/or labour are very limited. So the demand reduction effect dominates leading to lower demand for labour and capital. The downward pressure on capital and labour markets imply lower equilibrium prices which mitigate but do not cancel the volume effects.

Table 57: Unemployment Rate (EU28)

(p.p. difference from reference)	2020	2025
B21a - Taxation case	0.23	0.30
B21b - Taxation case	0.52	0.60
B22 - Price mark-ups	0.51	0.55
B24 - Generation Mix	0.33	0.36

Source: GEM-E3

Table 58: Real Average labour cost (EU28)

(% change from the reference case)	2020	2025
B21a - Taxation case	-0.71	-0.87
B21b - Taxation case	-0.47	-0.66
B22 - Price mark-ups	-0.47	-0.64
B24 - Generation Mix	-0.25	-0.31

Source: GEM-E3

Higher unemployment rates (Table 57) along with lower wages and capital return rates are indicated (Table 58), although the labour and the capital markets do dispose some degree of flexibility. If gas and electricity price rise as a result of additional taxation, and assuming that the additional state revenues are used to reduce labour costs, by decreasing the employer's contributions to the social security system, the reduction of the effective cost of labour has positive influence in the labour market, increasing employment as compared to other scenarios with higher energy prices (Mark-up, High RES and Energy tax with lump-sum transfers to households).

In the labour intensive sectors, where human capital is the most important factor of production, unlike the energy intensive ones, experience some slight gain in competitiveness and an increase in their demand from trade due to the lower labour costs. In these sectors, notably some services sectors, exports increase on average by 0.4% over the period 2015-2050 compared to the reference.

The depression of demand and the reduction of rates of return on capital go together with slowing down of investments which is dynamically captured in the model. Investment expenditures reduce (Table 59), as demand growth expectations reduce. Lower investment implies lower demand for equipment goods, services and construction which are used to build investment; this adds to the depression of total domestic demand. In addition, the reduction of the rate of return on capital, makes investment in the EU less attractive and induces re-orientation of global capital flows which exerts pressures on the current account towards a deficit. Thus lending becomes more expensive and also savings increase which further implies lower consumption. If mark-ups in electricity and gas supply are the causes of electricity and

gas price increases capital income increases and these extra revenues are recycled back in the economy acting in favour of investment; thus the increased availability of funding favours overall investment in the economy and despite the depression of demand investment slightly increases dynamically over time (0.001% over the period 2015-2050 compared to the reference) helping to attenuate quickly the adverse effects of the price rise on domestic activity.

Table 59: Impacts on Investment (EU28)

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
B21a - Taxation case	-0.18	-0.26	-0.18
B21b - Taxation case	-0.51	-0.64	-0.53
B22 - Price mark-ups	-0.04	-0.04	0.00
B24 - Generation Mix	0.15	-0.26	-0.16

Source: GEM-E3

The model results confirm that all high energy prices scenarios imply lower EU GDP relative to the reference case (Table 60). Depending on the causes that drive the increase in energy prices the negative impact on GDP is different in magnitude and on each GDP component.

Table 60: Impacts on GDP (EU28)

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
B21a - Taxation case	-0.19	-0.25	-0.22
B21b - Taxation case	-0.34	-0.46	-0.41
B22 - Price mark-ups	-0.35	-0.40	-0.23
B24 - Generation Mix	-0.46	-0.50	-0.36

Source: GEM-E3

The impact of loss of competitiveness on trade is significant for energy intensive products. The adverse effects are far more pronounced on energy intensive products which are more exposed to foreign trade, primarily on ferrous and non-ferrous metals, but also on chemicals. Impacts are lower on non-metallic minerals and on paper which are less exposed to trade and are more related to domestic demand as trade implies high transportation costs.

Table 61: Impacts on trade of energy intensive products in taxation case B21a (EU28)

	% change of Exports		% change of Imports	
EU28	2020	2025	2020	2025
Ferrous metals	-7.85	-9.05	6.42	7.49
Non ferrous metals	-5.75	-6.66	5.12	5.87
Chemical Products	-1.96	-2.36	1.94	2.29
Paper Products	-1.57	-1.81	1.37	1.56
Non metallic minerals	-0.81	-1.02	0.42	0.48
Entire economy	-0.22	-0.25	0.00	0.02

Source: GEM-E3

The consequences of gas and electricity price rise is thus more severe for the energy intensive sectors whose production costs rely heavily on energy inputs. Driven by depressed domestic

demand, lower exports and higher imports, domestic production of energy intensive industries is significantly reduced in all scenarios (Table 63, Table 62 and Table 64). As a result, trade surplus of the EU in the energy intensive industries decreases over the period 2015-2050.

Table 62: Impacts on production of energy-intensive industries (EU28)

(% change from reference cumulatively over 2015-2050)	Ferrous metals	Non ferrous metals	Chemical Products	Paper Products	Non metallic minerals
B21a - Taxation case	-2.69	-1.43	-0.97	-0.39	-0.61
B21b - Taxation case	-2.98	-1.73	-1.17	-0.59	-0.86
B22 - Price mark-ups	-2.68	-1.42	-0.97	-0.44	-0.52
B24 - Generation Mix	-1.34	-0.88	-0.67	-0.50	-0.41

Source: GEM-E3

Table 63: Impacts on imports of energy-intensive products (EU28)

(% change from reference cumulatively over 2015-2050)	Ferrous metals	Non ferrous metals	Chemical Products	Paper Products	Non metallic minerals
B21a - Taxation case	4.64	3.21	1.36	0.87	0.25
B21b - Taxation case	4.50	3.16	1.29	0.82	0.08
B22 - Price mark-ups	4.74	3.35	1.31	0.38	0.80
B24 - Generation Mix	1.51	1.19	0.43	0.23	0.05

Source: GEM-E3

If price changes are perceived by firms as a permanent rather than a temporary shock the effects are higher on the European economy. The model-based simulations have assumed that price changes are permanent but their intensity changes over time as the price increases tend to vanish in the long term. So the model captures dynamic re-adjustment of the EU economy and shows some degree of attenuation of adverse effects in the long term.

Table 64: Impacts on exports of energy-intensive products (EU28)

(% change from reference cumulatively over 2015-2050)	Ferrous metals	Non ferrous metals	Chemical Products	Paper Products	Non metallic minerals
B21a - Taxation case	-5.95	-4.47	-1.49	-1.24	-0.72
B21b - Taxation case	-6.18	-4.73	-1.60	-1.40	-0.81
B22 - Price mark-ups	-6.02	-4.56	-1.43	-1.22	-0.71
B24 - Generation Mix	-2.53	-2.08	-0.75	-0.75	-0.38

Source: GEM-E3

Nonetheless the model does not capture readjustment effects stemming from changes in R&D and induced productivity. The change in the relative prices of factors of production creates incentives for the firms to invest more funds on R&D to improve energy efficient methods of production. Technological progress creates the potential for a rebound effect in the European competitiveness, compensating for the increased price of energy inputs. Nonetheless, the induced technological change cannot fully offset the effect of higher prices on unit production costs as energy (and in particular electricity and gas) is an essential input in production. Negative effects will be mitigated but will still persist although the long run resilience of the economy to energy price increases will be higher. Despite not fully capturing the induced

technological progress, the model results show significant improvement of energy intensity and reduction in emissions.

In conclusion the modelling indicates that 17% to 25% higher electricity and gas prices will reduce the European GDP growth by 0.2% - 0.45%, with the magnitude being dependent on the trade openness of the sectors who contribute the most to the value added of the economy and the form of revenue use, and it is expected that this reduction will be accompanied by a transformation towards higher shares of services and less energy-dependent goods.

Scenarios B21a and B21b: Taxation of electricity and gas

These scenarios explore the impacts of rising taxation of electricity and gas as a possible cause of electricity and gas price rise. As described in the previous section, domestic rise of electricity and gas prices in the EU asymmetrically has negative effects on GDP, domestic activity and private income due to crowding out effects and through the weakening of foreign competition. The intensity of impacts assuming taxation as the cause of price rise is similar to findings of simulation of impacts by other possible causes. But it is worth mentioning that the indirect effects of how taxation revenues are recycled aback to the economy constitute an important consideration as the results show that the recycling scheme is not at all neutral regarding the impacts on the economy. Two different recycling schemes have been examined:

i) The revenues are used to reduce social security contributions of employers and thus help reducing labour cost (**B21a**).

ii) The revenues from increased energy taxation are directed to households so as to increase their income and sustain private consumption (**B21b**)

The negative effects on GDP are significantly more pronounced in the second case. Consumption changes resulting from an increase in the disposable income of households fail to compensate for the competitiveness loss in EU due to higher electricity and gas prices. The increased costs of production undermine the competitiveness of European sectors and the demand for EU products from abroad falls by 0.28% in 2025 (compared to the reference). Although public transfers support households' income the incurred loss in competitiveness drives the EU GDP down (-0.44% cumulatively) as exports deteriorate (-0.23% cumulatively over the period 2015-2050 as compared to the reference).

Additional income of households is spent on both domestic and imported goods. Thus part of the additional income translates into demand for goods produced by non-EU countries. In this scenario imports are sustained from higher household demand for imported goods as preference shifts over relatively cheaper imported goods (-0.03% cumulatively over the period 2015-2050). At a sectoral level, the increase in total production cost of energy intensive sectors (-1.5% on average in 2025 compared to the reference) is higher among the two taxation cases and this implies stronger adverse effects on production and exports (they reduce by 2.0% and 3.5% respectively in 2025 in the second taxation case).

Recycling tax revenues so as to reduce social security contribution rates implies lower labour costs and this partly offsets cost impacts of electricity and gas prices on production costs and mitigates price increasing trends in the economy. Thus competitiveness losses are also alleviated and so depressive effects on domestic demand are mitigated, compared to the alternative taxation case. The decrease in the cost of labour sustains demand for labour and as a consequence the reduction in wage income is mitigated, hence the effect of higher energy prices on private consumption (-0.3% in 2025 compared to the reference) is lower than in the alternative taxation case.

The beneficial effects of recycling taxation revenues towards reducing labour costs hold true also for energy-intensive industries although they are not labour intensive. This finding is attributed less to direct consequences on competitiveness but rather to general economic multiplier effects because the labour cost reductions has overall demand sustaining effects in the economy hence positively affecting domestic demand addressed to energy-intensive industries. In addition, negative effects of taxation cases on investment and construction are also mitigated in case of recycling in favour of reducing labour costs which also favours demand addressed to energy-intensive industries.

Taxing electricity and gas and recycling revenues to households has found to exert the highest, among all cases, negative impact on energy intensive sectors. In cumulative terms, the mitigation of negative effects on production due to recycling taxation revenues in favour of labour costs is 0.30 percentage points (annual change) for metal products and 0.20 percentage points for the rest of energy-intensive products.

Table 65: Impacts on production by sector in the two taxation cases (EU28)

(cumulative % change from reference over the period 2015-2050)	B21 - Taxation case (a)	B21a - Taxation case (b)
Agriculture	-0.12	-0.30
Industry (energy intensive)	-1.03	-1.26
Consumer goods industries	-0.23	-0.42
Equipment goods	-0.15	-0.46
Construction	-0.23	-0.50
Transport	-0.17	-0.31
Services	-0.08	-0.23

Source: GEM-E3

Labour cost reductions result in net competitiveness gains for labour intensive industries (e.g. services) and as a consequence exports increase and imports decrease, despite the increase of electricity and gas prices. The gains from trade are, however, not sufficient to drive positive effects on domestic production of the services sector, because of lower domestic demand. The impacts on domestic activity are mitigated for all sectors in the recycling case towards labour costs (Table 65).

The overall effect on the trade balance of non-energy intensive sectors is found to be positive. The loss of exports of energy-intensive products is partly compensated by higher exports of services and other low energy-intensive products. These sectors benefit from cost reductions due to labour and capital unit costs which as mentioned above decrease in the taxation scenarios as a result of the overall depression of activity (Table 66).

Table 66: Trade balance (EU28)

(% change from reference cumulatively over 2015-2050)	Agriculture	Energy intensive industries	Consumer goods	Equipment goods	Transport	Services
B21a - Taxation case	-1.8	-17.3	0.1	-3.1	0.2	1.1
B21b - Taxation case	-1.7	-17.6	0.3	-2.4	0.2	1.0

The signs stand for deficit (-) or surplus (+)
Source: GEM-E3

Scenario B22: Higher mark-ups on electricity and gas costs

In scenario B22 higher costs mark-up in the electricity and gas prices, assumed to be the cause of electricity and gas price rises, imply higher operating surpluses in the electricity and gas sectors. Households and firms collect higher dividends and funding of investment is potentially higher although for individuals the additional income is also used for consumption purposes. Consequently, investment is found to be less affected in this scenario than in any other of the EU price increase scenarios. This result has to be considered with caution because it is due to modelling assumptions reflecting the general equilibrium approach of the model. Market failures or non-optimal capital flows seen in reality as driving less efficient outcomes of mark-up based revenues; these are not captured by the model.

Sustaining investment has dynamic impacts in the economy which are captured by the model. Although the negative effects on GDP are of the same order of magnitude as in the other EU price rising scenarios, the long term effects on GDP are lower: the pace of vanishing GDP impacts is much faster than in any other scenario.

Nonetheless, the mark-up scenario shows higher negative effects on GDP than the labour cost recycling taxation case during the period of peaking price differential for electricity and gas.

Scenario B24: Higher price only for electricity driven by generation mix

For scenario B24 it is assumed that non-optimal investment in expensive renewables takes place in electricity generation and drives higher electricity prices (9% above reference in 2025), as capacity expansion hence generation mix deviates from optimality as simulated in the context of the reference scenario. It is also assumed that in order to finance the additional investment requirements in electricity sector, funds are drawn from households which implies that income is reduced and private consumption has also to decrease. The additional investment expenditure in electricity sector, although accounted for in total investment, is not driving additional productive capacity as it is assumed that capacity remains unchanged and that only unit cost of investment in electricity sector increases. Obviously this assumption corresponds to loss of efficiency in the economy and lower demand by households. In addition, the high capital requirements in electricity sector stress capital markets and lead to higher average cost of capital which has adverse effects on costs in other sectors and as a consequence activity decreases, economy-wide, also driven by lower private consumption. Gas prices are assumed not to change relative to reference. So average energy costs in industry is less affected than in other scenarios.

The increase in investment costs due to capacity expansion towards inefficient renewable energy forms implies higher demand for equipment goods used to build the renewables. This

effect is however small and fails to counteract the effects of dropping demand driven by crowding out effects to the detriment of private consumption.

Compared to taxation scenarios, B24 shows significantly higher negative impacts on GDP and on production by sector but also significantly lower negative effects on energy-intensive industry. The latter effect is due to the energy price costs which increase in B24 much less than in the taxation scenarios.

Scenario B23: Low electricity and gas prices in the non – EU countries

The B23 scenario differs from the other because it is assumed that electricity and gas prices reduce in the non-EU countries and not in the EU, which is quite different from assuming price rise indigenously in the EU.

In the B23 scenario the non-EU countries collect benefits from getting higher access to low cost energy resources and to more productive extraction of gas; as electricity and gas prices reduce in these countries, economic growth is boosted and demand addressed also to the EU increases. In addition, product prices in the non-EU countries decrease and so EU can import goods at lower prices relative to the reference. The non-propagation of energy price decreases in the EU implies competitiveness losses for the European goods and services which implies trends towards EU imports and lower exports by the EU. This exerts negative effects on the EU economy. So, in the B23 scenario the EU is affected by two mainly counteracting mechanisms: higher demand from abroad and lower prices of the goods sold in the EU which have positive effects on demand and deteriorated trade competitiveness which has negative effects on activity.

The additional growth in non EU countries driven by lower energy costs is found to amount to 0.6% for GDP and 0.8% for consumption, cumulatively over the period 2015-2050 compared to the reference case. This increase sustains the demand primarily for non-energy intensive European goods and services hence exports of EU increase (0.6% over the period 2015-2050 as compared to the reference). In addition EU is benefitting from cheaper imports and private consumption increases marginally by 0.01% over the period 2015-2050 compared to reference.

The decrease in energy costs induce competitiveness gains for energy intensive industries located outside the EU and increase imports' penetration in the European market. Imports by the EU increase by 2.0% over the period 2015-2050. Nevertheless the recorded reduction in the production of the European energy intensive industries is lower than in other scenario examined (-0.6% over the period 2015-2050) due to higher global demand. Changes in domestic (EU) demand induced by negative income effect (i.e. the increase in prices reduces real income thus demand) are moderated since the cost of living does not increase. Therefore changes in production in the EU (for energy intensive industries) are driven primarily by changes in foreign trade. Trade balance in the EU worsens as a consequence of the shift towards the consumption of cheaper imported products and GDP remains stable (0.02%) as compared to the reference.

Table 67: Macroeconomic effects on the EU of asymmetrically lower prices in non-EU world

(% change from the reference case)	2020	2025	Cumulative (2015-2050)
GDP	-0.03	-0.04	-0.02
Private Consumption	-0.02	-0.02	0.00
Investment	0.01	0.01	0.02
Imports	0.49	0.61	0.45
Exports	0.31	0.36	0.24
Impacts on production of energy-intensive industries	-0.86	-0.99	-0.60
Impacts on imports of energy-intensive products	3.57	4.04	2.34
Impacts on exports of energy-intensive products	-2.03	-2.30	-1.34
Impacts on Unemployment Rate (p.p. diff.)	0.01	0.01	
Real Average labor cost	-0.01	-0.01	

Source: GEM-E3

4.3. Chapter conclusions

The aim of the present chapter has been to quantify economic impacts on the EU economy of future price differentials for electricity and gas between the EU and the non-EU world. From a modelling perspective, scenarios have been quantified using the GEM-E3 global general equilibrium model, in which electricity and gas price rise in the EU has been hypothetically driven by taxation and other possible causes. A different scenario has been also quantified in which electricity and gas price reductions take place in the non-EU world and do not propagate to the EU. These are obviously stylized scenario cases. The results are compared to a reference scenario, also quantified using GEM-E3, which mirrors the recently published Reference 2013 scenario of the European Commission.

The model results clearly show that a strong asymmetric **rise of electricity and gas prices** in the EU would have adverse effects on the economy, **depresses domestic demand**, activity and investment. The energy intensive industries could suffer from loss of competitiveness due to energy prices and see diminishing shares in global markets. Adjustments in capital and labour markets towards lower capital and labour prices driven by lower demand would not appear to offset competitiveness losses. Substitutions towards less energy intensive production and consumption patterns, as far as captured by the model, are also unable to fully alleviate consequences. It is worth considering more closely the causes of energy price rises because they have different economic effects. **Raising taxation of electricity and gas but using tax revenues to reduce labour costs, through social security accounting, was found to be the most beneficial among the cases examined for GDP and private consumption, but also for competitiveness.** However, despite labour cost reductions the negative effects in the EU economy remain. Recycling taxation revenues as lump-sum transfers to households was found to be less beneficial for GDP, welfare and sectoral activity than reducing labour costs. This is a finding which is shared by a vast literature on possible double dividend analysis (for environment and employment).

Electricity and gas price rises driven by market power in electricity and gas supply was found to exert negative effects on the economy in the medium term but to present a different dynamic pattern showing rapid deceleration of negative impacts. This is due to the dynamics of investment which is shown to sustain in this scenario due to higher returns on capital. Nonetheless the economic effects remain detrimental to private consumption and welfare.

A different case of price differential is when prices of electricity and gas decrease in the non-EU world but not in the EU. Assuming that productivity and cheap resources drive the price drop, **the non-EU world benefits from lower costs allowing for higher growth**. Hence, global demand increases in this scenario and the EU collects benefits from higher demand addressed also to the EU and from lower cost imports, the latter being beneficial to domestic private consumption. The EU still bears negative effects on activity stemming from the undermining of competitiveness, but **the overall the effects are neutral or even slightly positive on the EU, as benefits collected from abroad almost offset impacts of competitiveness losses.** So this case fully contrasts the cases where electricity and gas price differentials are due to indigenous reasons in the EU.

Details are provided by sector of activity. The results confirm the vulnerability of energy intensive industries in particular those that are exposed to foreign competition, such as metals and chemicals. In all scenarios, activity in these industries is significantly more reduced than in other industries. It was found that some of the low energy-intensive sectors, such as the services, may even profit from capital and labour cost decreases in some of the scenarios.

Annex 1. Electricity and gas price evolution: results by Member State

As part of the data-collection exercise for this report, Member States provided the Commission with data on energy prices for electricity and natural gas for median industrial and domestic consumption bands in two years, 2008 and 2012. In this data (referred to as *Metadata* in the report), prices were broken down first into the categories of energy and supply costs, network costs and taxes and levies. These sub-headings were then broken down further into individual components: for example, network costs were divided into the cost of transmission and the cost of distribution; taxes and levies were decomposed into excise taxes, VAT and other special levies.

This Annex is based on the results from the Metadata analysis, intended to improve understanding of the exact composition of each price component (energy and supply, network, taxes and levies). Throughout the report the Metadata was used only in cases where a comparable – though not as disaggregated – data is not available from Eurostat, namely in the case of breakdown by price component of retail prices for natural gas for households and industrial users.

The level of detail in which Member States reported their energy prices in the *Metadata* varied significantly. In some cases, network costs were reported as a single, undifferentiated item; in others, they were broken down into as many as five separate components. The same is true of energy and supply costs and taxes and levies.

There were also significant differences in the ways in which Member States categorised certain kinds of charges. The heading energy and supply costs, for example, does not always designate the same set of charges and activities in each country. It is important to bear these inconsistencies in mind when considering the data, as they complicate the task of comparing the breakdown of Member States' prices. To take the most salient example, the part of the electricity bill relating to support for renewable energy generation is counted variously as an energy and supply cost (Belgium, United Kingdom, Spain), as a part of network charges (Czech Republic, Slovakia, Denmark) or most commonly as a levy (Austria, Germany, various other Member States).

EU	For the EU as a whole, between 2008 and 2012 retail electricity prices rose for both industrial and domestic consumers, by 17.28% and 12.87% respectively. For domestic consumers, this equated to a rise of 2.98c per kWh, of which 1.76c were attributable to taxes (including VAT). Looking at the HEPI weighted average for capital cities of 15 EU Member States[179], energy and supply costs rose by 3.39% and network costs by 32.33%. Gas prices also rose across the EU, although to a lesser extent than electricity prices – domestic prices rose by 13.67% and industrial ones by 5%. The main driver in this change for domestic consumers was non-tax costs, although proportionally the greatest change was in taxes and levies.
AT	Between 2008 and 2012, Eurostat data shows that average Austrian electricity prices for domestic users rose by 14.2% to a level slightly above the EU average. This was mainly due to significant increases in energy and supply costs and network costs, although taxes and levies were the component which rose most sharply. Domestic gas prices also rose by over 23% to a level slightly over the EU average. For industry, the electricity price rises were more moderate, increases in the grid tariff and taxes (charges such as the community levy and renewables surcharge) tempered by

[179] Austria, Belgium, Denmark, Germany, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, UK.

	a decrease in energy and supply costs.
BE	Domestic electricity prices in Belgium were above the EU average in 2012. There was an increase of 3.3% from 2008 to 2012, of which a major part was due to rising distribution charges. For industrial consumers, electricity prices were consistently below EU averages but grew by 15.2%, again driven by increased distribution charges. Industrial gas prices fell by 10.7% in the same period thanks to decreasing energy and supply costs.
BG	Bulgarian gas prices rose sharply between 2008 and 2012, by 42.2% for domestic consumers and by 49.2% for industrial users. The main driver behind these rises were energy and supply costs, although VAT rises and (for industry) distribution costs were also significant factors. Electricity prices also rose, although not at the same rate, with the main driver being energy and supply costs, including the additional price for green energy. All electricity price components increased at roughly a similar rate (14-17%).
CY	In Cyprus, domestic electricity prices rose by 42.6% from 2008 to 2012, to levels well above the EU average. Industrial prices were volatile, rising 31.66% to levels almost double the EU average. The greatest percentage of the increase was in generation and supply costs, but the rise in VAT was also an important factor.
CZ	Eurostat databases show that Czech electricity prices for all users decreased slightly between 2008 and 2012. Increases in network costs, among which is counted the charge related to support for renewable generation and CHP, were offset by declining production supply costs. In the same period, domestic gas prices rose steeply (by nearly 25%), the changes driven by increases in energy and supply costs, while for industrial users this component actually decreased, leading to a fall of 13.4%.
DE	Industrial and domestic electricity prices in Germany each rose by over 20% from 2008 to 2012, driven in particular by an increase in taxes and levies. The EEG-Levy (financing renewable generation) and an increase in VAT were each important factors in the rise in this component. In parallel, gas prices decreased, falling in particular for domestic users by nearly 15% as the cost of energy and supply reduced.
DK	Electricity prices were among the highest in Europe for Danish users between 2008-2012, despite a significant fall in energy and supply costs. The single largest part of Denmark's electricity price was composed of the country's electricity tax, which in 2012 represented over 31% of the price paid by domestic users and a higher proportion for industry. The Increasing network costs also played a role in this, in particular the "Public Service Obligation", primarily financing support to RES[180]. Gas prices also rose in the same period, by 23.58% for industrial users, from cent EUR 3.86 / kWh to cent EUR 4.77 / kWh.
EE	Estonia's electricity prices remained below EU averages between 2008 and 2012, but proportionally saw some of the steepest rises, driven in particular by increases in taxes and levies, including charges introduced by the country's Renewable Energy Act. Gas prices also rose, by over 35% for industrial consumers, as distribution and transmission costs went up and VAT was increased.
ES	Domestic electricity prices rose steeply in Spain, from a level slightly below the EU average in 2008 to one above it in 2012. This increase of 46.1% was attributable in particular to increased distribution costs (which includes other, non-network costs and charges such as RES and tariff deficit financing), increased VAT and the increase in the special regime premium for RES and CHP generation. The pattern was the same, although increases less pronounced, for industrial users. Spanish domestic gas prices also rose by 39.5%, due to increases in VAT and network costs.

[180] See http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/NATIONAL_REPORTS/National%20Reporting%202010/NR_En/E10_NR_Denmark-EN_v2.pdf

FI	Increases in Finnish electricity prices from 2008 to 2012, of 22.5% for domestic and 11.3% for industrial consumers were driven in particular by growing network costs and an increase in taxes and levies. Industrial gas prices in this period increased by 42.6% to a level above the EU average. The major contributor to this increase was a rise in taxes and levies (in particular carbon dioxide tax) and a rise in energy and supply costs.
FR	In France, electricity price increases of around 27% between 2008 and 2012 were driven primarily by increases in all individual components. Increases in network costs were a significant factor, in particular for industry. Gas prices rose sharply for domestic consumers, by 17.99%, although taxes were not the major factor in this rise.
GR	Greek electricity prices rose steeply for both industrial and domestic consumers (29% and 37.3% respectively), although in both cases they remained below the EU average. In part these increases can be explained by the introduction of non-recoverable tax rates where previously there had been none. In 2012, gas prices in Greece were comfortably above the EU average for both domestic and industrial consumers.
HR	Although below the EU average, Croatia's domestic electricity prices rose by 16.9% between 2008 and 2012. Industrial price rises were more modest, in part due to a decrease in the network costs paid by industry. The country's gas prices rose sharply, by 70.4% and 104.6% for domestic and industrial consumers respectively. A VAT increase was one factor here, but the main cause was a major rise in the natural gas shipping rate.
HU	For Hungarian industrial consumers, electricity prices slightly decreased between 2008 and 2012, mainly due to decrease in energy supply costs. Rises for domestic consumers were mostly in line with the overall consumer price index, resulting from a fall in wholesale prices offset by rising transmission costs and increased VAT. Gas prices for both industry and domestic use fell, due to decreased supply costs.
IE	Gas prices rose in Ireland by 3.4% for domestic and 6.2% for industrial use, driven in each instance by an increase in taxes and levies. In both instances, Irish prices remained below EU averages. Electricity prices fell for industry by 1.8% thanks to a fall in energy and supply costs, while domestic prices rose by 9.1%. Tax increases, specifically the introduction of an energy tax, were a significant factor in rises for each sector.
IT	Electricity price rises in Italy were primarily driven by increases in taxes and levies, which for industrial users more than doubled and for domestic consumers increased by over 42%. Gas prices fell for industrial consumers but domestic prices rose by 34.4%.
LT	Lithuanian electricity prices rose by 46.6% for domestic and 39.8% for industrial uses, the largest portion of the increases owing to the rising energy price. For gas, there was a major rise in domestic bills of nearly 60%. Rising gas supply prices affected domestic consumers most significantly, with the increase in distribution costs also having a significant impact on all users.
LU	The most significant rises in Luxembourg's energy costs were for gas, where industrial prices rose by 25.4% and domestic ones by 15.6%. Major increases in wholesale gas prices drove this increase; distribution and transport tariffs decreased, and the tax component of gas bills fell or remained constant. Over the 2008-2012 time period, electricity prices increased only slightly, at just over 6% domestically and 3.5% for industry, thanks to a fall in the price of wholesale electricity.
LV	Although below EU averages, Latvia's electricity prices increased significantly (by 36.5% for domestic and 43% for industrial use). Rising charges to support renewable energy played a significant role in these increases, as did an increase in VAT. Distribution and transmission tariffs also went up. Gas prices rose by 12% for domestic consumers, affected again by rises in VAT.
MT	Malta's industry faced electricity prices above the EU average between 2008 and 2012. Industrial and domestic prices grew at a similar rate (11.2% to 10.7%). The rises were attributable to increases in the single largest component in bills, energy and supply costs.
NL	Energy and supply costs for electricity fell in the Netherlands, but increases in network (in

	particular transmission) costs of nearly 20% for domestic users and 13.4% for industry plus rising taxes and levies meant that there were price increases of 5.7% and 6% for households and industry respectively. Gas prices for industry fell by 0.9%, although they rose for households by 11.5%, due in part to a significant increase in the cost of transmission.
PL	Domestic consumers in Poland experienced electricity price increases of 18%, driven by energy and supply cost increases of 30% as well as rising cost of transmission and distribution. For industry, price rises were more modest, and the burden of network costs and taxes and levies actually decreased. Gas prices rose at similar rates for industry and household, by 11.8% and 12.4% respectively, with the main factor being the gas and supply costs.
PT	In Portugal, taxes and levies rose on domestic electricity consumption rose by over 107%, the most significant factor in an overall price increase of 35.3%. The major increase was in VAT, followed by increases in capacity payments and old stranded generation costs. For industry, transmission and distribution costs were the major contributor to a price rise of 48.9%. Domestic gas prices increased by 35.6%; again, the main driver of this increase was the rise VAT.
RO	Romania's electricity prices bucked the EU trend by decreasing over the 2008-2012 period, as both energy and supply and network costs fell. Domestic prices decreased by 2.5% and industrial ones by 7.2%. Gas prices, too, fell significantly; 18.5% for domestic consumers and 1.8% for industry, due to falling energy and supply costs.
SE	Electricity prices rose only very slightly (0.5%) for Swedish industry, but by a more significant margin (19.3%) for domestic users. Although energy and supply costs went down, significant increases in network costs (of over 43%) and taxes and levies ensured a net price rise. Gas prices also rose, by 24.8% for households, a decrease in energy and supply costs offset by in particular by increased taxes.
SI	Electricity prices for Slovenian industry fell by 4.3% between 2008 and 2012, thanks to the falling wholesale electricity price and reduced transmission and distribution costs. These decreases were partially counterbalanced by an increase in taxes and levies, in particular the excise tax on electricity consumption. Increases in network taxes and VAT pushed gas prices for industry up by 20.8%. Domestic electricity prices increased by 33.4% overall, with every individual component increasing. Rising energy and supply costs were the main price component but the cost of network distribution also contributed.
SK	In Slovakia, there were modest increases in the prices industry paid for energy, of 0.5% for electricity and 6% for gas. Household users faced greater rises, totalling 12.8% for electricity and 10.5% for gas. For electricity, network costs and taxes and levies accounted for a greater proportion of the rise than did energy and supply costs. For industry, the cost of charges related to the country's Renewable Energy Act in particular increased more than fourfold, pushing up network costs.
UK	In the UK, gas prices for domestic consumers rose steeply between 2008 and 2012, by around 20.9%. This was mainly due to increased wholesale costs. In the same period, gas network costs in the UK decreased. For industry, there was a more modest rise of 6%, although in each case the UK remained below the EU average. For domestic electricity users, a price increase of 11.4% was driven by rising energy and supply costs; network costs actually decreased by 21.4% in this period. Under the heading of energy and price costs were counted a number of schemes, such as the Renewables Obligation, the EU ETS and energy efficiency schemes which could be counted as levies and which acted to increase energy costs even though wholesale prices fell. For industrial users, an increase in network costs of 24.5% was the most significant factor in an electricity price increase of 12.8%. The single largest component of electricity bills remained the wholesale energy price, but overall increases in bills were driven by rising taxes and network costs.

Annex 2 Methodology for a bottom up analysis of industry sectors

The bottom-up case studies presented in the study compile data from energy intensive industrial sectors and sub-sectors, where the relative importance of gas and electricity as energy inputs in the overall energy and total production costs is high. Geographical coverage across the EU and the presence of big and small players have been factors in selecting the following sectors:

- Bricks and roof tiles – NACE code 2332
- Wall and floor tiles – NACE code 2331
- Flat glass – NACE code 2311
- Ammonia - refers to several Prodcom codes mainly under NACE 2015 'Manufacture of fertilisers and nitrogen compounds'
- Chlorine - refers to several Prodcom codes under NACE 2013 'Other inorganic basic chemicals' and also NACE 2014 'Other organic basic chemicals'
- Aluminium – NACE code 2442
- Steel – NACE code 2410

A standard questionnaire was circulated to potential respondents in each sector and sub-sector identified with the help of industry associations. Between August and October 2013, about 110 questionnaires were filled by respondents. Responses were checked for completeness. For each sector and subsector, industrial sites that responded to the questionnaires were sampled according to four main criteria:

- Geographical: include as many Member States as possible while accounting for the relative importance of each Member State in terms of total EU production capacity in the respective sector or sub-sector;

- Production capacity: ensure that the sample reflects the actual distribution of capacities across the EU and its regions;

- Production technology: ensure that the sample reflects the actual distribution of technologies across the EU and its regions;

- Size: ensure that the sample mirrors the reality of each sector in terms of proportion of SMEs and larger companies.

Based on the number and type of respondents in each sector as well as their Member State of origin, the criteria above have had different weight in the definition of samples and implied that, for some sectors, not all questionnaires received could be fully used.

The need to deal with the confidentiality of highly sensitive commercial information implied that data was presented anonymously, aggregated and/or indexed in order to ensure that it could not be attributed to any specific plant.

A way of dealing with the confidentiality constraint has been to present sector-specific results by broad regions (e.g. Central Northern Europe, Southern Europe, etc.). The composition of geographical regions may vary across sectors analysed due to the location of respondents, as well as again due to the confidentiality constraint.

The use of geographical aggregates implied that no analysis at country level was possible. In order to address this shortcoming, an assessment has been conducted also for four Member States - Germany, Italy, Poland and Spain – for which a sufficient number of questionnaires were collected across all covered sectors so as to allow country-specific analysis whilst ensuring the anonymity of plants.

The analysis looked first at the level and components of gas and electricity prices paid by industry operators and at their evolution over the period 2010-2012 (chapter 1). The collection of data on electricity and gas consumption and production volumes allowed presenting the relation between energy intensity and energy prices for anonymous exemplary plants. An attempt was made in order to assess the impact of energy prices and their components in terms of unit production costs (chapter 2). For some subsectors and after ensuring for comparability in terms of consumption range, it was possible to collect data on the level of electricity and gas prices paid by plants in some non-EU countries, allowing for comparison with the situation in the EU (chapter 3 and Annex 4).

The analysis of energy prices composition distinguishes the following price components: (i) production cost, (ii) network fees, (iii) non-recoverable taxes and levies (excluding VAT), (iv) RES support schemes: depending on the Member State where an installation is located, these are either part of the network fees or levies. Attribution to network fees or levies is sometimes subject to yearly change.

Energy efficiency and indirect costs (e.g.: emission costs) and the extent to which these indirect costs were passed on by utilities onto the final consumers have also been analysed. Changes in costs and efficiency indicators over a short period of time (between 2010 and 2012) does not provide a fully-fledged analysis on the observable trends in the industries.

A further underlying component of the electricity price is represented by the CO_2 indirect cost, that is, the CO_2 allowance price which is accounted for by electricity producers either as opportunity or as real cost and is passed over in the electricity price paid by consumers. However, with only few exceptions, this component cannot be easily detected as normally it does not appear in the electricity bill. Therefore, in the case studies presented, an attempt has also been made to estimate the average CO_2 indirect costs by sector and region. The impact of indirect costs is considered to be already implicitly included in the other price components reported, in particular in the energy supply component. In order to estimate CO_2 indirect costs, the average electricity intensity of respondents in each sector and region has been calculated and associated to regional CO_2 emission factors for electricity production as well as to assumptions in terms of CO_2 price pass-through rate from producers to final consumers. The results are presented in Textbox 3 in chapter 2.2.3.

All energy prices collected via the questionnaire and processed in the analysis exclude exemptions or reduction of taxes, levies and transmission costs and represent the final unit price paid by respondents.

The following tables show data on sampling for each case study:

- ***Bricks and roof tiles***

Size of the sample

Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison
23	13	13	13	8	6

Northern Europe includes 5 plants: IE, UK, BE, LU, NL, DK, SE, NO, LT, LV, FI, EE
Central Europe includes 3 plants: DE, PL, CZ, SK, AT, HU
Southern Europe includes 5 plants: FR, PT, ES, IT, SI, HR, BG, RO, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.

- ***Wall floor tiles***

Size of the sample

Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and margins
24	12	12	12	6	6	9

Central and Northern Europe includes 3 plants: IE, UK, BE, LU, NL, DK, DE, PL CZ, LV, LT, EE, SE, FI
South-Western Europe includes 5 plants: ES, PT, FR
South-Eastern Europe includes 4 plants: IT, SI, AT, HU, SK, HR, BU, RO, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculation based on questionnaires

- ***Float glass***

Size of the sample

Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs	Margins
10	10	10	7	10	7	4

All together, the 10 sampled plants represent about 19% of European production.
Western Europe includes 6 plants: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes 2 plants: BG, RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes 2 plants: IT, MT, CY, PT, ES, EL, SI
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculation based on questionnaires.

- ***Ammonia***

Size of the sample

Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs
10	10	10	10	10	7

All together, the 10 sampled plants represent about 26% of EU27 production

The sample includes 2 small, 4 medium and 4 large-sized plants, representing all together about 27% of total EU production capacity. The 10 plants are located in 10 different member states.

Western-Northern Europe includes: IE, UK, FR, BE, LU, NL, DE, AT, DK, SE, FI
Eastern Europe includes: RO, CZ, HU, EE, LT, LV, SK, PL
Southern Europe includes: IT, MT, CY, PT, ES, EL, SI, BG
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons. The number of sampled plants per region cannot be disclosed due to confidentiality.
Source: CEPS, calculation based on questionnaires.

- ***Chlorine***

Size of the sample

Number of questionnaires used in the case study

Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	Production costs
11	9	9	9	9	5

All together, the 9 sampled plants represent about 12% of EU27 production

Central-Northern Europe includes 6 plants: IE, UK, BE, LU, NL, DE, PL, CZ, LV, LT, EE, DK, SE, FI
Southern-Western Europe includes 3 plants: ES, PT, FR
For remaining MS, no questionnaires were received and no averages could be calculated.
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculation based on questionnaires.

- ***Primary aluminium***

The evidence presented in the case study for aluminium is based on data collected via a questionnaire from a sample of 11 out of the 16 primary smelters in the EU, representing more than 60% of EU primary aluminium production in 2012. These data were also validated and integrated using the CRU database

No sampling by geographical region is presented. The averages calculated for the whole sample are compared to averages obtained for two subsamples: subsample 1 refers to plants which procure electricity through long-term contracts or self-generation (or long term contracts) while subsample 2 refers to plants which procure electricity in the wholesale market.

- ***Steel***

Size of the sample

Number of questionnaires used in the case study

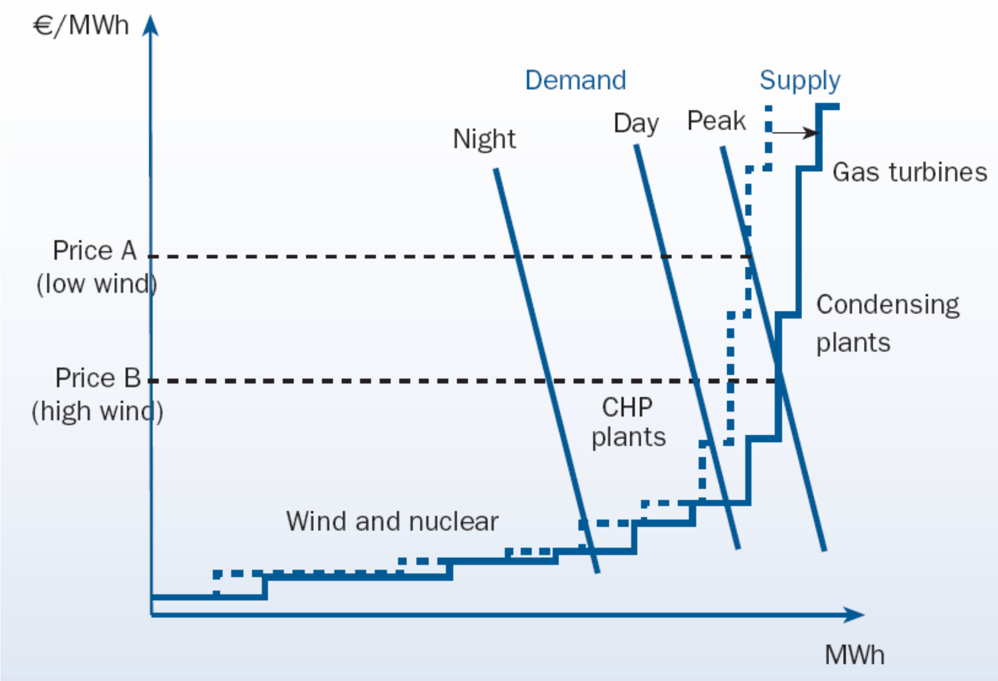
Received	Selected in the sample	Energy prices trends	Energy bill components	Energy intensity	International comparison	Production costs and Margins
17	17	15 (gas) 17 (electr.)	14 (gas) 17 (electr.)	11 (gas) 14 (electr.)	3	*

North-Western Europe includes 9 plants: FR, BE, LU, NL, IE, UK, DE, AT, DK, FI, SE
Central and Eastern Europe includes 3 plants: PL, SI, HU, RO, BG, CZ, SK, EE, LV, LT
Southern Europe includes 5 plants: IT, ES, PT, EL, MT, CY
Note that sampled plants do not come from all the MS in one region. The specific countries cannot be indicated due to confidentiality reasons.
Source: CEPS, calculation based on questionnaires.

Annex 3. The merit order effect

Estimates of the surcharge for renewable energy are estimates of the difference between market prices and revenue of supported technologies. It is however important to note that these estimates are not representing the total costs of renewable energy for at least two reasons: a) they include the decrease in wholesale market prices caused by renewable energy (the merit-order effect[181]), but *negatively*; when renewable energy reduces wholesale electricity prices, the support level appears larger, as the gap between wholesale prices and support levels increases, and b) large fractions of the industry in Member States is partly or wholly exempted[182] from the surcharge in order to avoid carbon leakage and to ensure that the industry remain competitive.

Figure 136: Schematic description of the merit-order effect (Poyry 2010)



<u>What is the merit-order effect?</u>

The quantity of the merit-order effect depends on the shape of the merit-order (thereby its name). The figure below shows how wind electricity injection has different price impacts depending the time of the day and the marginal supply at that time. An overall estimation of its overall impact therefore requires an assessment of the impact throughout the year, hour by hour.

The merit-order effect is evaluated in several scientific studies which indicate that the additional supply of electricity from renewable sources reduces the spot price, and sometime so much that it outweighs the costs of the subsidies. The table below shows some of the results of the literature for Member States in Europe; it shows that for wind electricity in Spain and Ireland the benefits for electricity consumers in terms of reduction in whole-sale prices outweigh the costs of subsidies. For a range of renewable technologies that was in the

[181] Renewable electricity typically has insignificant operational costs, and thus shifts the merit-order to the right, thus decreasing the whole-sale market price for electricity. The merit-order effect is essentially a shift of wealth from incumbent producer's surpluses to consumers.
[182] 47% of German industry's electricity consumption is fully part of the EEG system (financing of RES in Germany)

market in 2006 in Germany, the picture is the same. However, after the significant increase in PV in Germany in the period 2009 – 2012, the costs of subsidies increased, and the balance got negative, with costs of subsidies being larger than the benefit of the reduction in whole-sale prices.

Author:	Member State:	Technology:	Merit-order effect: [€/MWh]	Merit-order effects minus support cost [€/MWh]
Gil. et al. 2013	Spain	Wind	44.9	16.7
Sensful et al. 2008	Germany (2006)	RES-E	95	26[183]
Saenz de Miera et al. 2007	Spain	Wind	51.4	12.4
O'Mahoney et al. 2011	Ireland	Wind		47.7[184]
Öko-Institut (2012)	Germany	RES-E		-45[185]

More information on the merit-order effect and its magnitude can be found elsewhere[186]. The benefits of reduced whole-sale market price caused by renewable electricity should however be allocated efficiently to cover the external costs of increased renewable electricity, like the costs of increased storage and flexibility in the grid.

[183] Assuming an average value of renewable energy at spot market of 40 €/MWh.

[184] The benefit is calculated at 141 € Million for 2009. 47.7 €/MWh is calculated by dividing by the amount of wind power in 2009: 2955 GWh.

[185] Figure 13 in Öko-Institut (2012) Strompreisentwicklungen im Spannungsfeld von Energiewende, Energiemärkten und Industriepolitik. Der Energiewende-Kosten-Index (EKX)

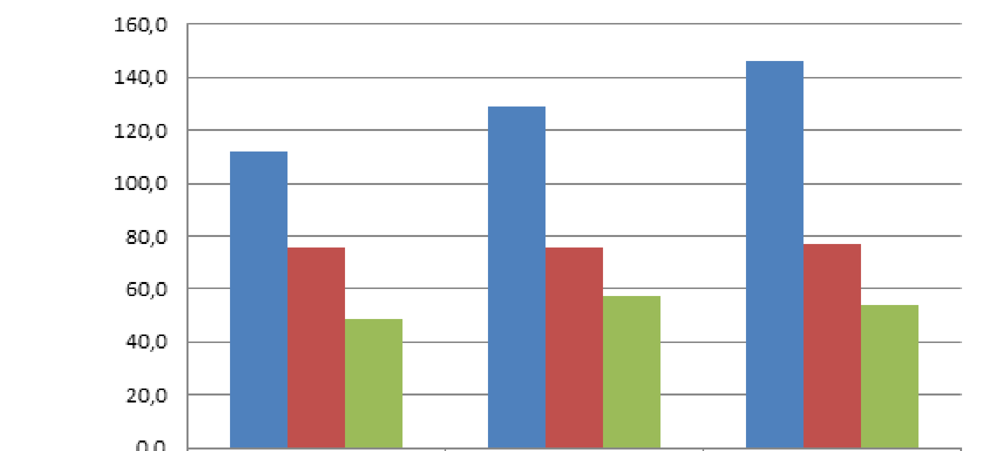
[186] More literature is listed below:

1.Delarue, Erik D., Luickx, Patrick J., D'haeseleer, William D. 2009. The Actual Effect of Wind Power on Overall Electricity Generation Costs and CO2 Emissions. Energy Conversion and Management 50 (2009) 1450–1456.
2.Gil, Hugo A., Gomez-Quiles, Catalina, Riquelme, Jesus,2012. Large-scale wind power integration and wholesale electricity trading benefits: estimation via an ex post approach. Energy Policy 41(February), 849–859.
3.Jonsson, Tryggvi, Pinson, Pierre and Madsen, Henrik. 2009. On the Market Impact of Wind Energy Forecasts. Energy Economics (2009).
4.Munksgaard, J. and Morthorst, Poul Erik. 2008. Wind Power in the Danish Liberalised Power Market – Policy Measures, Price Impact and Investor Incentives. Energy Policy 2008.
5.O′Mahoney, Amy, Denny,E leanor, 2011.The merit order effect of wind generation in the Irish electricity market ,Washington,DC.
6.Saenz Miera, Gonzalo, Del Rio Gonzales, Pablo and Vizciano, Ignacio. 2008. Analysing the Impact of Renewable Energy Support Schemes on Power Prices: The Case of Wind Energy in Spain. Energy Policy 36 (2008) 3345–3359.
7.Sensfuss, Frank. Ragwitz, Mario and Genoese, Massimo. 2007. Merit Order Effect: A Detailed Analysis of the Price Effect of Renewable Electricity Generation on Spot Prices in Germany. Fraunhofer Institute Systems and Innovation Research. Energy Policy 36 (2008) 3086–3094.
8.Unger, Thomas, Erik Ahlgren, 2005. Impacts of a common green certificate market on electricity and CO2-emission markets in the Nordic countries. Energy Policy 33(16),2152–2163.
9.Weigt, Hannes. 2008. Germany's Wind Energy: The Potential for Fossil Capacity Replacement and Cost Saving. Applied Energy 86 (2009) 1857–1863.

Annex 4. International comparison of prices of electricity and gas paid by a sample of EU producers

ELECTRICITY

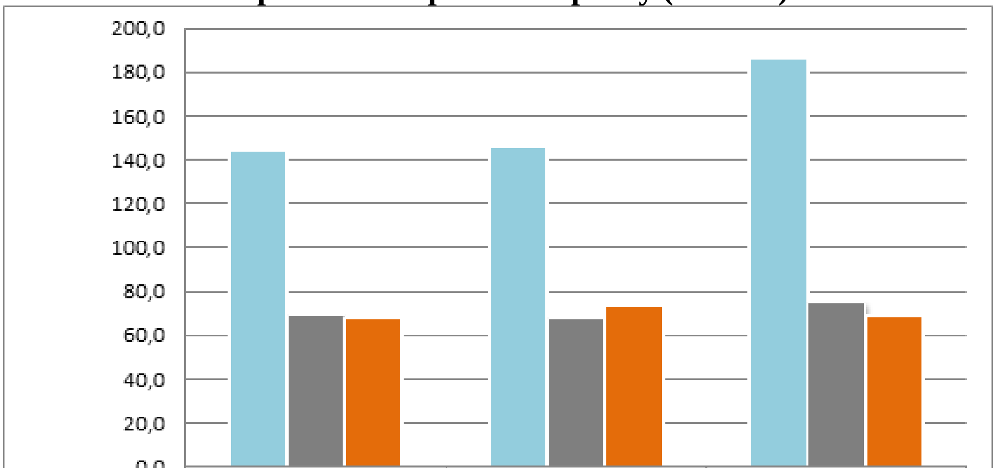
Figure 137 Prices of electricity: comparison of two EU-based brick and roof tile plants and one plant of comparable capacity in Russia (€/MWh)



	2010	2011	2012
EU Plant "A"	111,8	128,7	145,9
EU Plant "B"	75,8	75,4	77,1
RU Plant	49,0	57,4	54,0

Source: CEPS, calculations based on questionnaires.

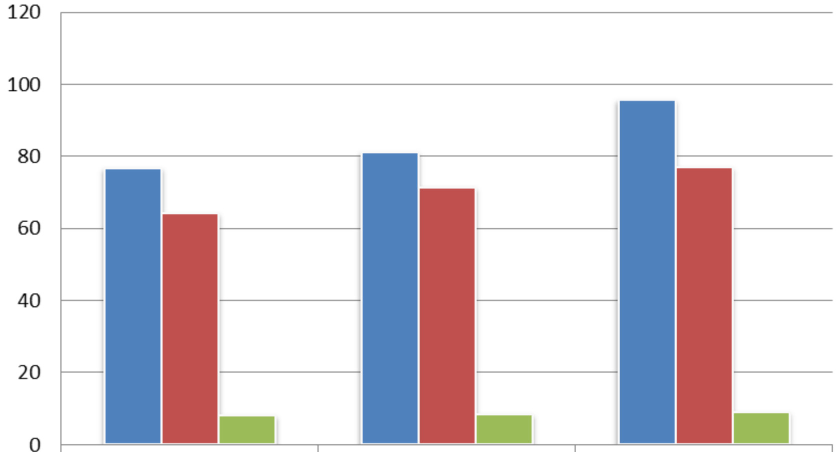
Figure 138 Prices of electricity: comparison of two EU-based brick and roof tile plants and one US-based plant of comparable capacity (€/MWh)



	2010	2011	2012
EU Plant "C"	144,1	146,1	186,7
EU Plant "D"	69,2	67,5	75,1
US Plant	68,5	73,4	69,1

Source: CEPS, calculations based on questionnaires.

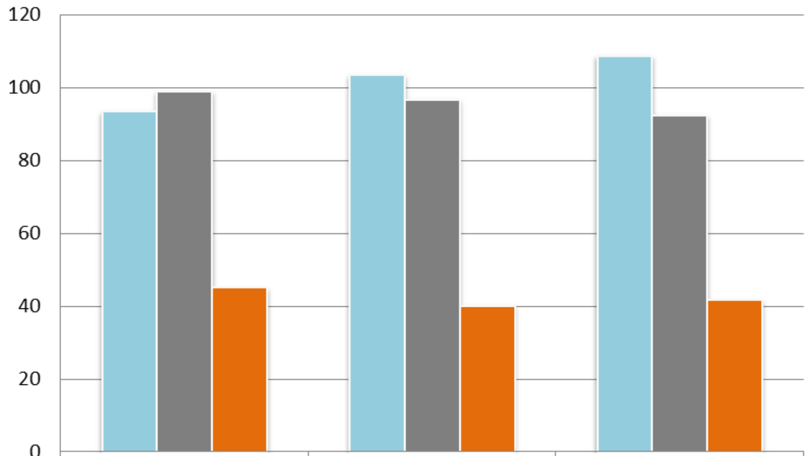
Figure 139 Prices of electricity: comparison of two EU-based wall and floor tile plants and one plant of comparable capacity in Russia (€/MWh)



	2010	2011	2012
EU plant "A"	76,7	81,1	95,6
EU plant "B"	64,1	71,4	76,9
RU plant	8	8,3	8,9

Source: CEPS, calculations based on questionnaires.

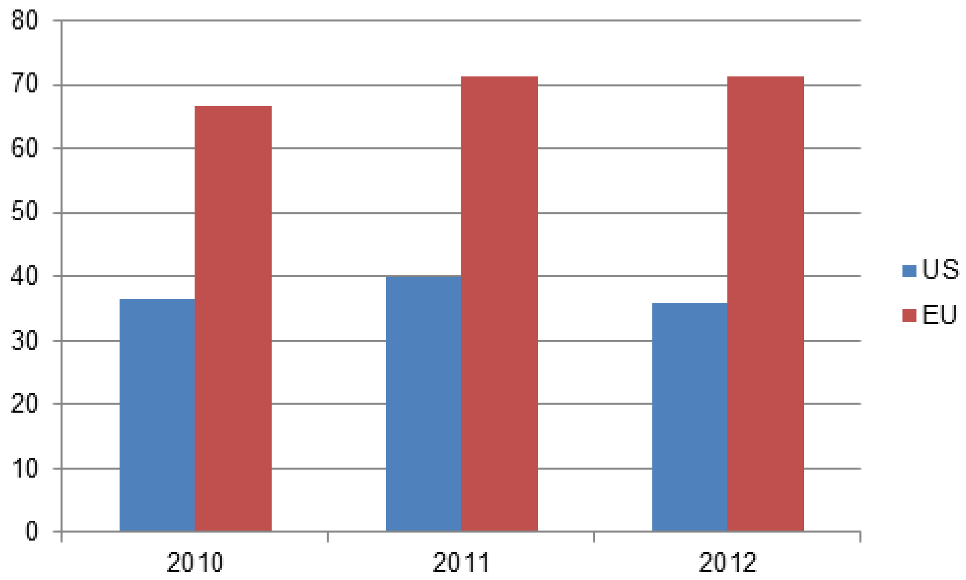
Figure 140 Prices of electricity: comparison of two EU-based wall and floor tile plants and one US-based plant of comparable capacity (€/MWh)



	2010	2011	2012
EU plant "C"	93,3	103,4	108,7
EU plant "D"	98,9	96,7	92,4
US plant	45	40,1	41,7

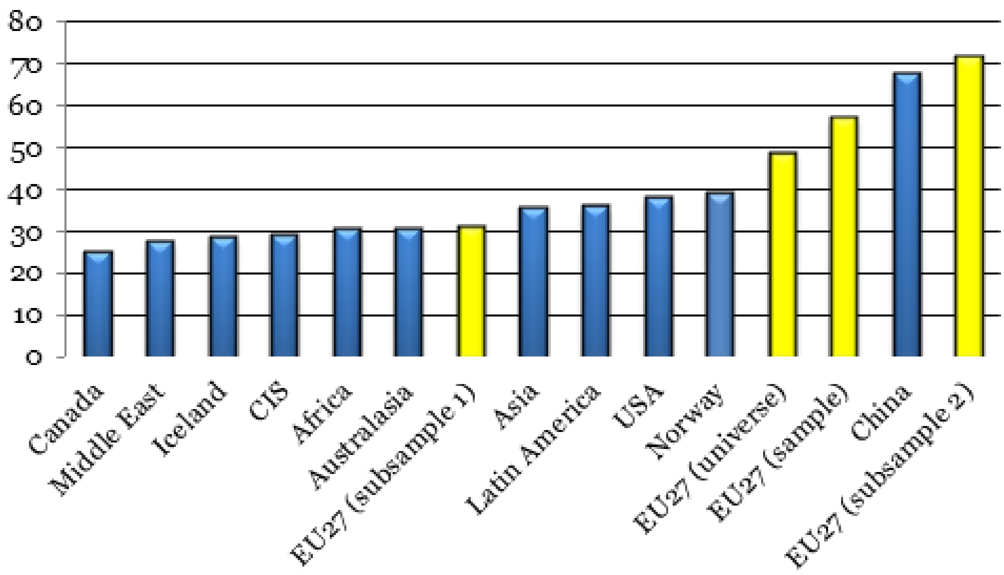
Source: CEPS, calculations based on questionnaires.

Figure 141 Electricity price: comparison between three US-based plants and seventeen steelmakers in the EU (€/MWh)



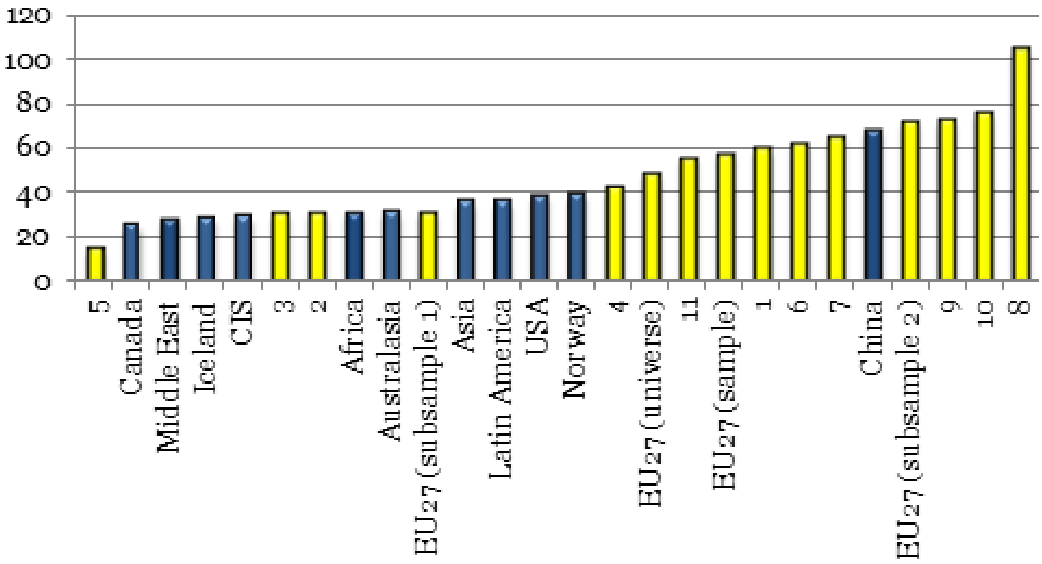
Source: CEPS, calculations based on questionnaires.

Figure 142 Electricity prices for aluminium smelters in different world countries and regions, 2012 ($/MWh, delivered at plant)



Source: The EU27 (universe) data comes from CRU, the data for the 2 subsamples (a total of 11 smelters, including EU27 subsample 1, EU27 subsample 2 and EU27 sample) comes from CEPS, calculations based on questionnaires. CRU for all international data.

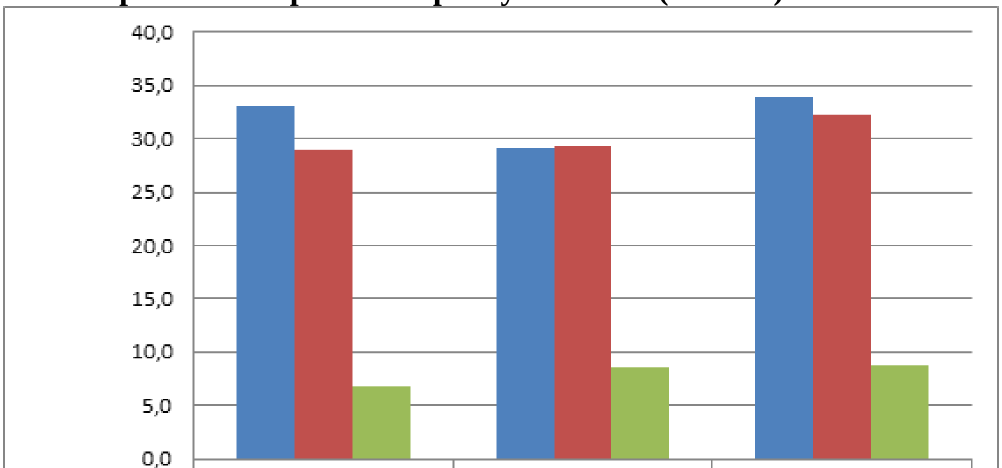
Figure 143 Electricity prices for aluminium smelters in different world countries and regions, 2012 ($/MWh, delivered at plant)



Source: CEPs, calculations based on questionnaires for the 11 EU-based smelters. CRU for EU27 and international data

NATURAL GAS

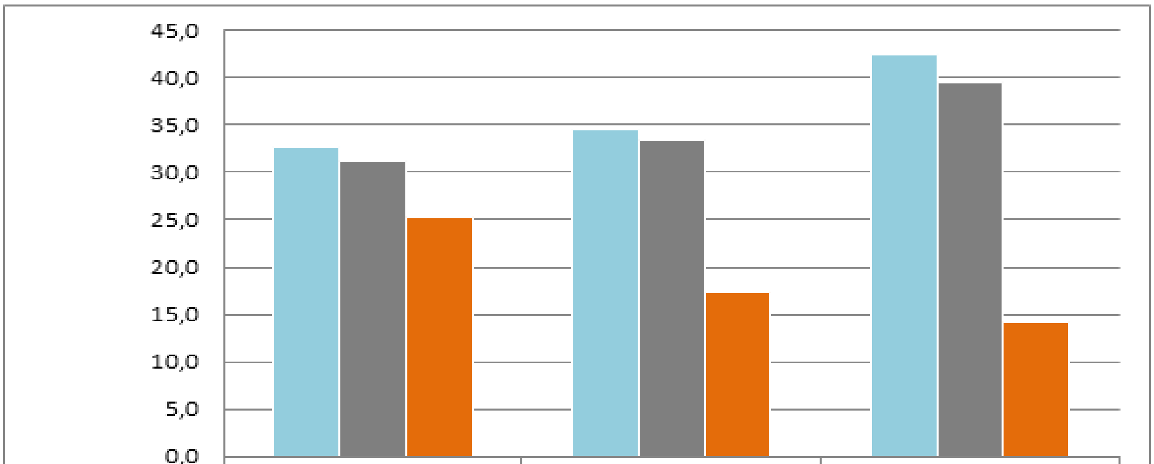
Figure 144 Prices of natural gas: comparison of two EU-based brick and roof tile plants and one plant of comparable capacity in Russia (€/MWh)



	2010	2011	2012
EU Plant "A"	33,1	29,2	33,9
EU Plant "B"	29,0	29,2	32,3
RU Plant	6,8	8,6	8,7

Source: CEPS, calculations based on questionnaires.

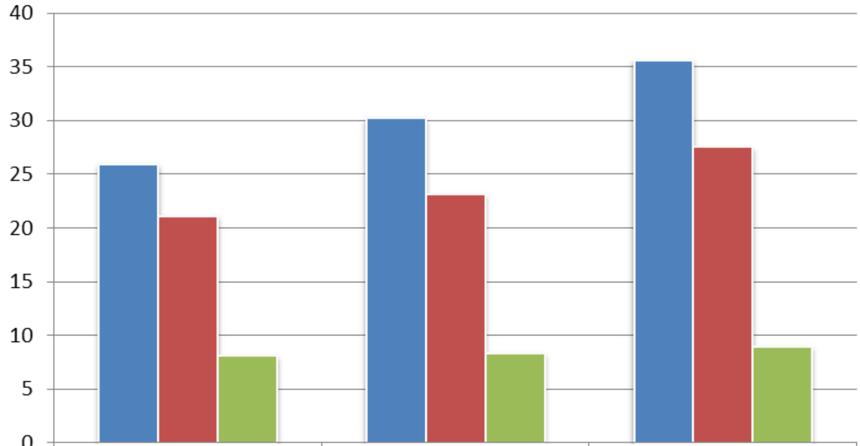
Figure 145 Prices of natural gas: comparison of two EU-based brick and roof tile plants and one plant of comparable capacity in the US (€/MWh)



	2010	2011	2012
EU Plant "C"	32,6	34,6	42,5
EU Plant "D"	31,2	33,4	39,5
US Plant	25,2	17,4	14,1

Source: CEPS, calculations based on questionnaires.

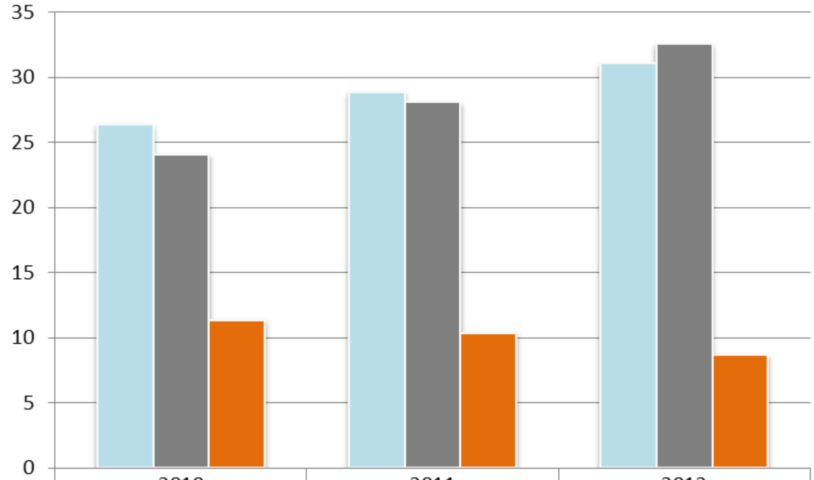
Figure 146 Prices of natural gas: comparison of two EU-based wall and floor tile plants and one plant of comparable capacity in Russia (€/MWh)



	2010	2011	2012
EU Plant "A"	25,9	30,2	35,6
EU Plant "B"	21,1	23,1	27,5
RU Plant	8,1	8,3	8,9

Source: CEPS, calculations based on questionnaires.

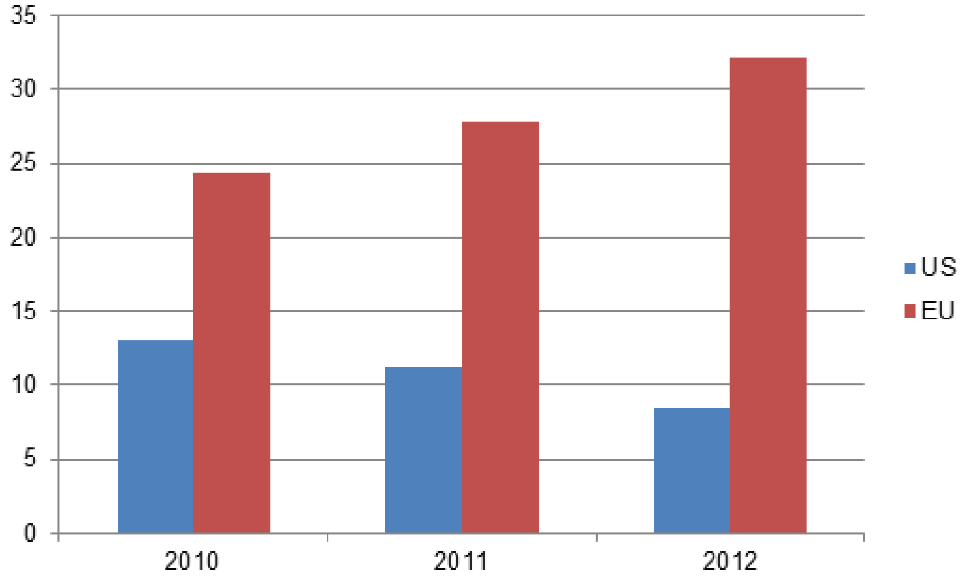
Figure 147 Prices of natural gas: comparison of two EU-based wall and floor tile plants and one plant of comparable capacity in the US (€/MWh)



	2010	2011	2012
EU Plant "C"	26,4	28,9	31,1
EU Plant "D"	24,1	28,1	32,6
US Plant	11,4	10,4	8,7

Source: CEPS, calculations based on questionnaires.

Figure 148 Natural gas price: comparison between three US-based plants and fifteen steelmakers in the EU (€/MWh)



Source: CEPS, calculations based on questionnaires.

Annex 5. Vulnerable consumers

Defining the concept of vulnerable customers

Increases in electricity and household gas prices have given rise to questions on the ability of lower income households to cope with rising energy bills. The question has been raised as to what kind of measures should be taken to protect *vulnerable customers*, though there is currently no universal definition of this concept.

Some Member States state that the concept has not been defined as vulnerable customers are covered by national social policy. Others use factors such as old age, retirement, unemployment, low income, disability, poor health, requiring an uninterrupted electricity supply, large family, being a carer or living in a remote area to define the concept.

The Third Energy Package requires Member States to define the concept of vulnerable customers as a first step in addressing the issue of vulnerability. The table below provides guidance for defining the concept, setting out the main elements that may drive and/or exacerbate vulnerability in the energy sector. Although energy vulnerability is not identical to energy poverty, the latter is implicitly addressed in the focus on the former.

	Market Conditions	Individual Circumstances	Living Conditions	Social/Natural Environment
Key Factors	Final energy price levels Level of competition	Income level Health and disability IT skills/internet access Education: literacy/ numeracy skills	Under-occupancy Type of heating system Quality of housing stock	State of economy Climate
Exacerbators	Debt policies Selling and pre-contractual practices Bill transparency/ accessibility Available payment methods Inclusiveness of corporate system designs and service provision	Age Single-parent/ large family/ carer Retired/unemployed Immigrant or ethnic minority Prepayment meters	Equipment efficiency (boilers etc.) Location Tenancy	Governance (local/regional/ national) Social inclusion

When defining energy vulnerability, one size may not fit all and a single, EU-wide concept may not be the best approach. Vulnerability is not a static state and may evolve in parallel to energy sector developments. Furthermore, consumer status may fluctuate depending on health, employment and other factors. There is a need for continuous efforts from Member State authorities to ensure that those who need support receive it at the appropriate time, whether short- or long-term. Some consumers may be vulnerable throughout their lifetimes, while others may have a one-off need for financial or other support or be pushed into temporary vulnerability by events such as unemployment.

Examples of Member State instruments and practices

The Commission has worked with stakeholders, primarily the Citizens' Energy Forum and its Vulnerable Consumers Working Group (active since March 2012), to provide examples of instruments and practices in place in Member States, for guidance purposes only. The instruments it cites are wide-ranging and cover areas from social and housing policy through to energy. They represent real-life examples rather than best practice, with the aim of providing ideas of what it is possible to implement to support vulnerable customers. It is intended that this list will be a running inventory and be made publicly available so it can be updated as new practices are introduced at a national level. Its examples are divided under six main headings: *household energy efficiency, financial support, protection, information and engagement, information sharing between stakeholders, and physical measures*.

Developing the policy mix

Member State authorities can use the table and the examples of Member State instruments and practices to help define energy vulnerability and introduce policies to ensure the best possible support for vulnerable consumers. Finally, it should be noted that social tariffs may distort the market, do not encourage energy-efficient behaviour, and have a proportionally higher financial impact on those who fall just outside the vulnerable classification.

Annex 6. Short description of the GEM-E3 model

The GEM-E3 model is a multi-regional, multi-sectoral, recursive dynamic computable general equilibrium (CGE) model. The model allows for a consistent comparative analysis of policy scenarios since it ensures that in all scenarios, the economic system remains in general equilibrium. The scope of the GEM-E3 model is general in two terms: it includes all simultaneously interrelated markets and it represents the system at the appropriate level with respect to geography, the sub-system (energy, environment, economy) and the dynamic mechanisms of agent's behaviour. The model formulates separately the supply and demand behaviour of the economic agents which are considered to optimize individually their objective while market derived prices guarantee global equilibrium. The model considers explicitly the market clearing mechanism and the related price formation in the energy, environment and economy markets: prices and quantities are computed endogenously by the model as a result of supply and demand interactions in the markets.

Total demand (final and intermediate) in each country is optimally allocated between domestic and imported goods, under the hypothesis that these are considered as imperfect substitutes. Agents' utility is derived from consumption by purpose (food, clothing, mobility, entertainment, etc.) which is further split into consumption by product. Substitutions are possible depending on relative prices.

The model is dynamic, recursive over time, driven by accumulation of capital and equipment. Technology progress is explicitly represented in the production function, either exogenous or endogenous, depending on R&D expenditure by private and public sector and taking into account spillovers effects. Moreover it is based on the myopic expectations of the participant agents.

The model is calibrated to the base year data set that comprises a full Social Accounting Matrices for each country/region represented in the model. The SAMs of the of the GEM-E3 model are based on the GTAP v8 database. Bilateral trade flows are also calibrated for each sector represented in the model, taking into account trade margins and transport costs. Consumption and investment is built around transition matrices linking consumption by purpose to demand for goods and investment by origin to investment by destination. The initial starting point of the model therefore, includes a very detailed treatment of taxation and trade.

Regional model resolution

Abbreviation	Country	Abbreviation	Country	Abbreviation	Country	Abbreviation	Country or Region
AUT	Austria	GRC	Greece	SVN	Slovenia	ARG	Argentina
BEL	Belgium	HUN	Hungary	SWE	Sweden	TUR	Turkey
BGR	Bulgaria	IRL	Ireland	ROU	Romania	SAU	Saudi Arabia
CYP	Cyprus	ITA	Italy	USA	USA	CRO	Croatia
CZE	Czech Republic	LTU	Lithuania	JPN	Japan	AUZ	Oceania
DEU	Germany	LUX	Luxembourg	CAN	Canada	FSU	Russian Federation
DNK	Denmark	LVA	Latvia	BRA	Brazil	REP	Rest of energy producing countries
ESP	Spain	MLT	Malta	CHN	China	SAF	South Africa
EST	Estonia	NLD	Netherlands	IND	India	ANI	Rest of Annex I
FIN	Finland	POL	Poland	KOR	South Korea	ROW	Rest of the World
FRA	France	PRT	Portugal	IDN	Indonesia		
GBR	United Kingdom	SVK	Slovakia	MEX	Mexico		

Sectoral model resolution

Sector	Sector	Power generation technologies
Agriculture	Non-metallic minerals	Coal fired
Coal	Electric Goods	Oil fired
Crude Oil	Transport equipment	Gas fired
Oil	Other Equipment Goods	Nuclear
Gas Extraction	Consumer Goods Industries	Biomass
Gas	Construction	Hydro electric
Electricity supply	Transport (Air)	Wind
Ferrous metals	Transport (Land)	PV
Non-ferrous metals	Transport (Water)	CCS coal
Chemical Products	Market Services	CCS Gas
Paper Products	Non Market Services	