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Delegations will find attached **a new version** of document SWD(2014) 20 final Part 2/4.

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PART 2/4

Corrigendum
Annule et remplace le document SWD(2014) 20 final. Concerne les corrections techniques

COMMISSION STAFF WORKING DOCUMENT

Energy prices and costs report

Accompanying the document

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

Energy prices and costs in Europe

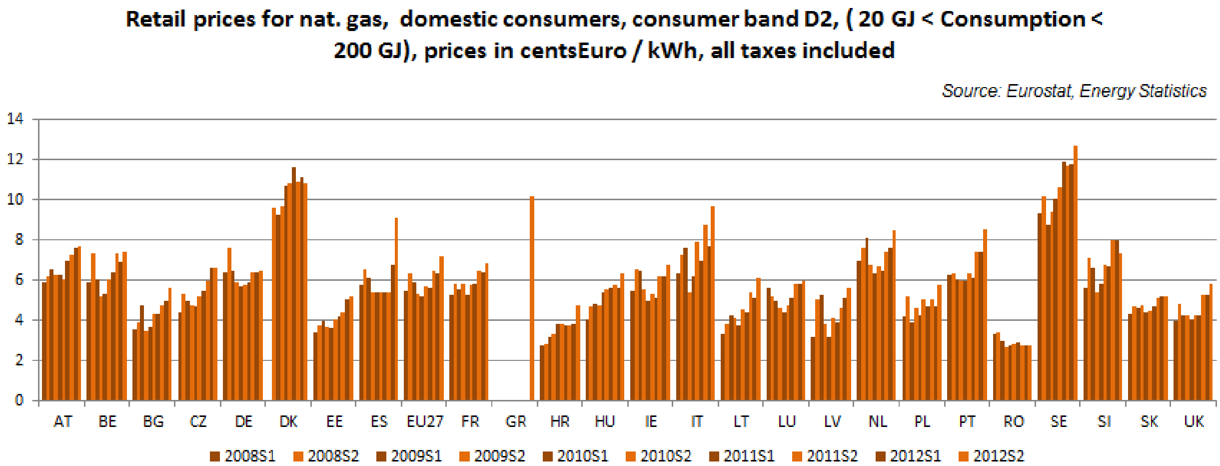
{COM(2014) 21 final}
{SWD(2014) 19 final}

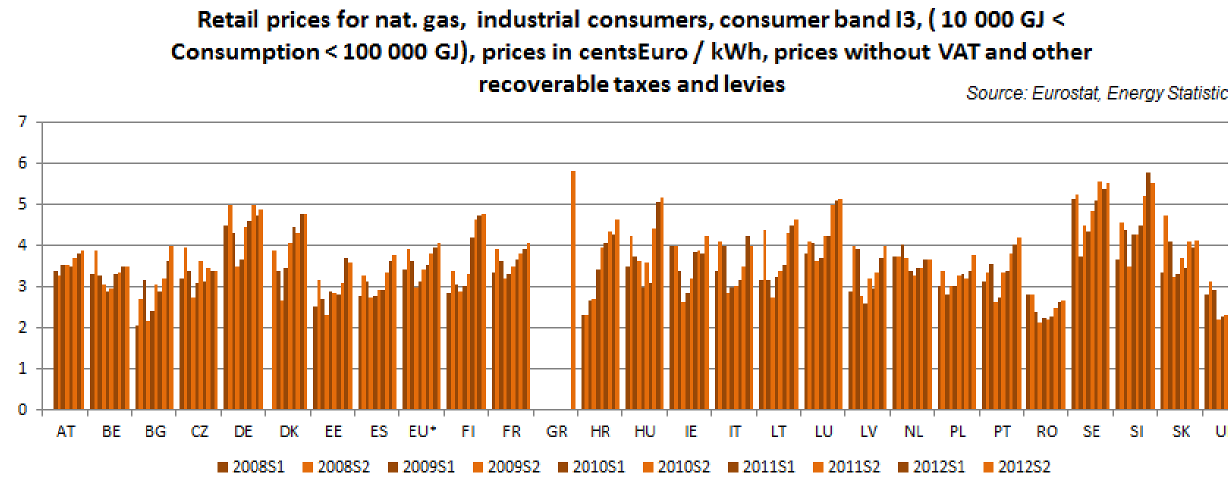
1.2. Developments in the retail markets for natural gas

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, rising **on average by more than 3% a year between 2008 and 2012**[1]. 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 of less than 1%. In most Member States a similar trend was observed: prices decreased in 2008 – 2009 and then picked up. However, growth rates varied wildly across Member States.

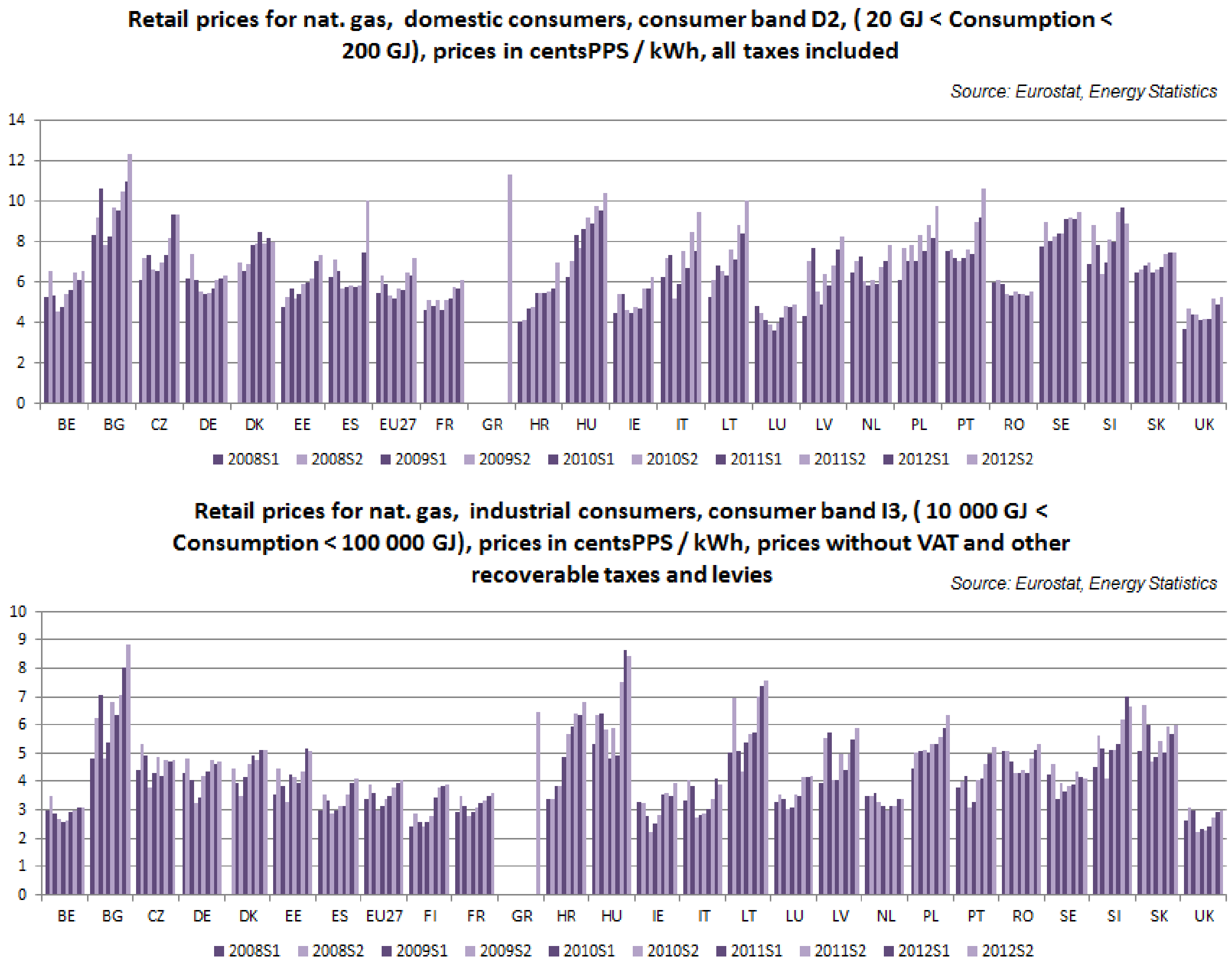
[1] Median household consumer band D2 with annual consumption between 5.56 and 55.56 MWh per year. Prices measured in cents EUR / kWh.

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 changes 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 from the Eastern part of Europe with the average consumer 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 allowed to set the prices.

Comparing natural gas price changes to inflation levels

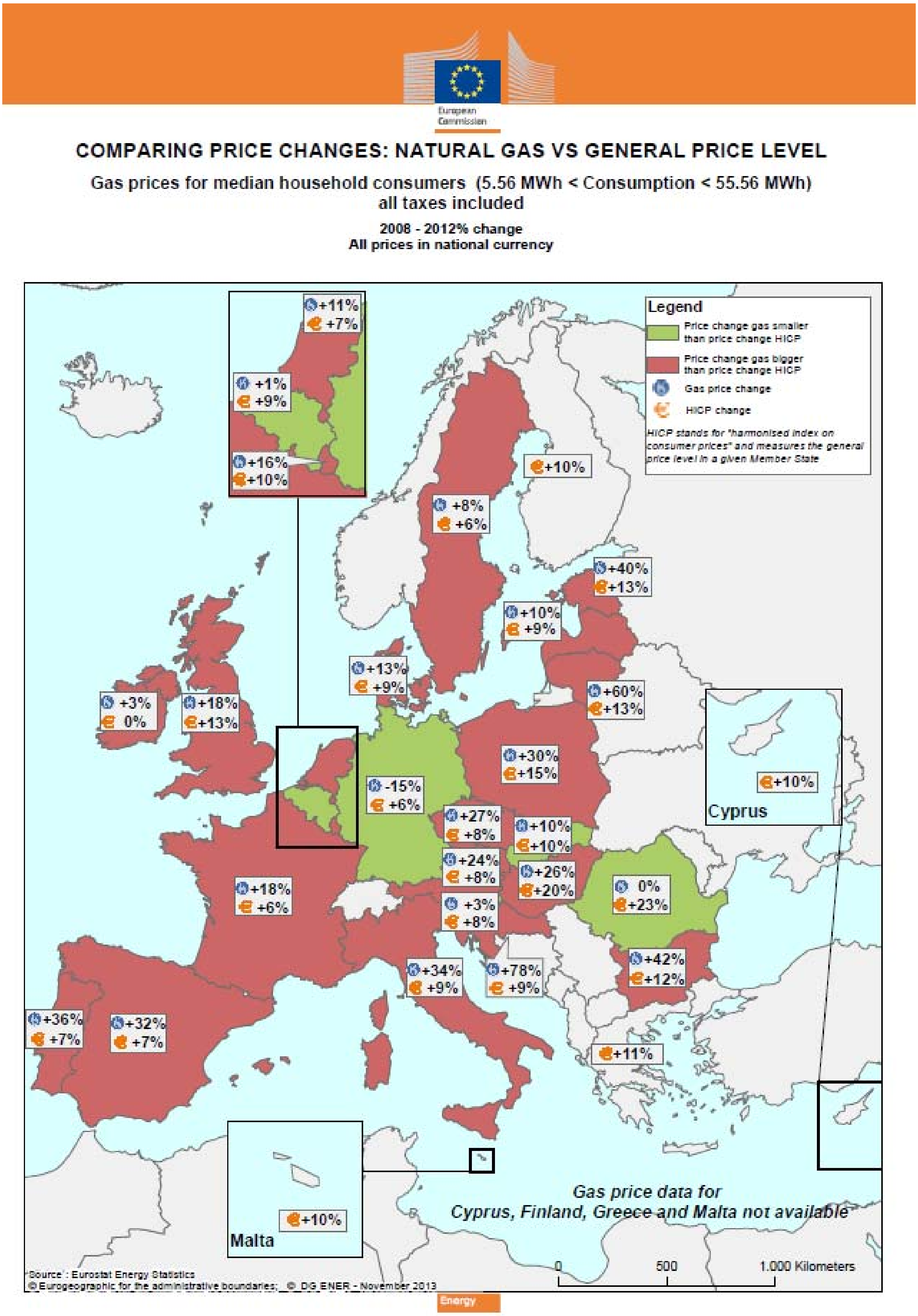
As shown on Map 4, during the observed period the increase of median household consumer prices for natural gas outpaced the increase of the general price level[2], as measured by the harmonized index of consumer prices (HICP). Belgium, Germany, Romania, Slovenia and Slovenia were the exception to that 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.

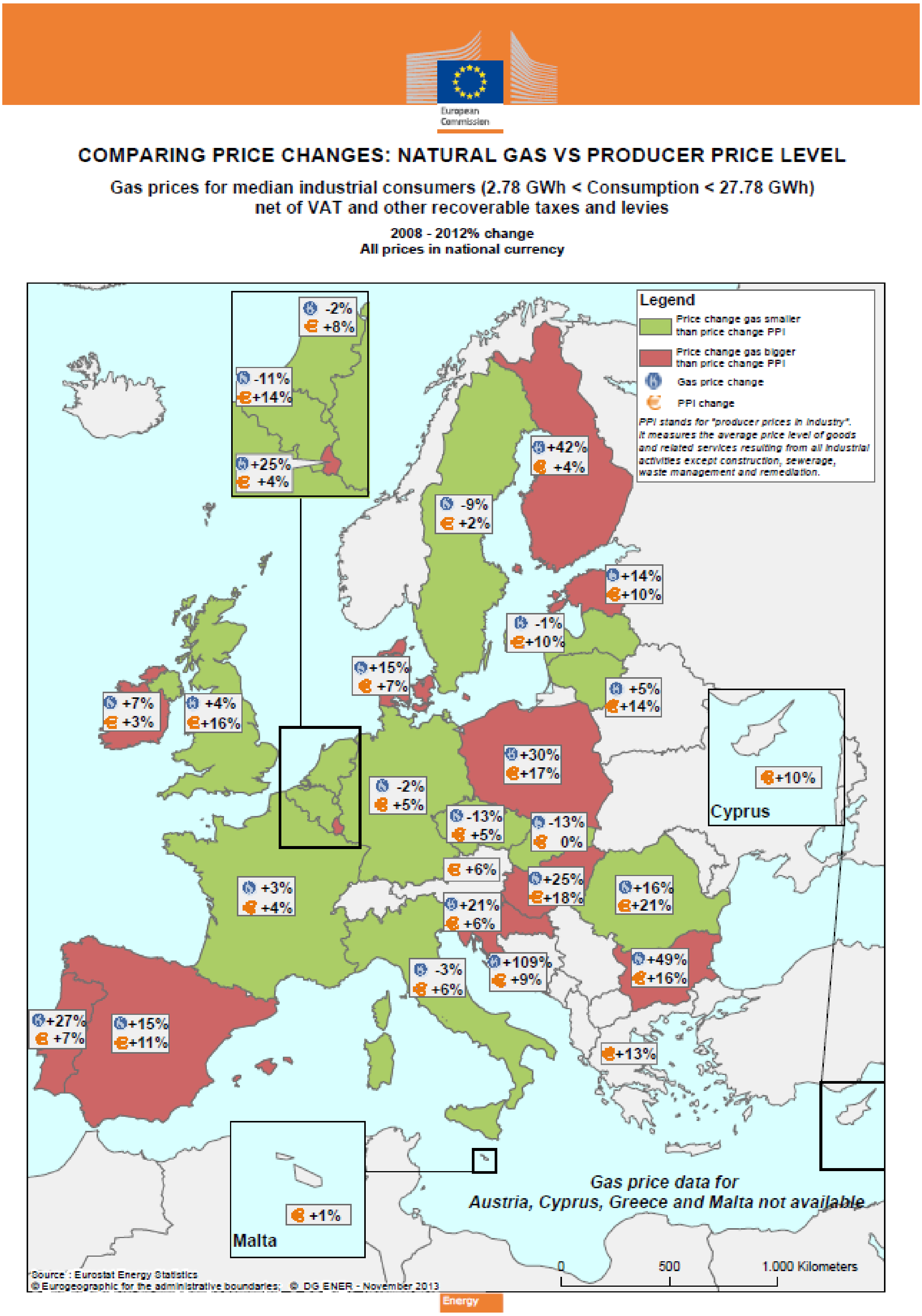
In the case of industrial consumers (**Map 5**), the situation was quite different. For the majority of Member States the price rise for gas was below the industrial price levels, as measured by the producer price index. The levels of producer price indices (PPI) and gas prices (excluding VAT and other 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).

[2] 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%).

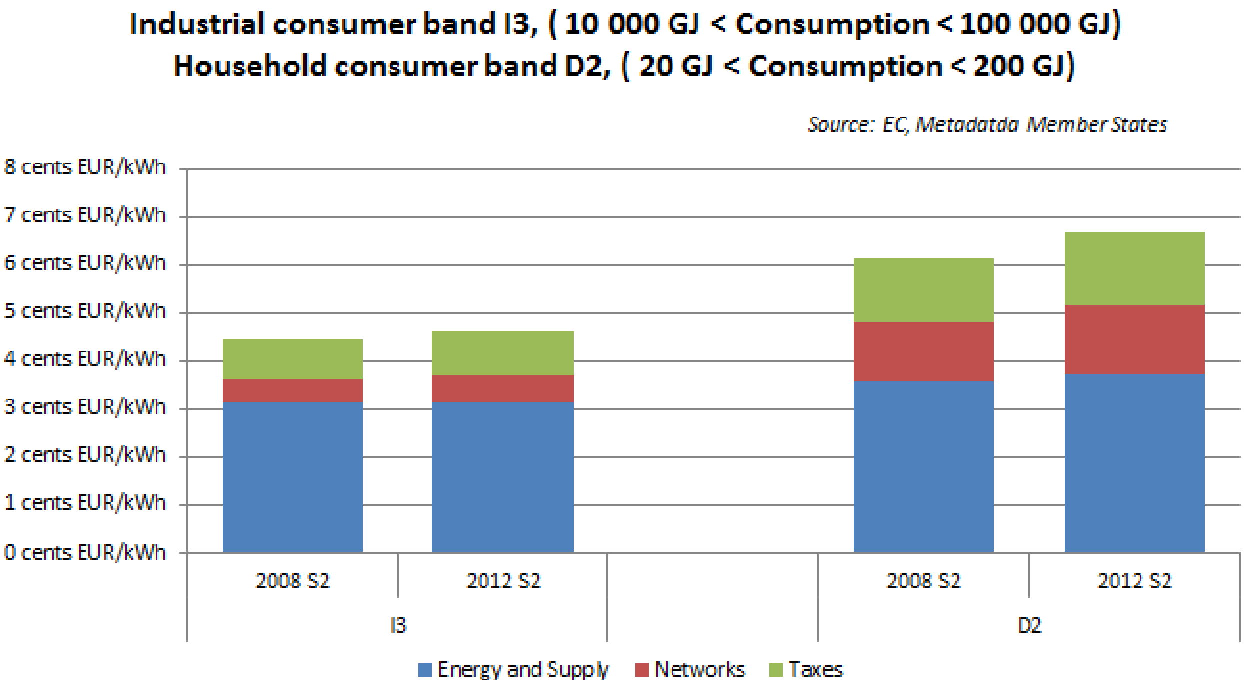
Swedish natural gas prices increased by 25 % in 5 years when measured in Euro; their rise was more gradual if measured in Swedish Kroners. The 9% appreciation of the national currency made the price rise appear bigger in Euros, with negative implications for the energy intensive export oriented companies.

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)



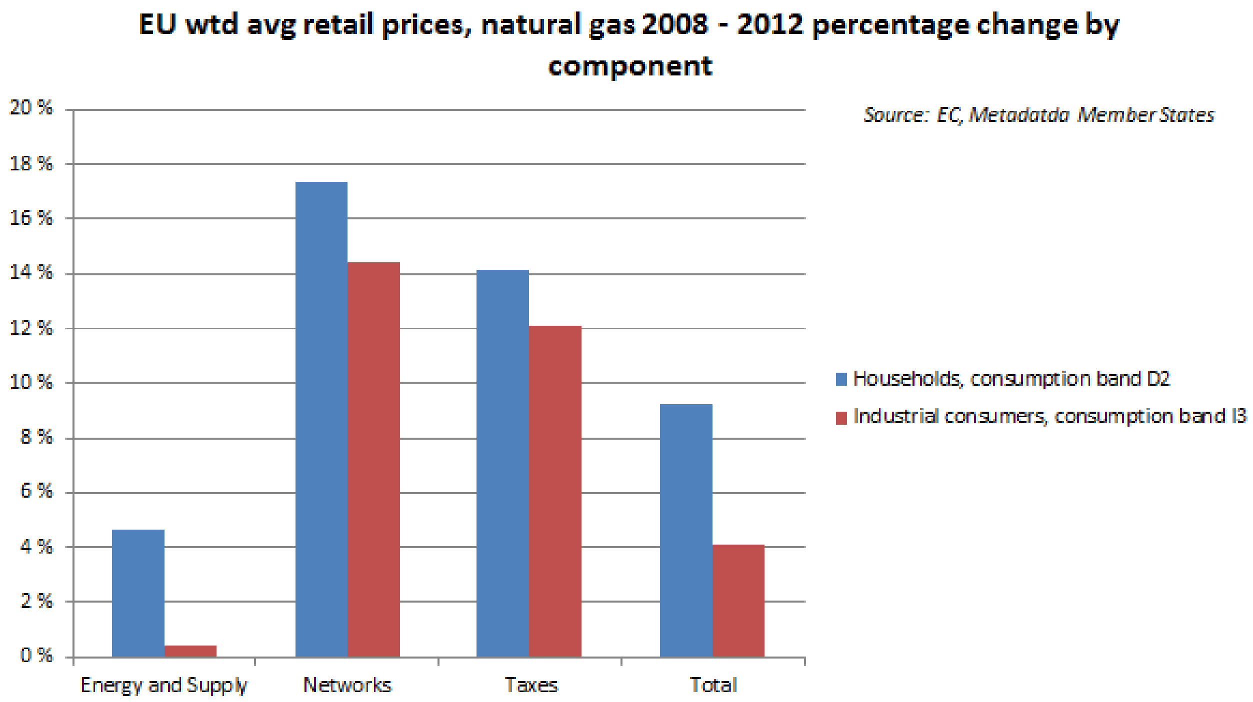
The data collected from Member States[3] indicates that, on EU level, **the average gas bill for the median industrial consumers remained stable around 4.5 cents EUR / kWh during the period** covering 2008 – 2012. The energy component accounted for 3 cents EUR per kWh in 2008 and in 2012 but its relative 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

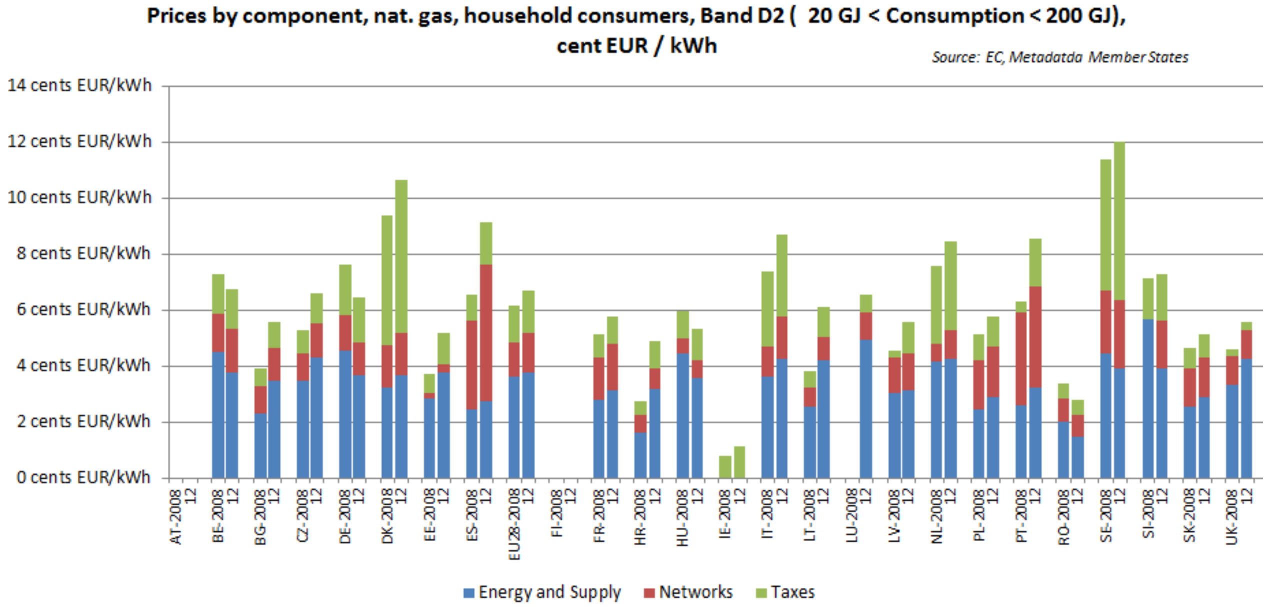
[3] The data was gathered under a reporting exercise, in the spirit of recital (16) and Annex II (n) of Directive 2008/92/EC. The data request concerned the exact composition of the cost elements reported under energy and supply, network and taxation components of retail prices of electricity and gas 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.

<u>Components at national level</u>

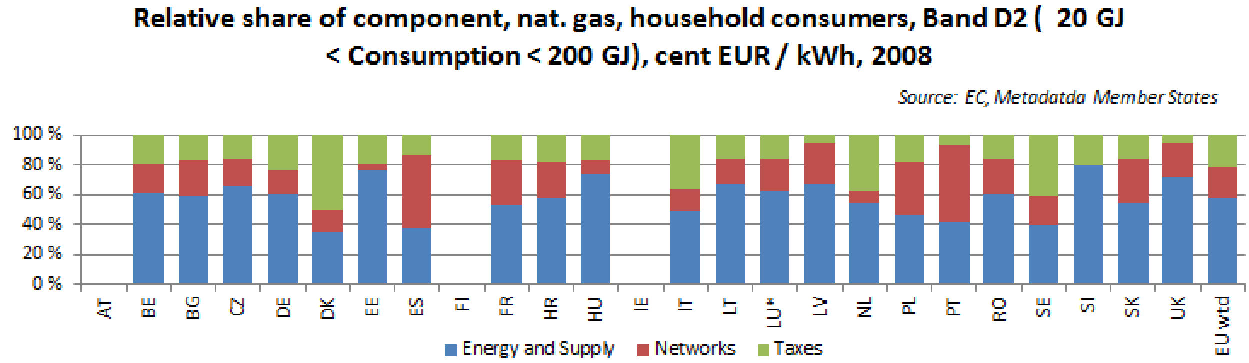
Similar to the case of electricity, the broad EU numbers conceal a wide range of variation for the retail gas prices across Member States. Figure 50 and Figure 51 trace the level and the relative share of the price components for each Member State and for the **median household consumers** in 2008 and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

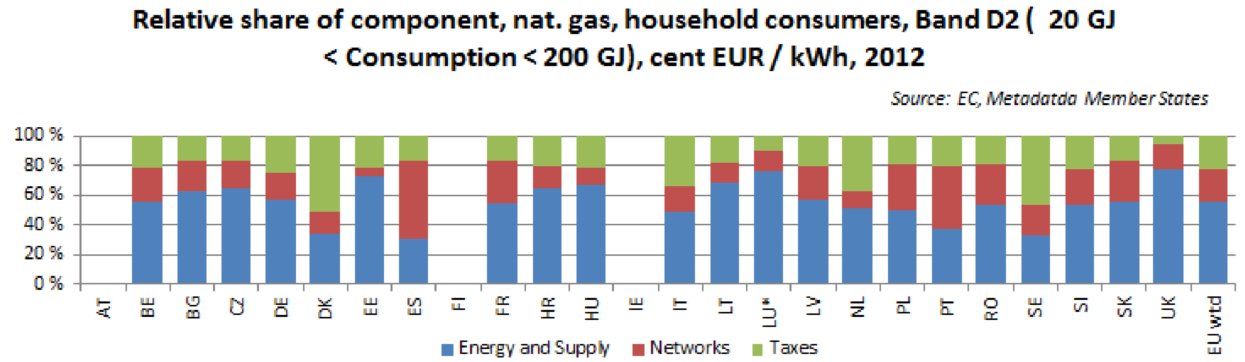
Figure 50. Natural gas prices by component, households, Eurocent/kWh (2012)



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





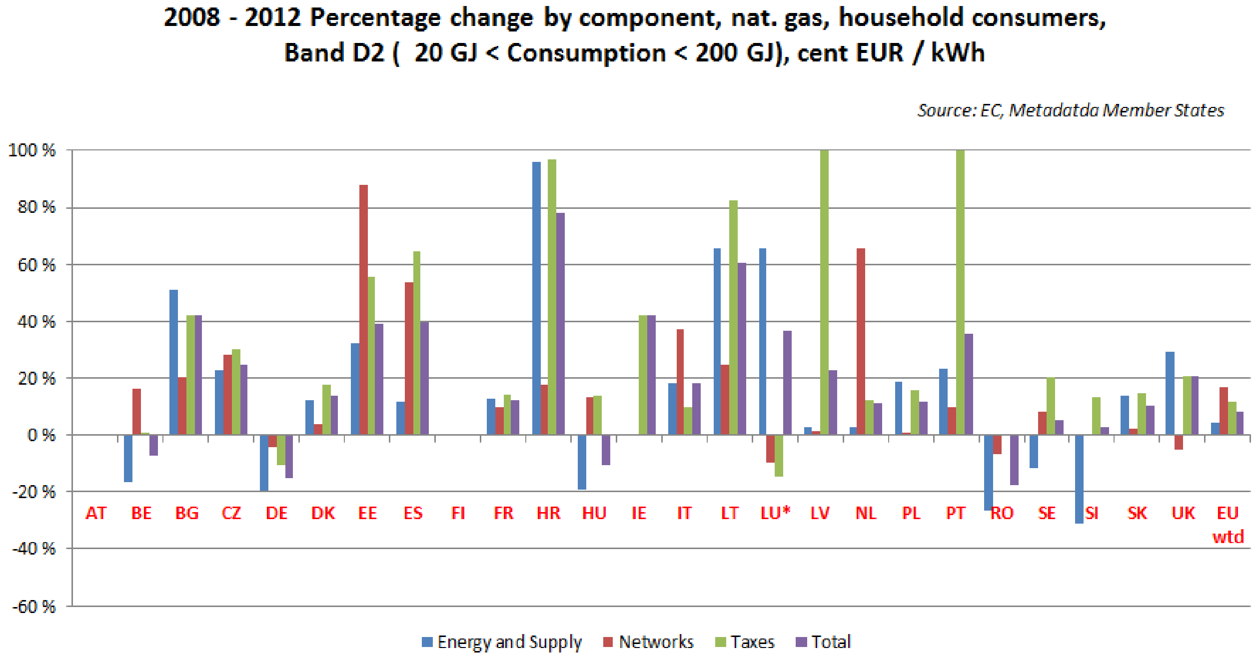
Note. No data was reported for: Austria (2008 and 2012), Cyprus (2008 and 2012), Finland (2008 and 2012), Greece (2008 and 2012) and Malta (2008 and 2012). Ireland reported only tax-related elements, so relative shares are not reported. * Luxembourg data is for 2009.

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[4], to increases by more than 50% in Bulgaria, Lithuania and Luxembourg and reaching almost 100% in Croatia.

[4] 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[5]).

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[6].

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.

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[5] The national tax rate applied by Latvia is EUR 0.43 /GJ which is close to the EU minimum of EUR 0.3 /GJ.

[6] 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

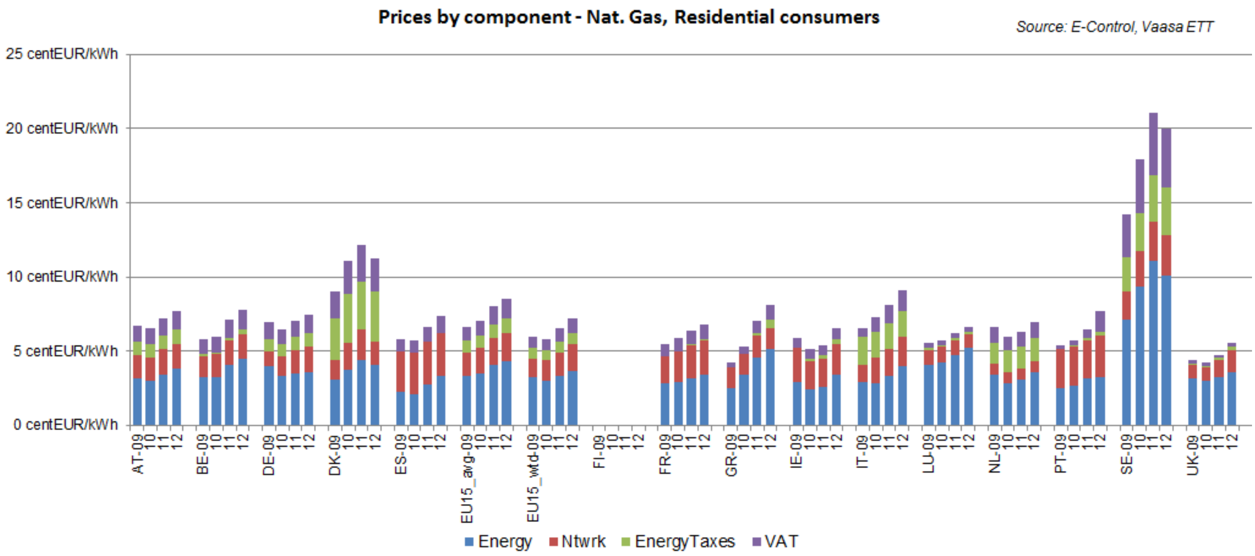
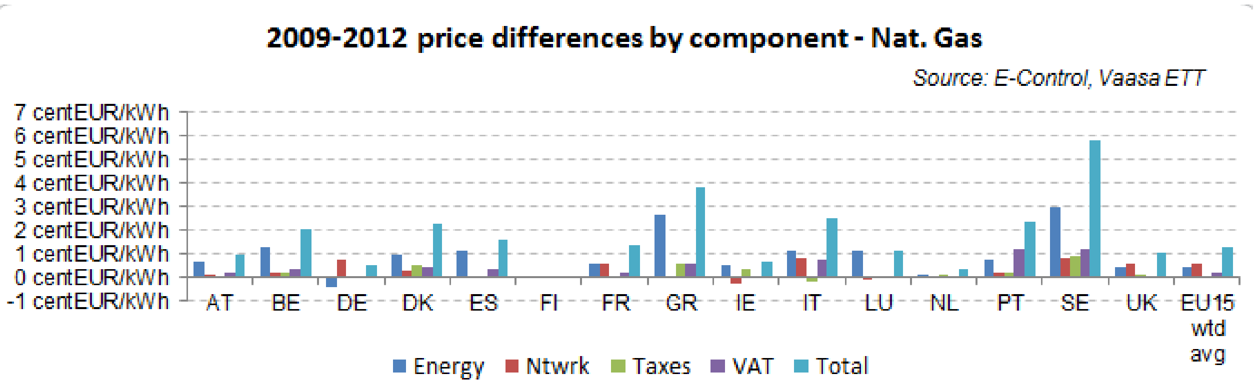
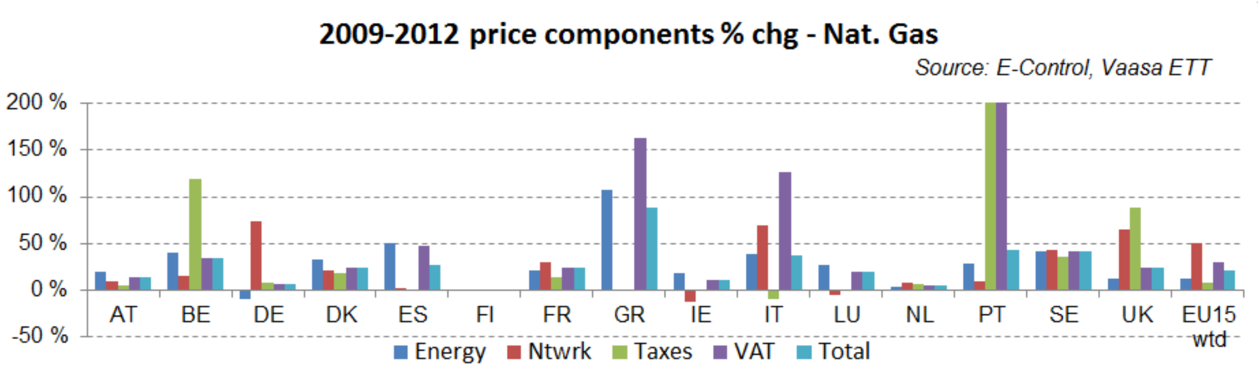


Figure 54. 2009 – 2012 differences and percentage changes by component, Eurocent/kWh





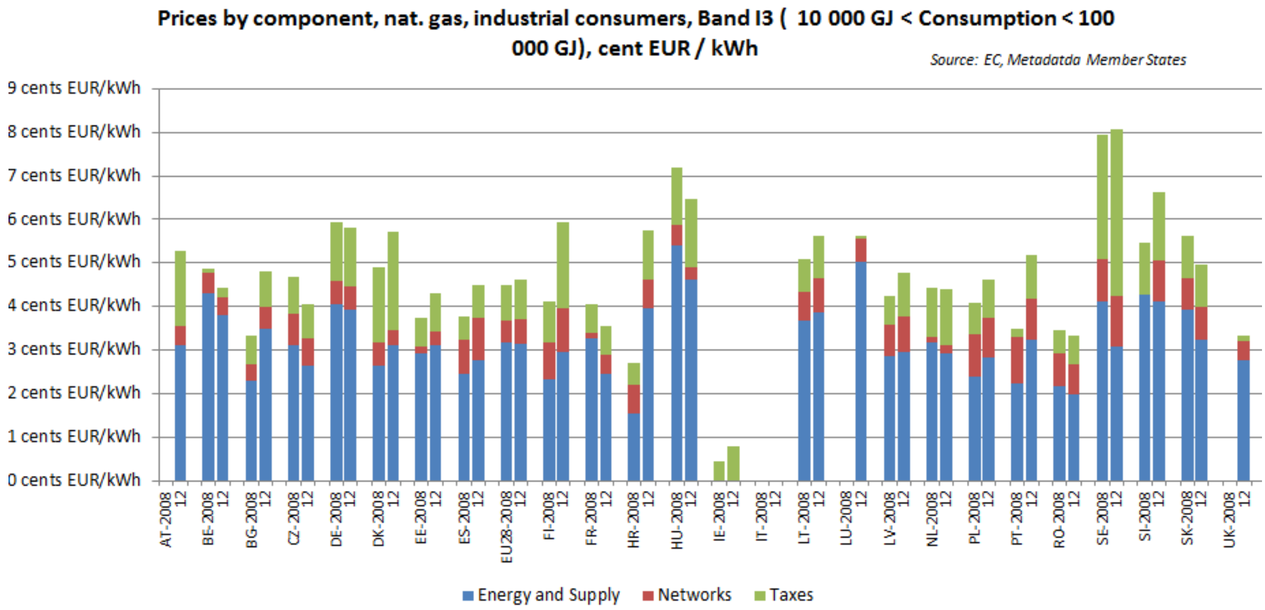
Turning now to **industrial consumers**, it appears that retail gas prices appreciated on average by 4%, from 4.44 Eurocent/kWh in 2008 to 4.62 Eurocent/kWh in 2012. This is the smallest increase across the energy products (gas and electricity) and consumer types (households and industrial consumers) 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.

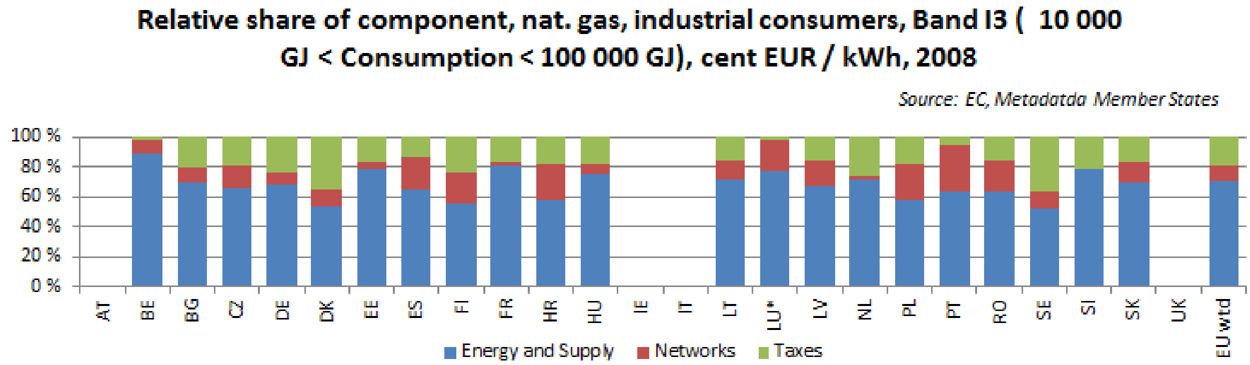
Figure 55 Natural gas prices by component, industrial consumers, Eurocent/kWh

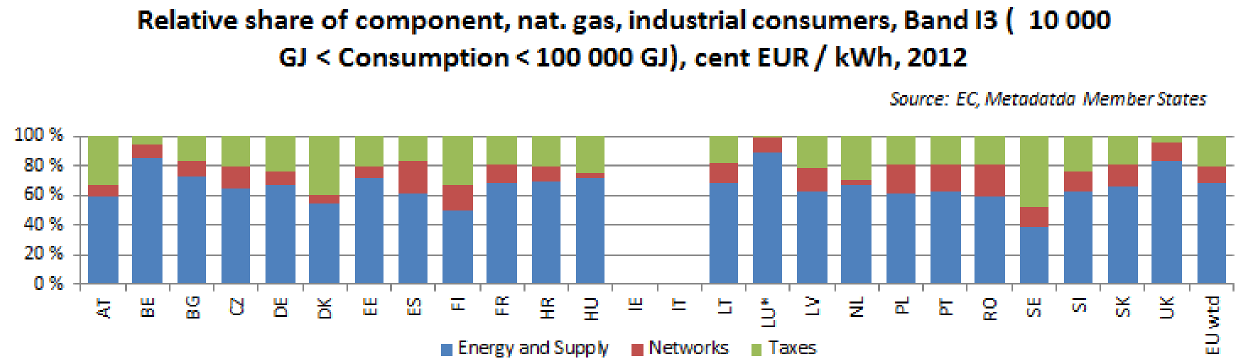


Note: No data was reported for: Austria (2008), Cyprus (2008 and 2012), Greece (2008 and 2012), Italy (2008 and 2012), Luxembourg (2008), Malta (2008 and 2012) and UK (2008). Ireland reported only tax-related elements.

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



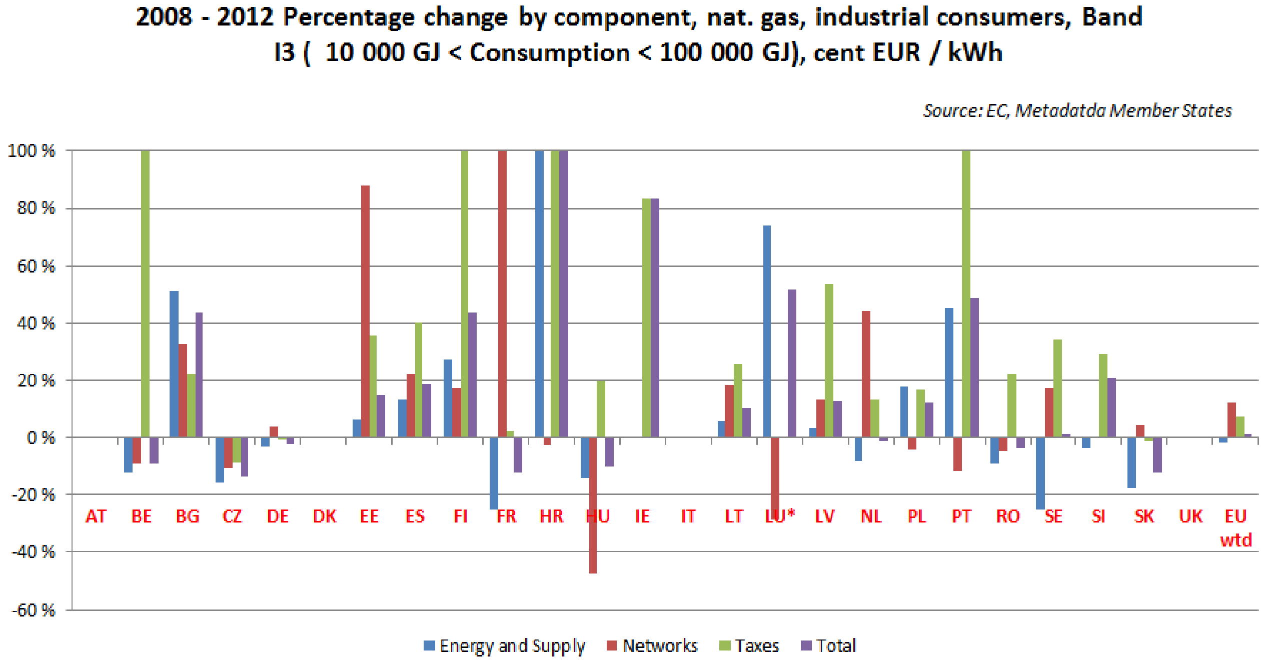


Note: No data was reported for: Austria (2008), Cyprus (2008 and 2012), Greece (2008 and 2012), Italy (2008 and 2012), Malta (2008 and 2012) and UK (2008). Ireland reported only tax-related elements. * Luxembourg data is for 2009.

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



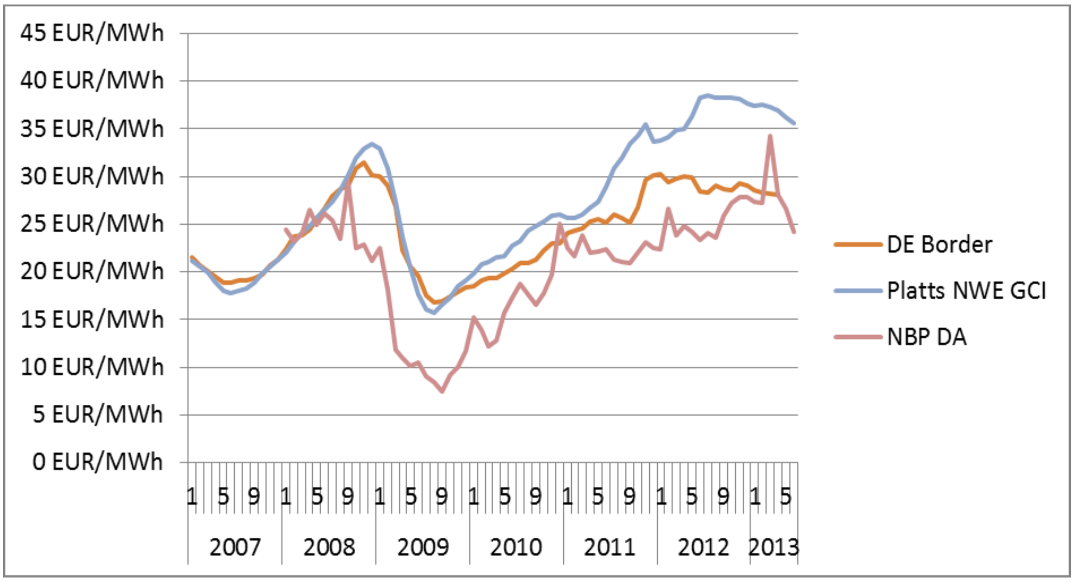
Finally, the taxation component decreased marginally in the Czech Republic, Germany and the UK whereas notable increases above 100% were observed in Belgium (increase in public levies and VAT and energy contribution), Finland (increase in the excise tax – energy content and CO2) and Croatia (increase 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[7].

Based on the latest report from *Prospex Research*[8], 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

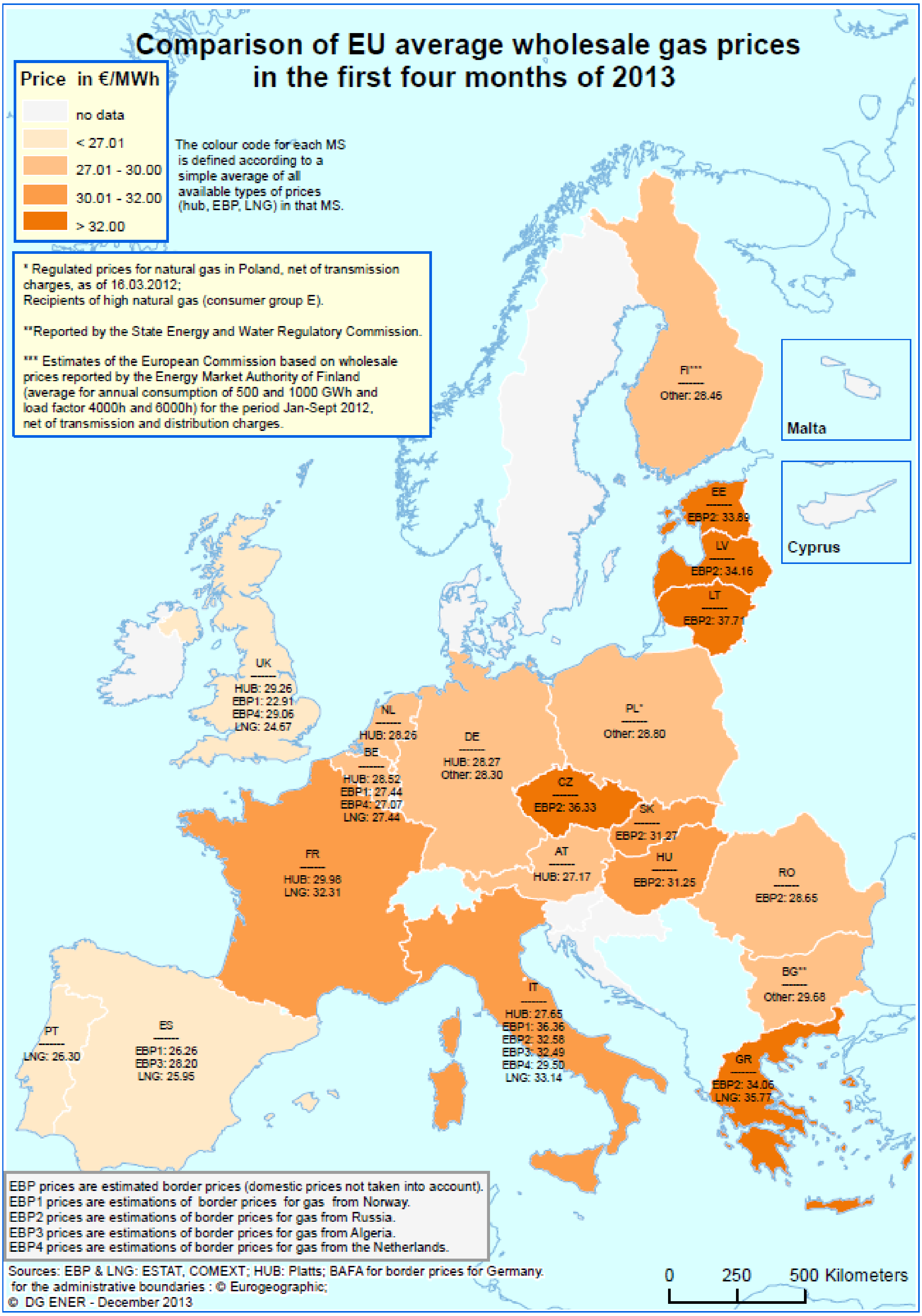
[7] Estimated border prices and estimated LNG prices based on data from Eurostat's database of international trade COMEXT. Day-ahead hub prices as reported by Platts.
[8] "European Gas Trading 2012", Prospex Research, www.prospex.co.uk

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[9] 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.

[9] 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.

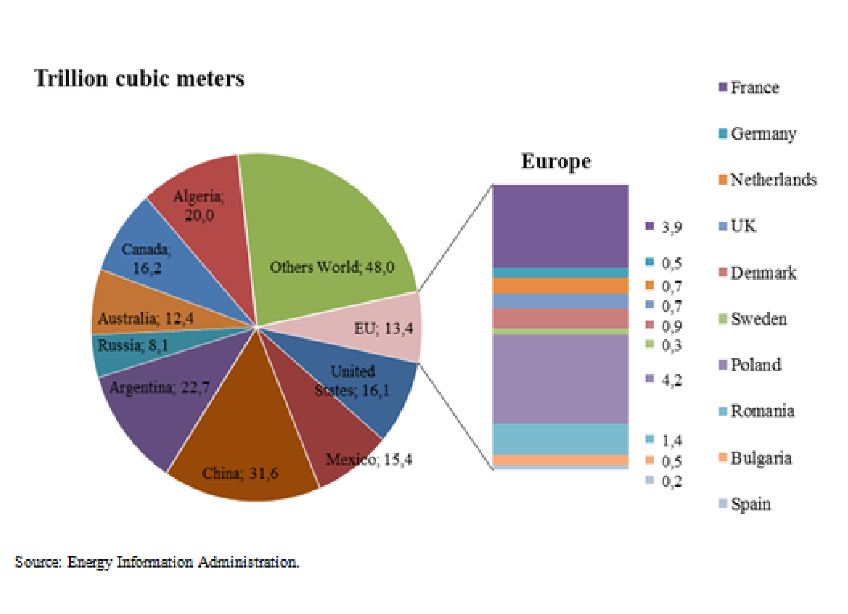
Yet, with gas exports hitting record levels, Norway is approaching full utilisation of its pipelines (transport capacity of the Norwegian pipeline system is 120 billion Sm3 per year). Further export growth of Norway may thus depend on transport capacity, including LNG terminals, and fields coming online.

According to some sources, recoverable shale gas in the EU could range between 2.3 tcm and 17 tcm[10], 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[11].

Textbox 2 Potentials and uncertainties for shale gas exploration in the EU and the US[12]

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

[10] European Commission (2012), Unconventional gas: potential energy market impacts in the European Union, JRC Scientific and Policy Reports, p 29

[11] Further information on shale gas reserve estimates are available in the Forthcoming publication, Energy Economic Development in Europe, DG ECFIN

[12] 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[13].

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[14] 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.

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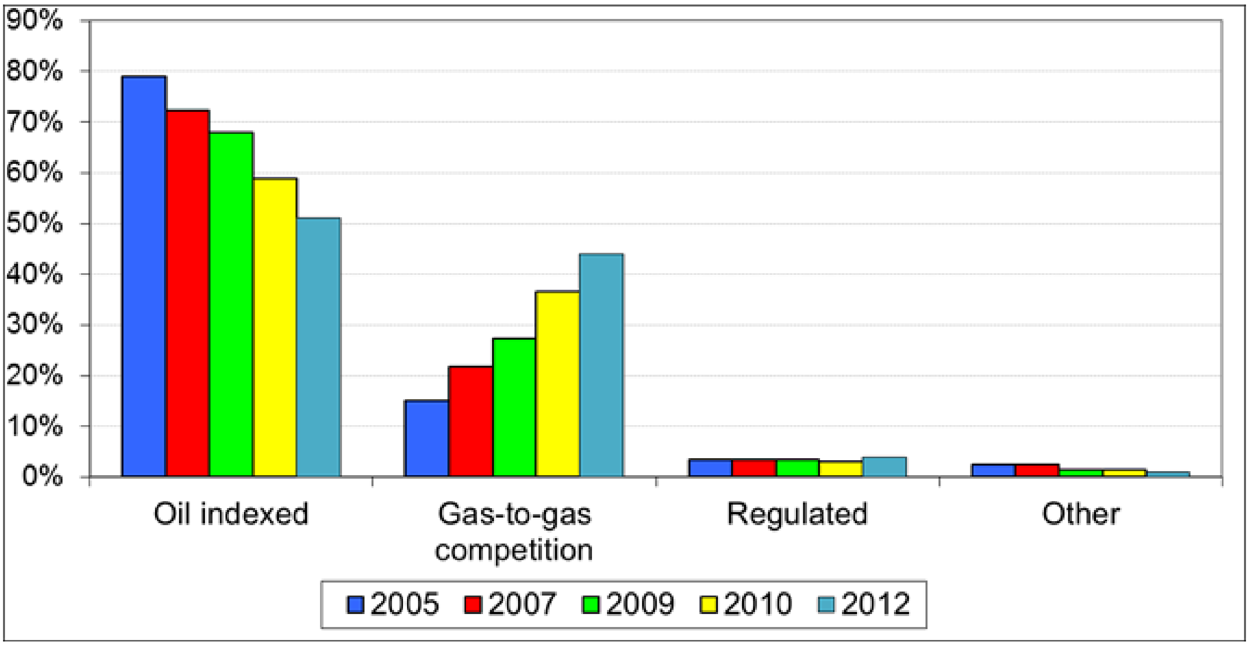
[13] Yet, the demand elasticity should not be overestimated: the switching of heating sources for example entails significant upfront capital costs for end consumers.

[14] 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



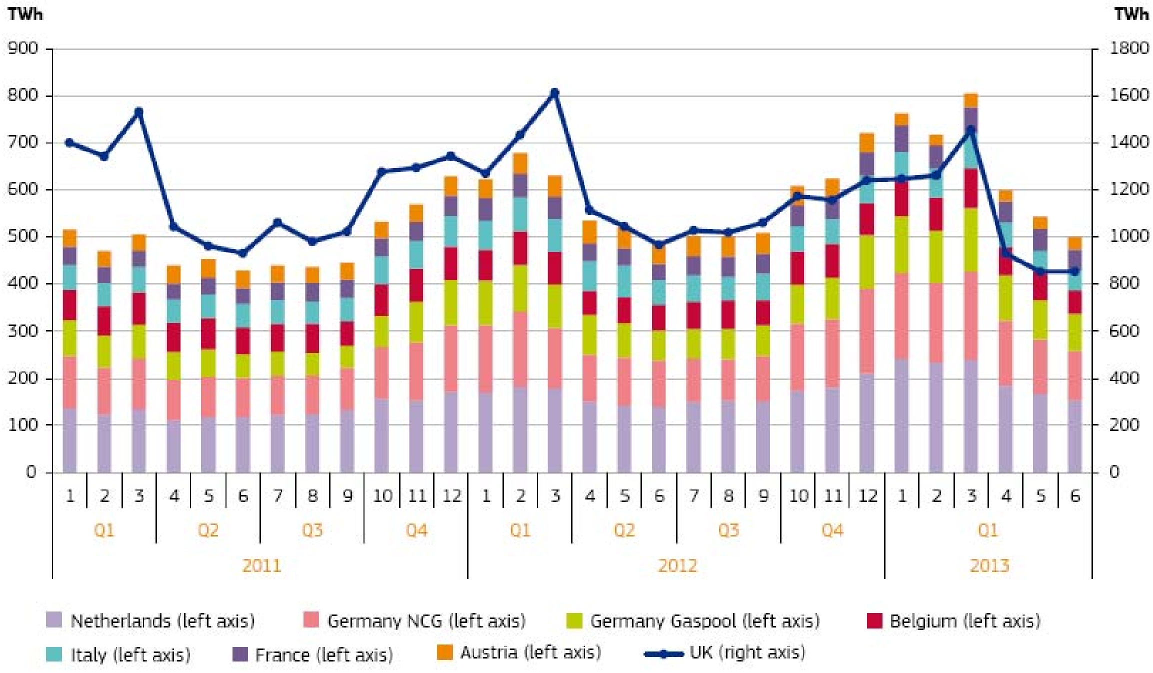
Source: International Gas Union

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 [15] 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.

[15] 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

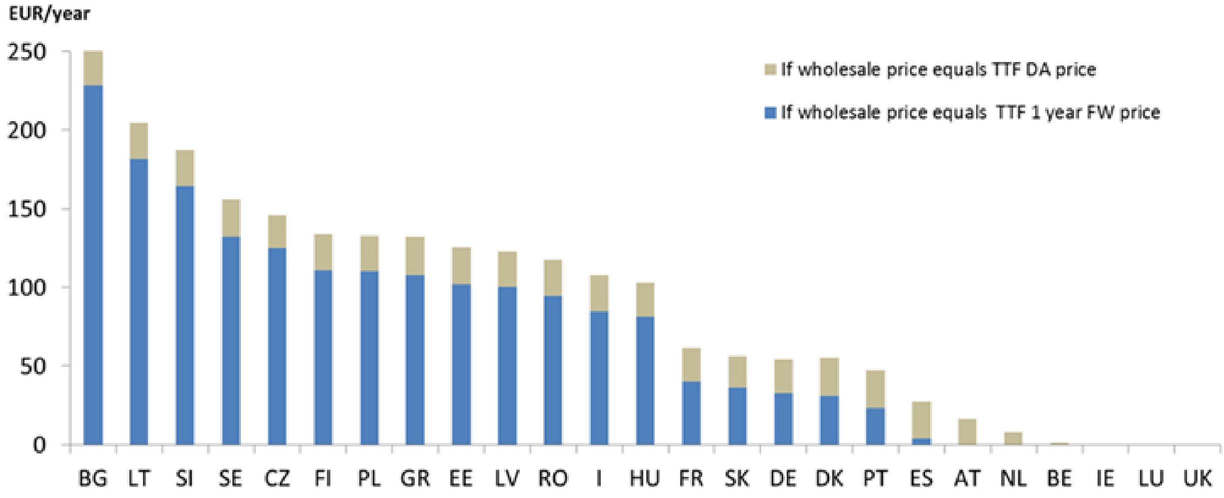


Sources: National Grid (UK), GTS (Netherlands), Huberator (Belgium), Gaspool (Germany), NCG (Germany), GTTGaz (France), Snamrete (Italy), CEGH (Austria). As of 15 July 2013: no data on volumes traded on Gaspool and PSV in June 2013.

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

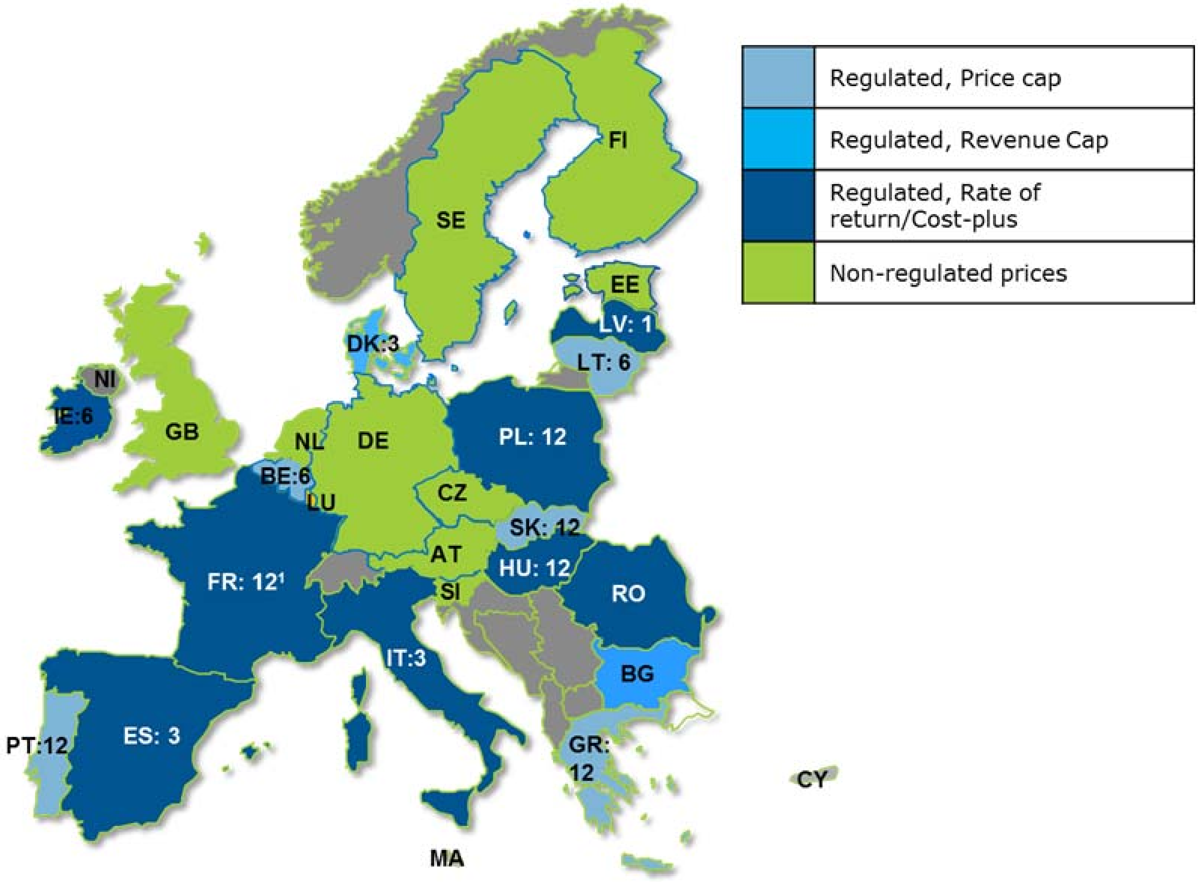
Barriers to the completion of the internal market are further analysed in the ACER-CEER report. It indicates that, "*in 2012, 46.2 million European household customers (about 46% of the total number of households with natural gas) were supplied under regulated prices (a 1.5% decrease compared with 2011)*".

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



Sources: CEER National Indicators database (2013) and ACER questionnaire on regulated prices (2013)

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[16] 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)[17].

[16] http://ec.europa.eu/consumers/consumer_research/cms_en.htm
[17] 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[18], 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.

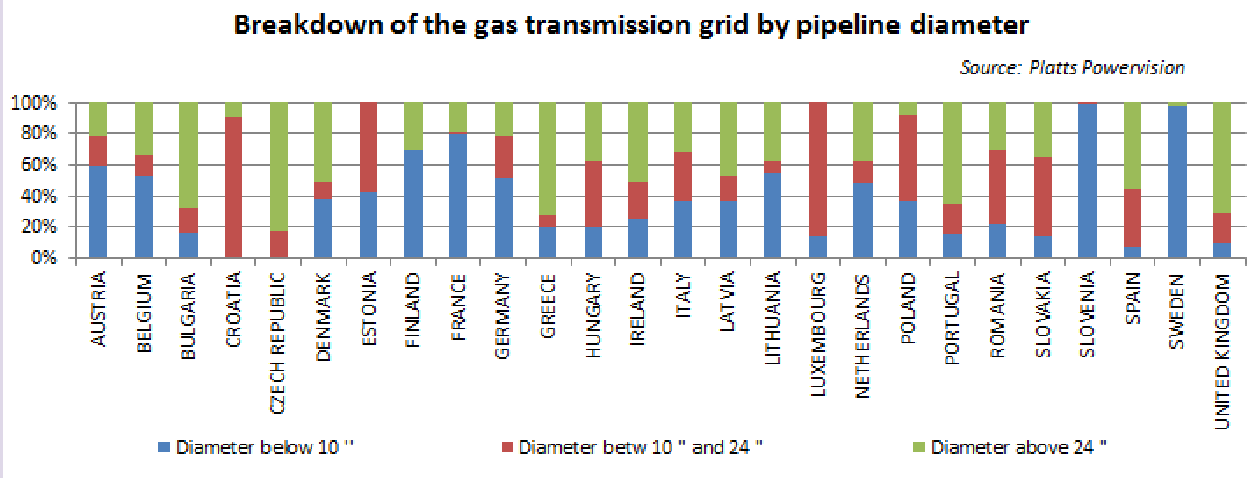
Detailed and harmonized information on gas networks in the EU is in general scarce with no scarce data on total length and age of operation by component. The Framework Guidelines on rules regarding harmonised transmission tariff structures for gas apply to the transmission

[18] 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[19].

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)

[19] 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

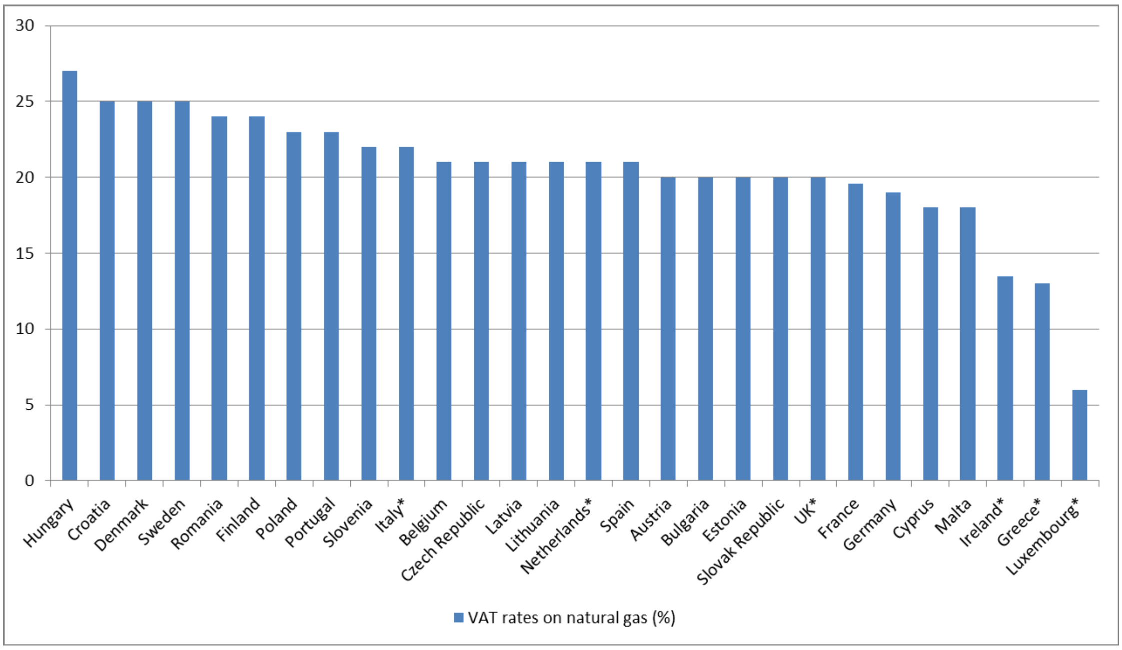
1.2.1.3. Costs related to taxation

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) [20] 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[21].

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.

[20] 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".

[21] 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.[22] 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.[23]

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).

[22] ICF report, p142
[23] 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.

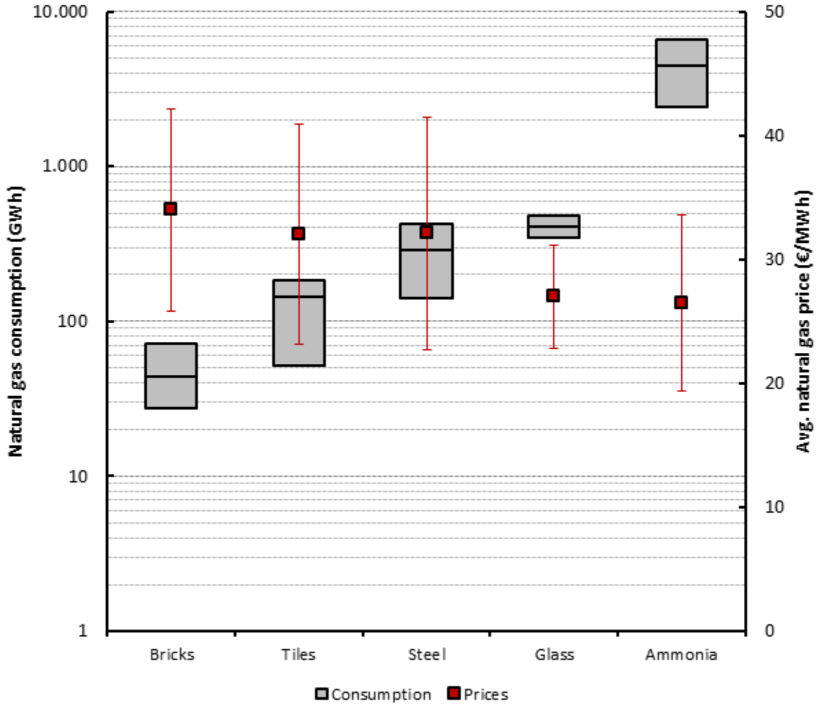
Natural gas data is not available or used for all sectors as, for example, both chlorine and aluminium producers mainly rely on electricity as an energy input. The number of questionnaires used for each sector is reported below.

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)

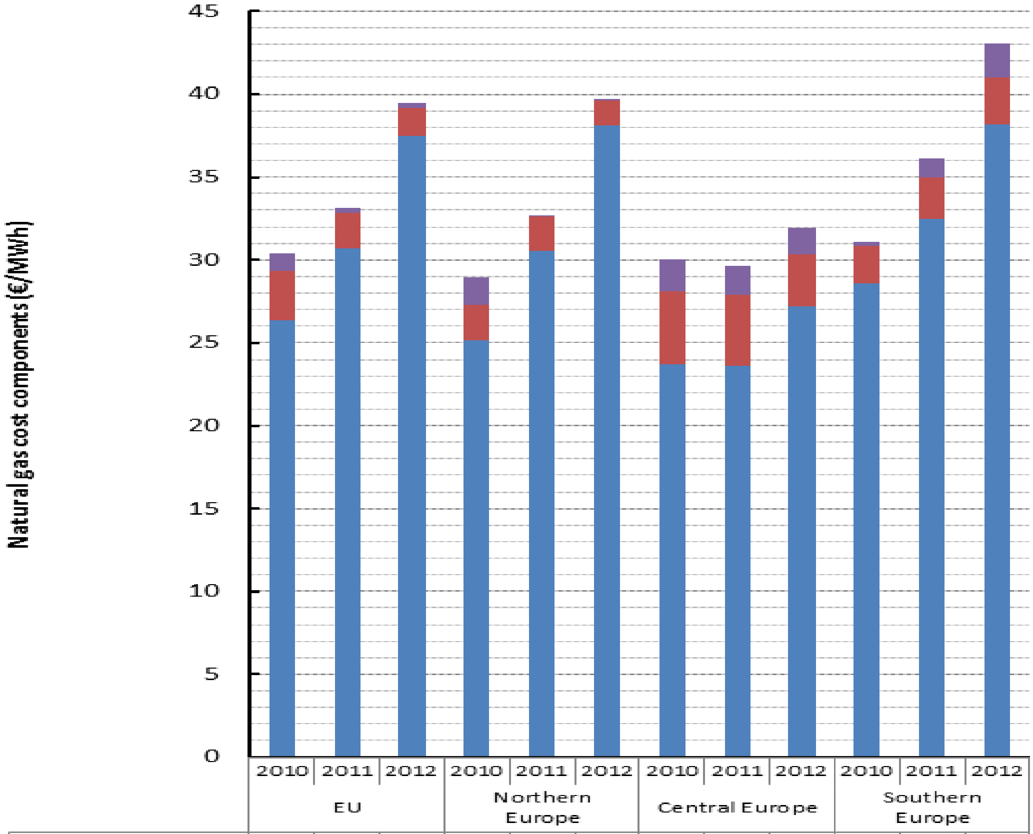
Natural Gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	30,4	33,2	39,5	29,9
EU minimum	18,7	25,6	24,7	32,1
EU maximum	48,1	57,2	63,5	32,0
Northern Europe (average)	28,9	32,7	39,7	37,4
Central Europe (average)	30,0	29,7	31,9	6,3
Southern Europe (average)	31,2	36,2	43,2	38,5

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)



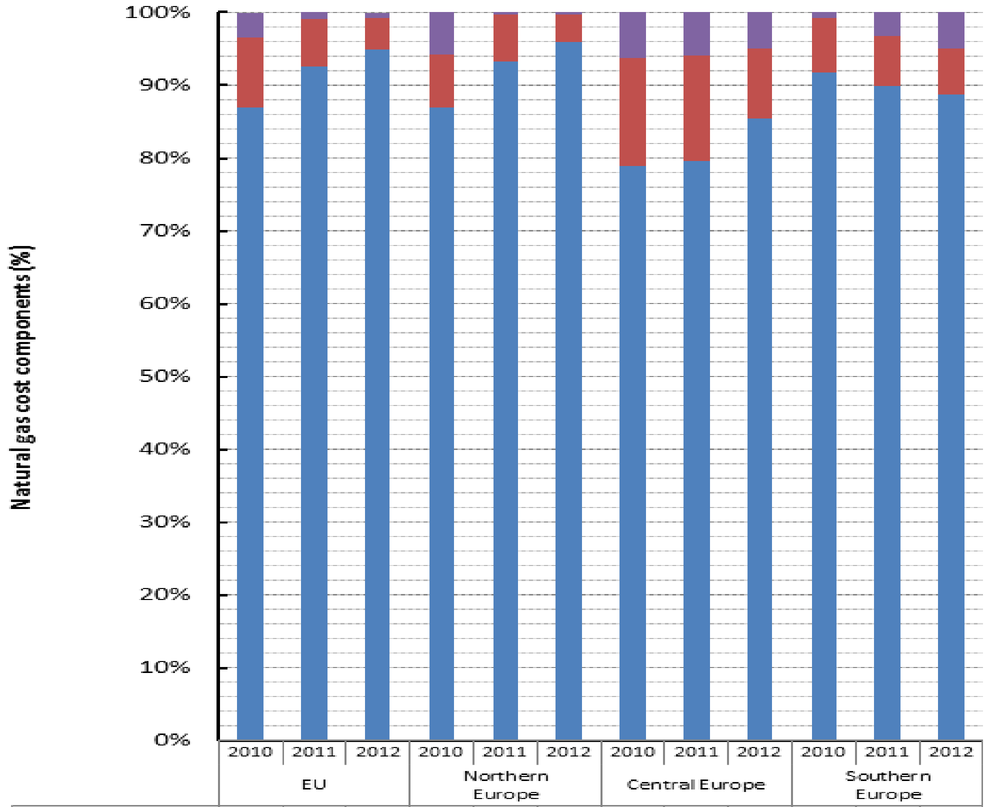
	EU 2010	EU 2011	EU 2012	Northern Europe 2010	Northern Europe 2011	Northern Europe 2012	Central Europe 2010	Central Europe 2011	Central Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other (excl. VAT)	1,0	0,3	0,3	1,7	0,1	0,1	1,9	1,8	1,5	0,2	1,2	2,1
Grid fees	3,0	2,1	1,7	2,1	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

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%

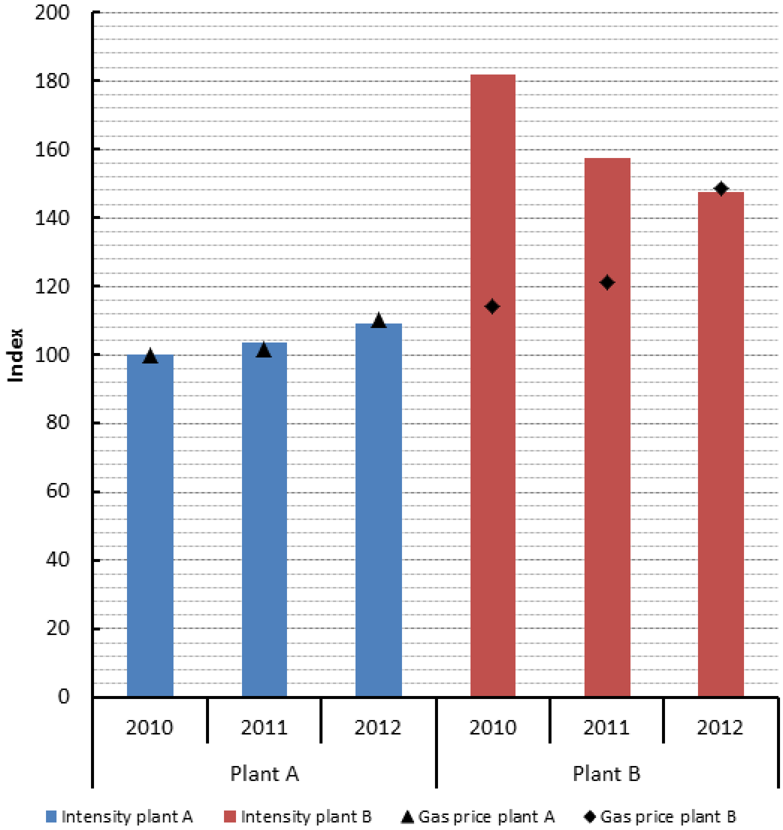
Energy component   Grid fees   Other (excl. VAT)

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)

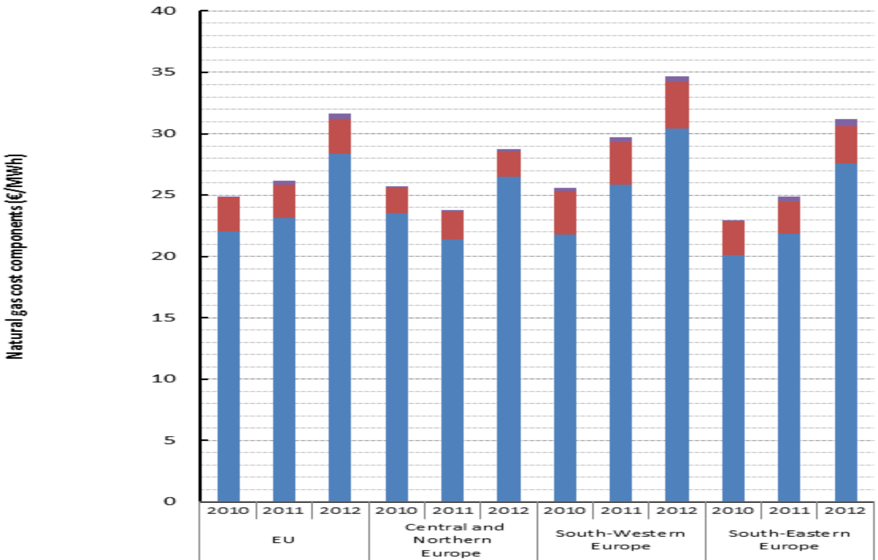
Natural Gas price (€/MWh)	2010	2011	2012	% change 2010-2012
EU average	25,0	26,2	31,7	26,8
EU minimum	21,0	23,1	27,6	31,4
EU maximum	32,3	35,3	37,8	17,0
Central and Northern Europe (average)	25,7	23,8	28,7	11,7
South-Western Europe (average)	25,6	29,7	34,7	35,5
South-Eastern Europe (average)	23,0	25,0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

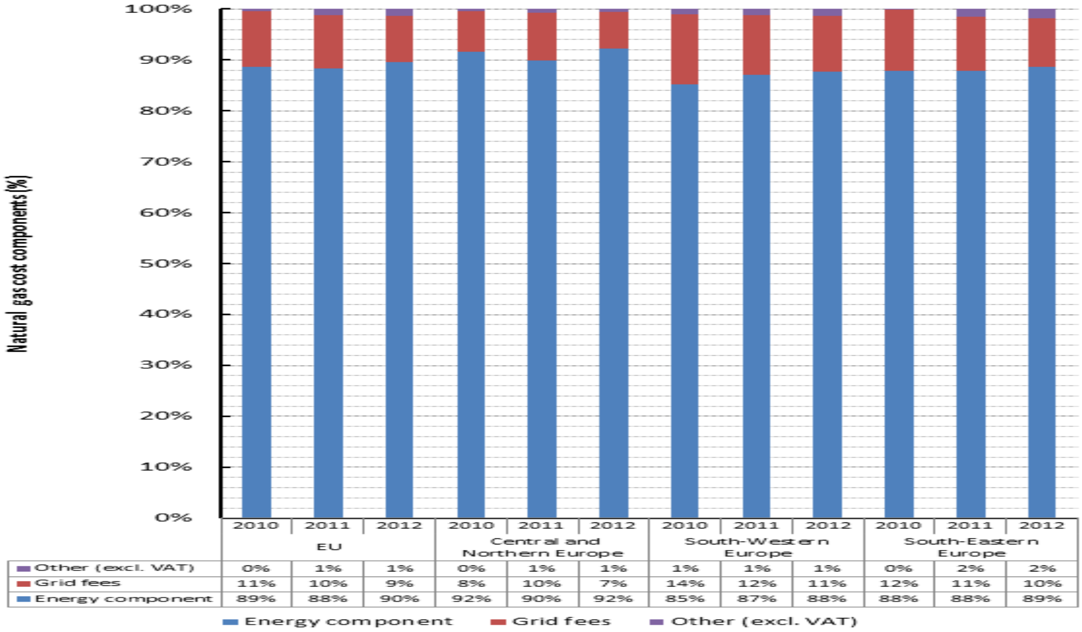
Energy component   Grid fees   Other (excl. VAT)

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 (%)

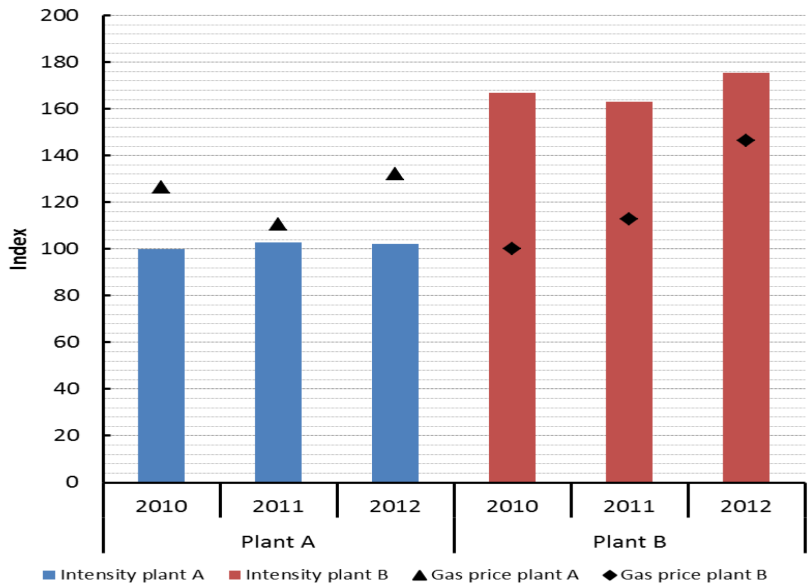


	EU			Central and Northern Europe			South-Western Europe			South-Eastern Europe		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Other (excl. VAT)	0%	1%	1%	0%	1%	1%	1%	1%	1%	0%	2%	2%
Grid fees	11%	10%	9%	8%	10%	7%	14%	12%	11%	12%	11%	10%
Energy component	89%	88%	90%	92%	90%	92%	85%	87%	88%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

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).

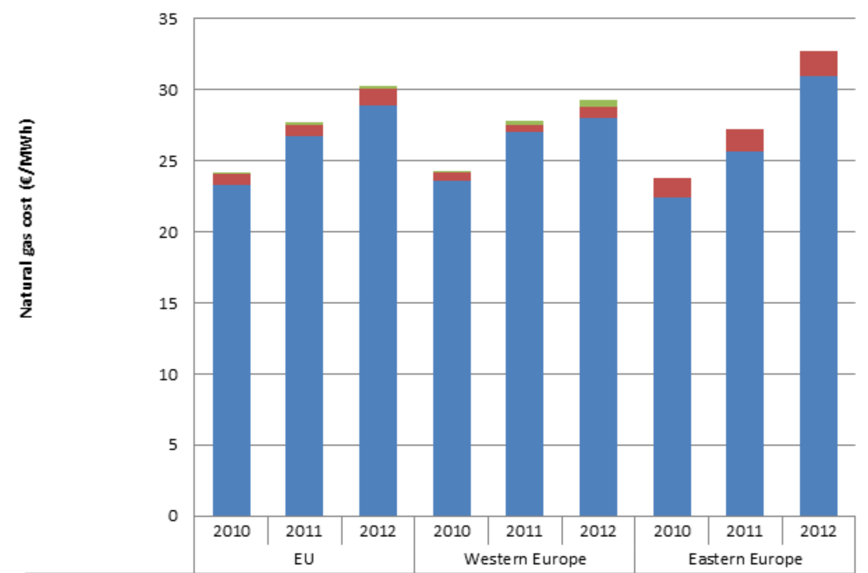
Table 26 Descriptive statistics for natural gas prices paid by the 10 sampled EU producers of float glass (€/MWh)

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.

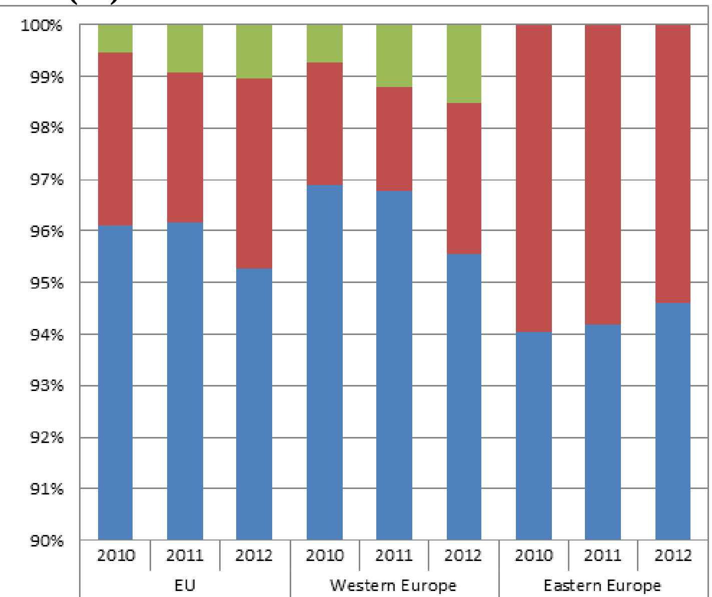
Figure 71 Components of the natural gas bills paid by the 10 sampled float glass producers in Europe (€/MWh)



	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 (%)



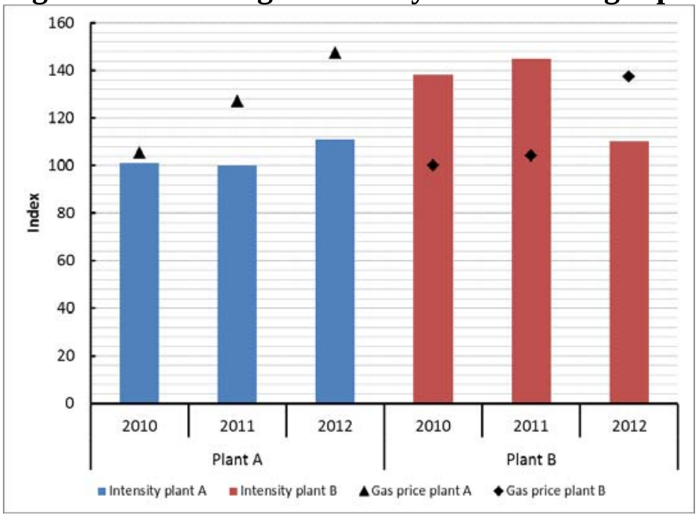
	EU 2010	EU 2011	EU 2012	Western Europe 2010	Western Europe 2011	Western Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012
Other (excl. VAT)	0,5%	0,9%	1,0%	0,7%	1,2%	1,5%	0,0%	0,0%	0,0%
Network cost	3,4%	2,9%	3,7%	2,4%	2,0%	2,9%	6,0%	5,8%	5,4%
Energy component	96,1%	96,2%	95,3%	96,9%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

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%).

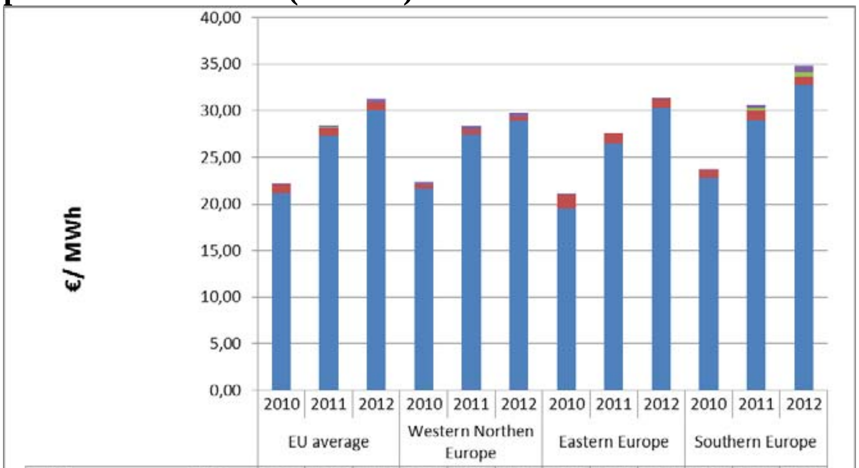
Table 28 Descriptive statistics for natural gas prices paid by the 10 sampled EU producers of ammonia (€/MWh)

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%).

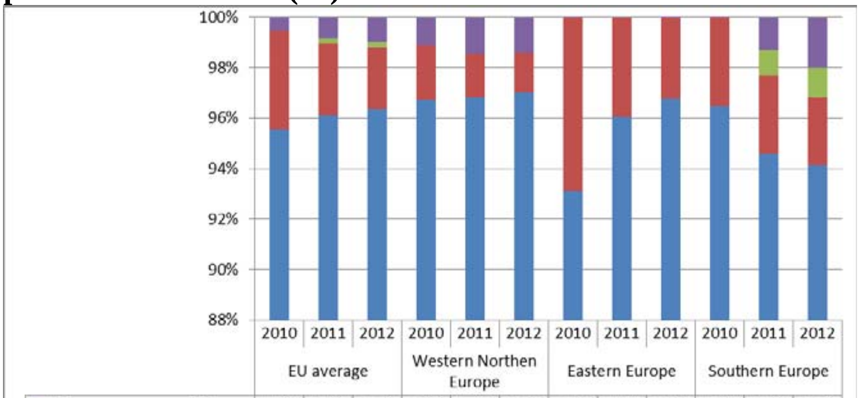
Figure 74 Components of the natural gas bills paid by the 10 sampled ammonia producers in the EU (€/MWh)



	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	0,12	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 (%)

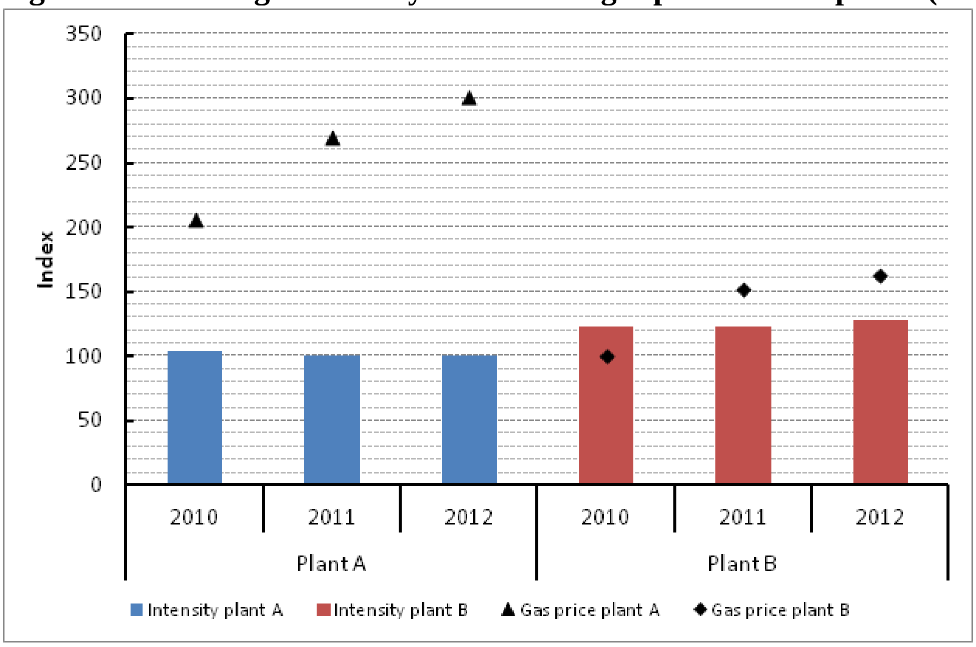


	EU average 2010	EU average 2011	EU average 2012	Western Northen Europe 2010	Western Northen Europe 2011	Western Northen Europe 2012	Eastern Europe 2010	Eastern Europe 2011	Eastern Europe 2012	Southern Europe 2010	Southern Europe 2011	Southern Europe 2012
Other non-recoverable taxes	0,5%	0,9%	1,0%	1,1%	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[24]

For each technology[25], 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:

[24] http://ec.europa.eu/enterprise/sectors/metals-minerals/files/steel-cum-cost-imp_en.pdf
[25] See technology explanations, abbreviations and representation in the sample in section **Error! Reference source not found.**.

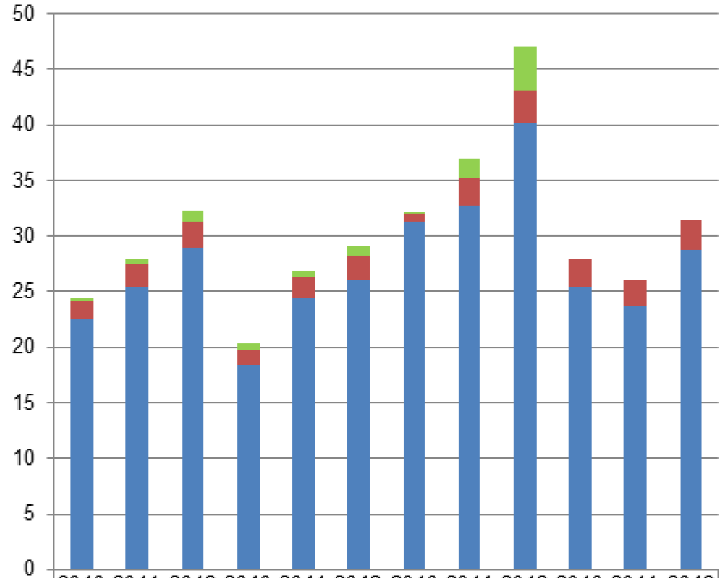
Table 30 Descriptive statistics for natural gas prices paid by 15 sampled EU producers of steel (€/MWh)

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%.

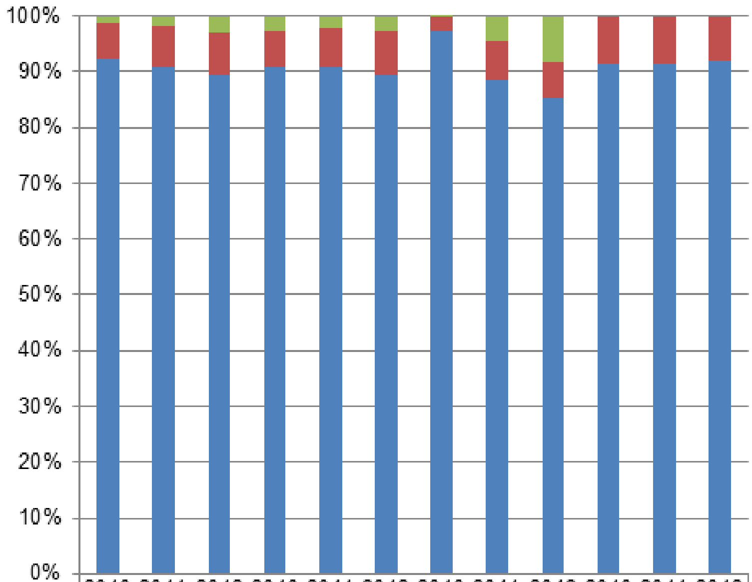
Figure 77 Components of the natural gas bills paid by 14 steel producers in the EU (€/MWh)



	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[26].

- 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.

[26] 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** for a selection of case studies of energy intensive industrial sectors 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[27] 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.

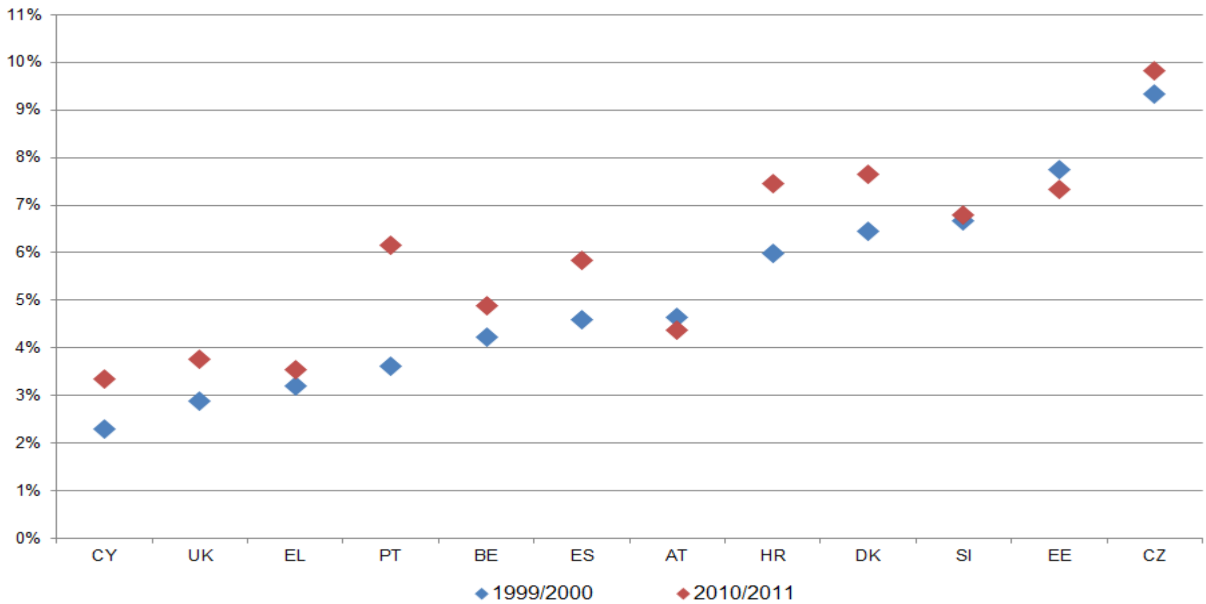
Household expenditure on transport fuels varied less by Member State than that of household energy expenditure related to heating and lighting needs. **In 2010/2011 transport fuel expenditure as a share of disposable income varied between 2.5% and 4.5%**, as Figure 80 shows.

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[28] 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.

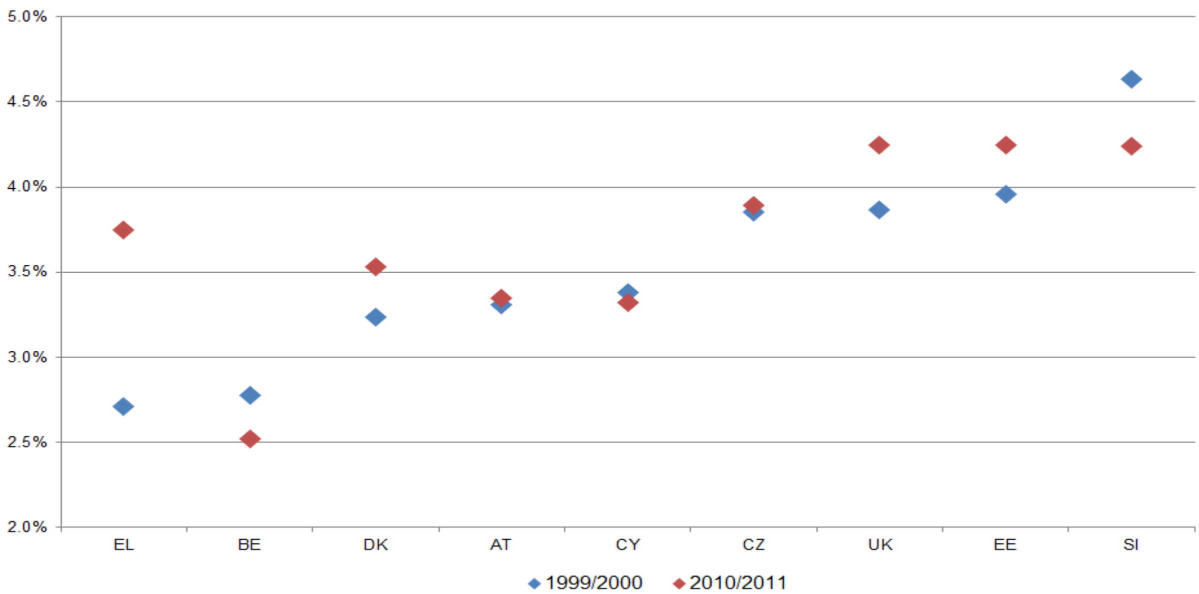
[27] In this paragraph transport fuels are not included in households' energy related expenditure.
[28] In order to better track developments in household expenditures on energy, all Member States should have comparable data in time and content; conclusion in this paragraph on expenditures related to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

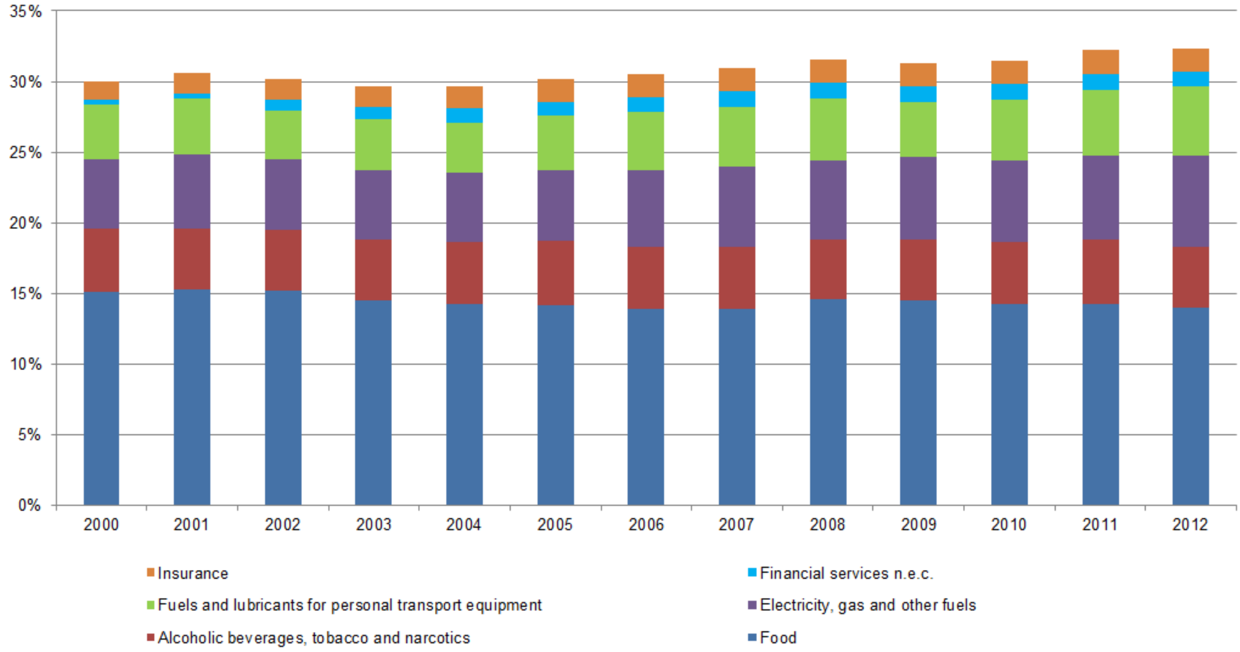
Given the lack of sufficiently detailed and recent data for many Member States, the Household Budget Survey (HBS) offers only a limited picture of the EU as a whole. HBS data collection is carried out once every 5 years in Member States and data reference periods are not harmonised across the EU. The 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[29], 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[30]. 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)

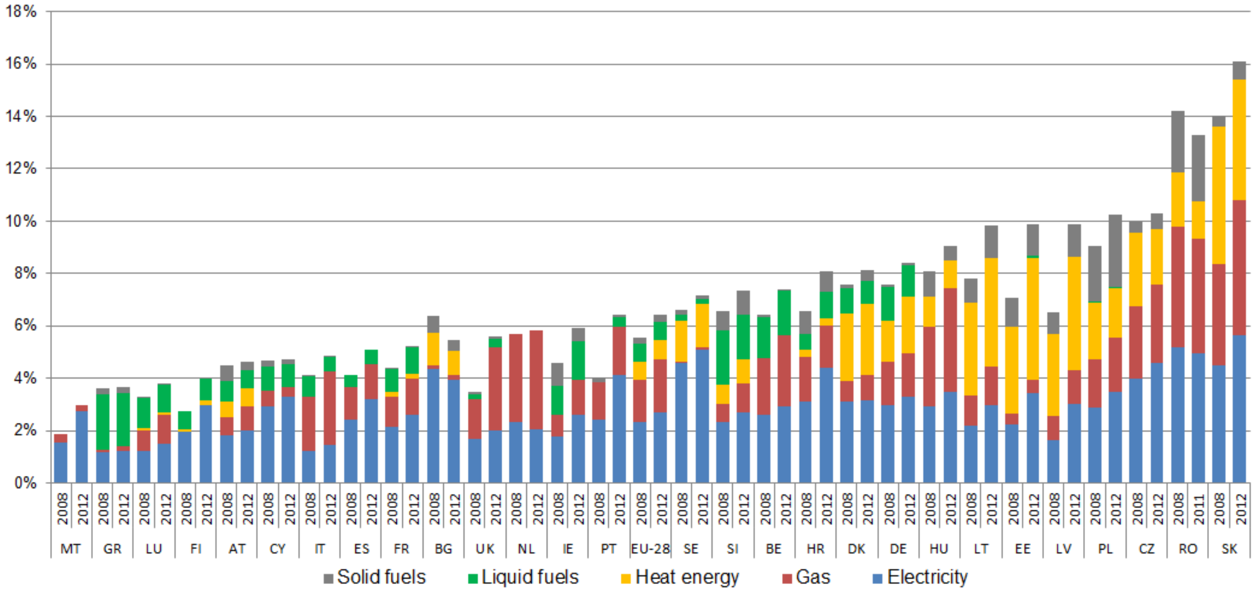
[29] 2012 HICP weights represent in reality the consumption structure of the households in earlier (2010 or 2011) periods across the EU Member States, these data are therefore comparable with HBS statistics time periods presented on the previous page

[30] 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*[31].

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.

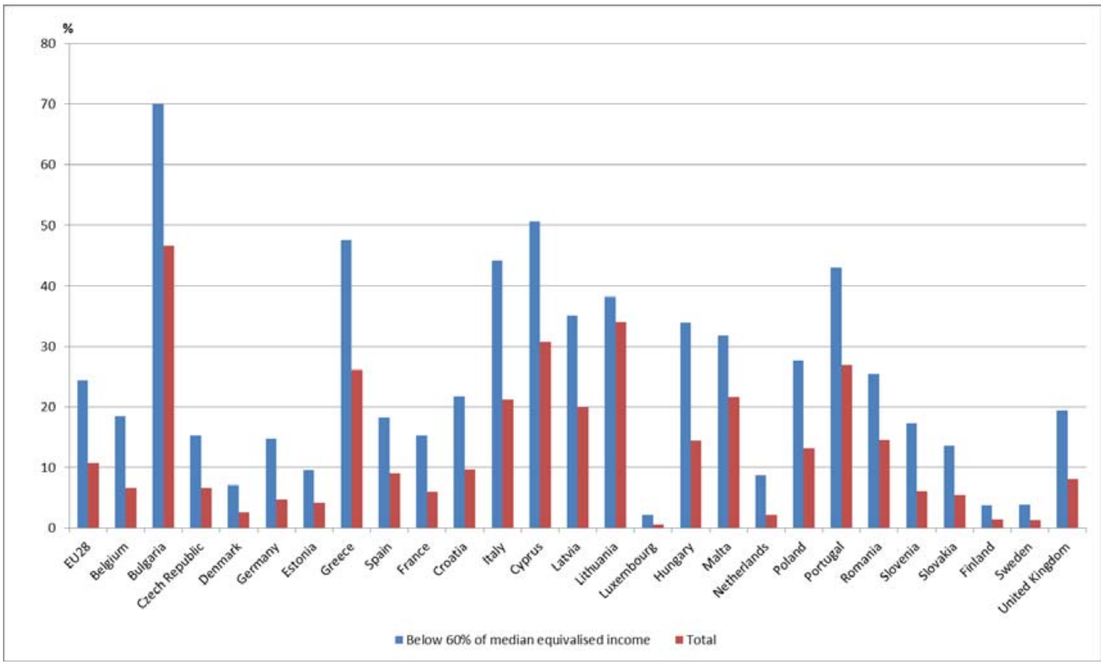
[31] Heat energy statistical category refers to district heating

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[32]. 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 reaches 46.5% in Bulgaria and a very high 70% in the lower income households in the country.

Figure 83. Inability to keep home adequately warm

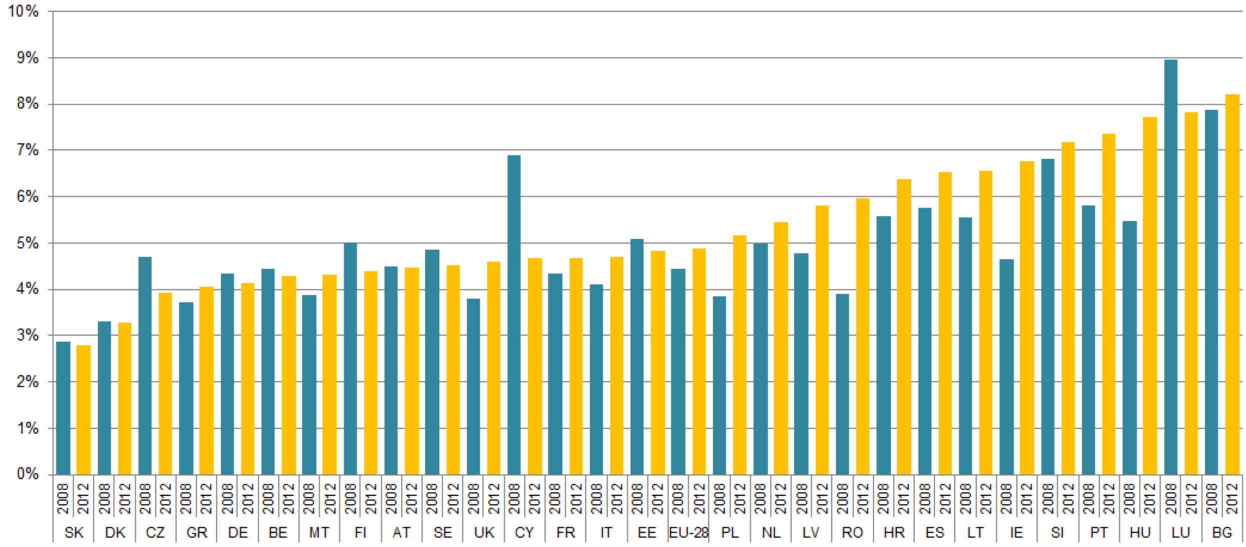


Source: Eurostat. Income and Living Conditions (ILIC) questionnaires

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.

[32] 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

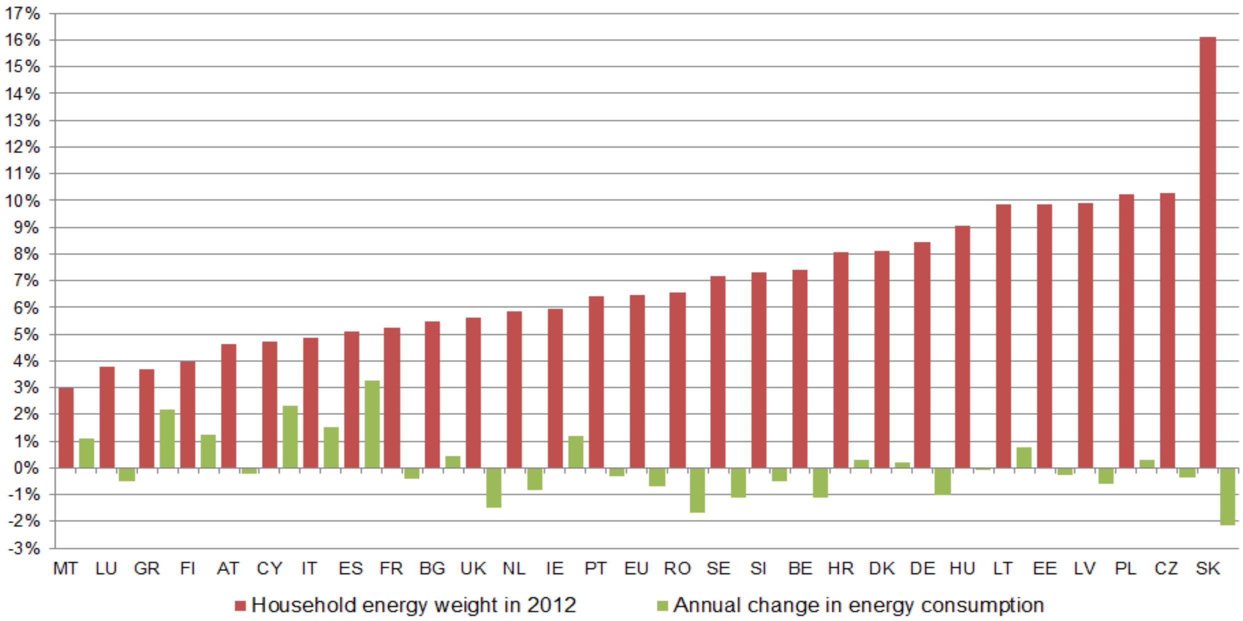


Source: Eurostat (Consumer Price Statistics)

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.[33]

[33] 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



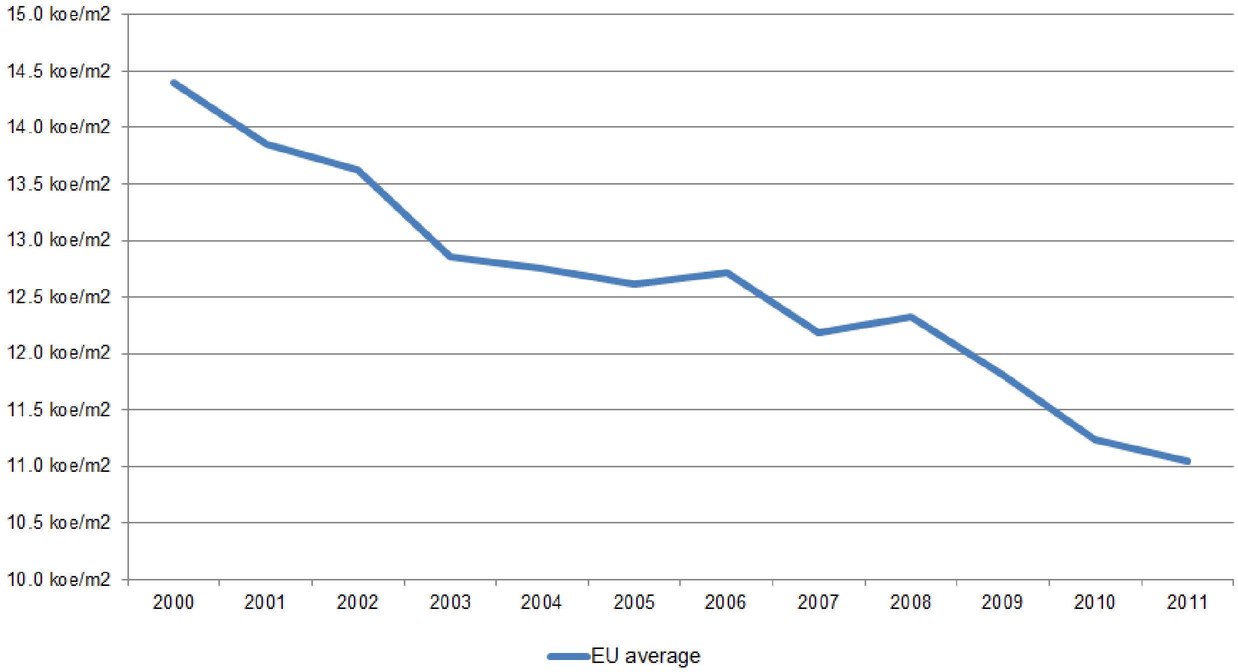
Source: Eurostat, ODYSSEE energy efficiency database

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[34] 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.

[34] 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**[35]:

- Manufacturing of paper and paper products[36]
- Manufacturing of chemicals and chemical products[37]
- Manufacturing of pharmaceuticals[38]
- Manufacture of non-metallic minerals[39]
- Iron and steel industry[40] and non-ferrous metals[41]

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[42]. 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

[35] 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.

[36] NACE groups 17 and 18

[37] NACE group 20

[38] NACE groups 21

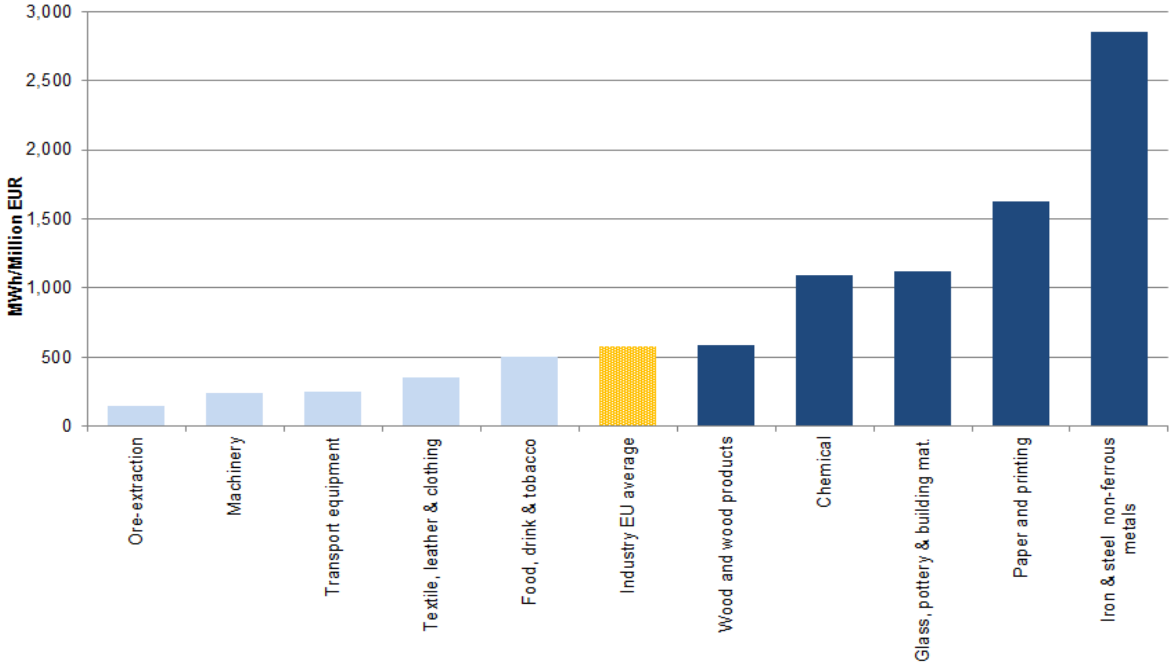
[39] NACE group 23, including building materials, glass, ceramics

[40] 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.

[41] 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.

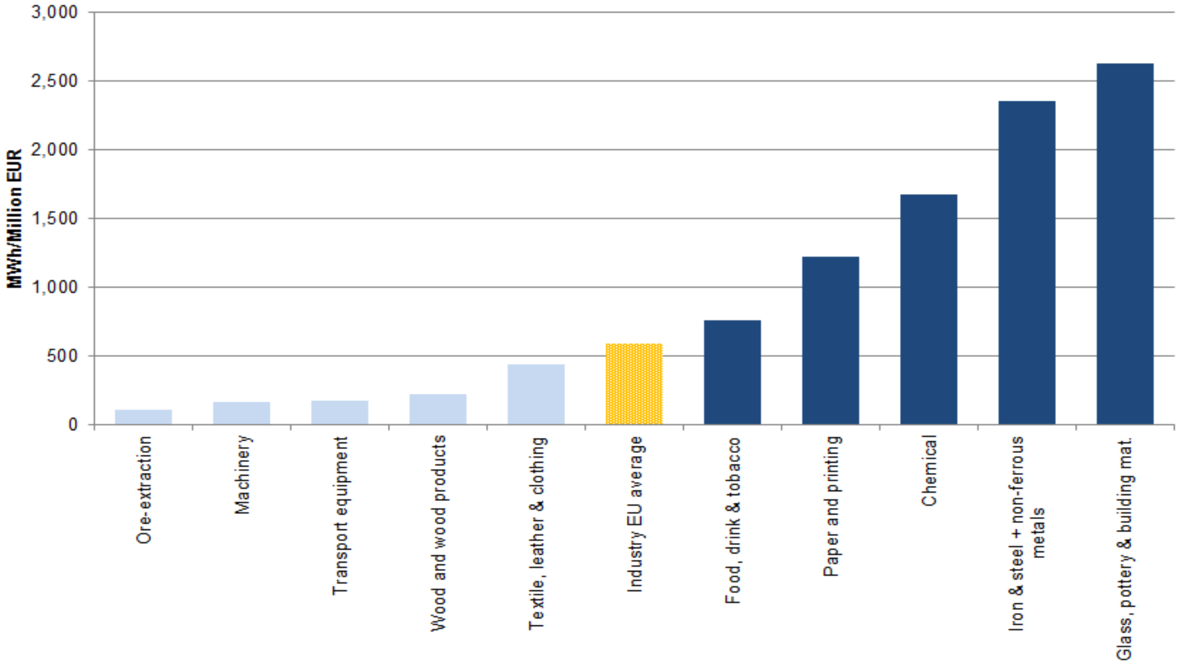
Figure 87 Electricity intensity in industrial sectors of the EU (EU average)



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.

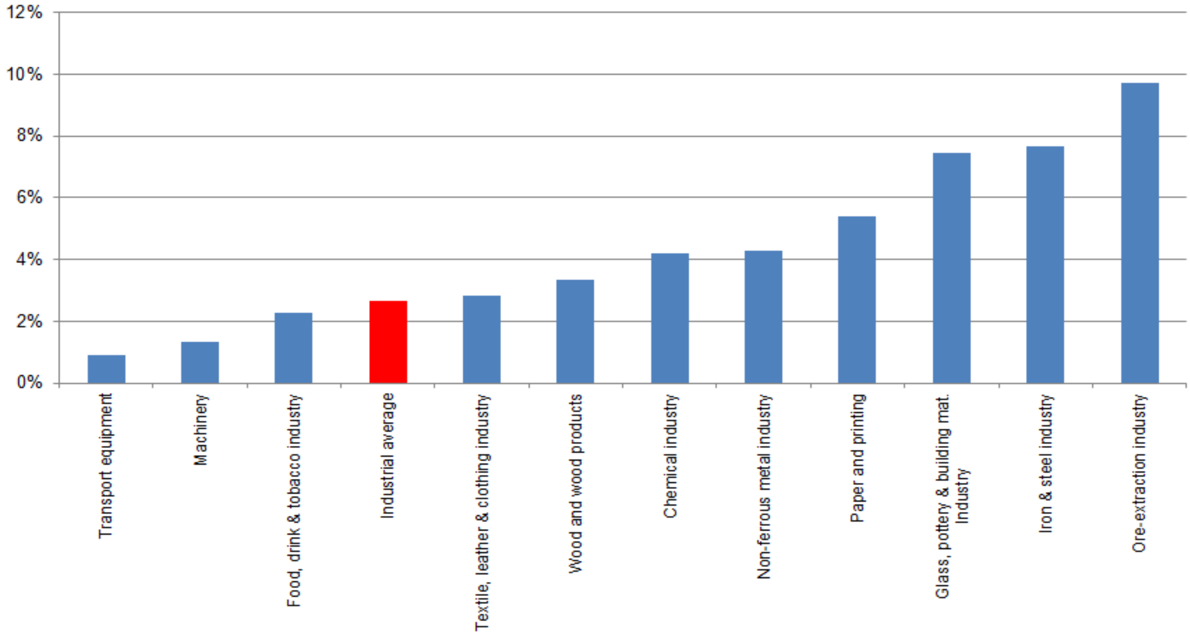
Figure 88 Gas intensity in industrial sectors of the EU (EU average)



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.

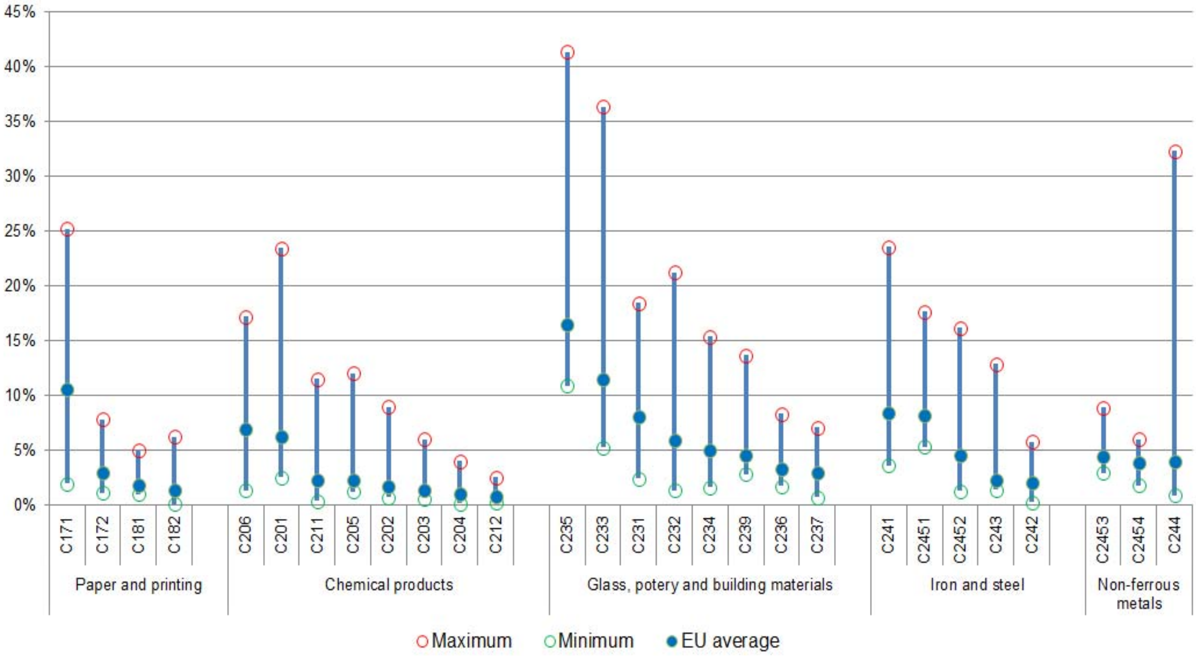
Going to the even more detailed level presented in Figure 90, specific individual industries might have very high energy intensity, as Table 31 shows. In some cases, (e.g.: chemical industry), energy products, like natural gas are also used as feedstock, and if use of energy products for purposes other 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[43]and to provide detailed analysis of the structure of incurred costs, improvements in energy intensity, exposure of the industry to international trade, etc.

[43] 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

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:

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

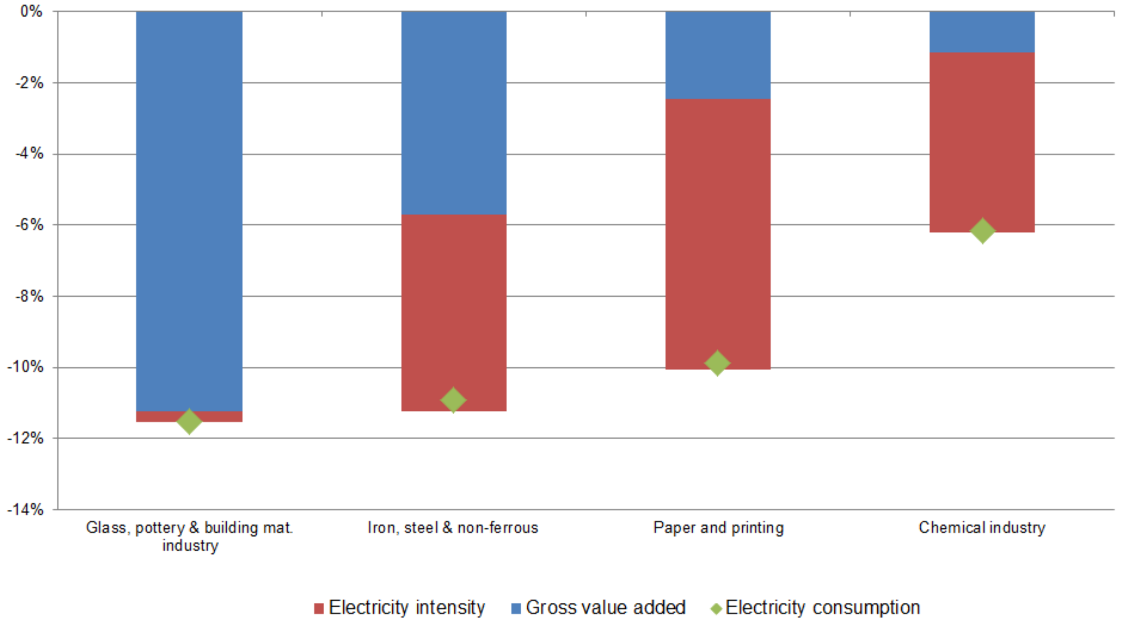
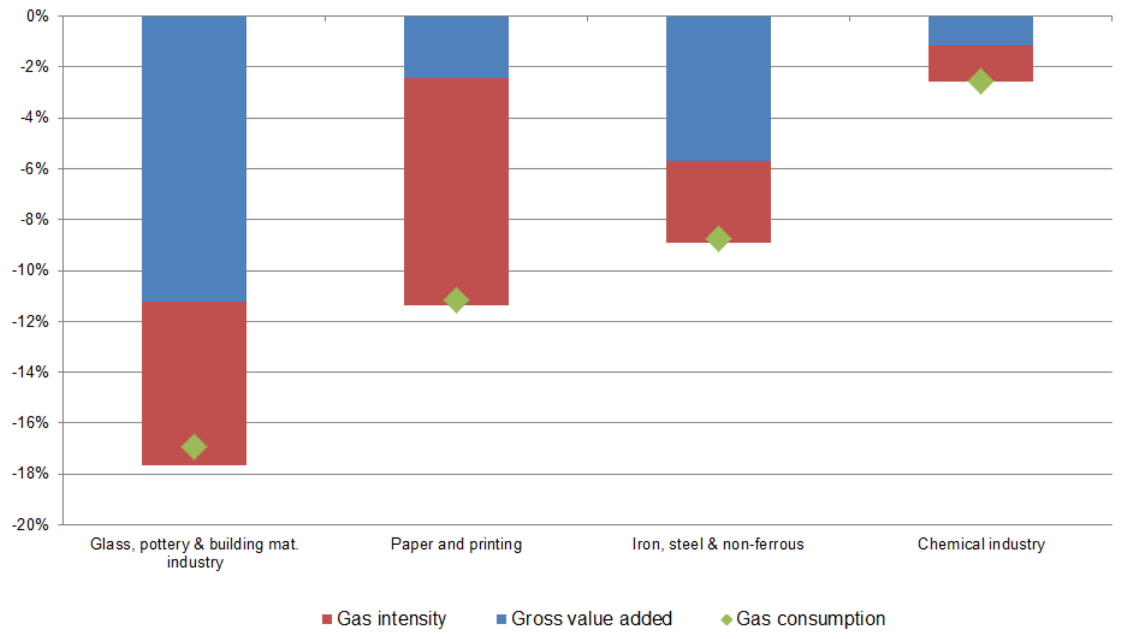


Figure 92 The impact of changes in gas intensity and gross value added on electricity and gas consumption between 2008 and 2011

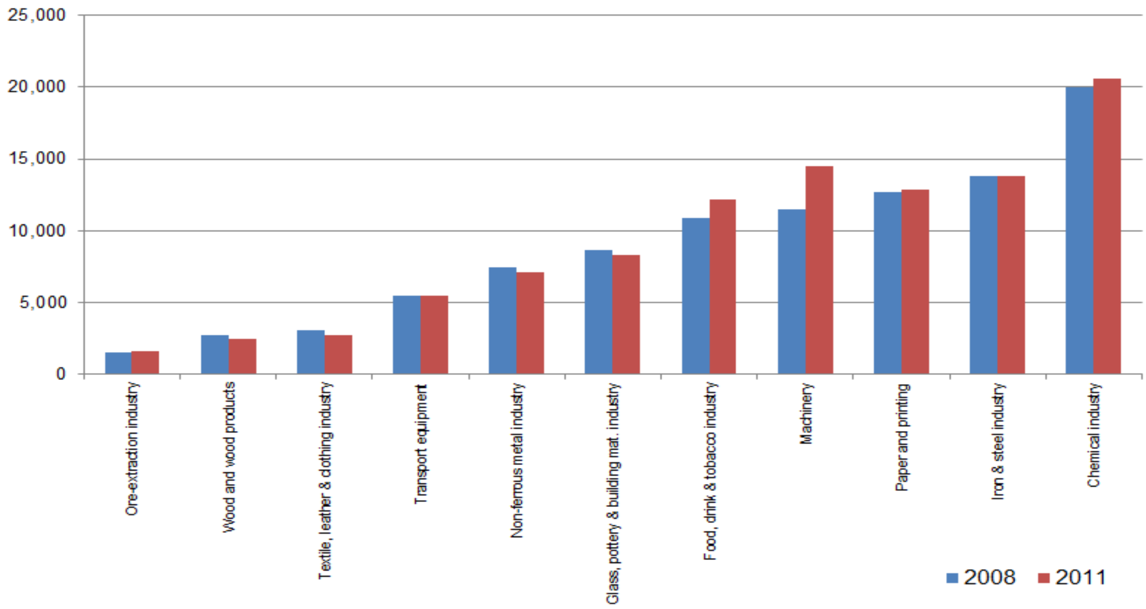


Source: Eurostat national accounts and energy balances; own computations.
Note: Data in national accounts is at NACE 2-digit level, whereby industry refers to manufacturing industry.

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[44]. In other industries there were also improvements, with the 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[45] 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.

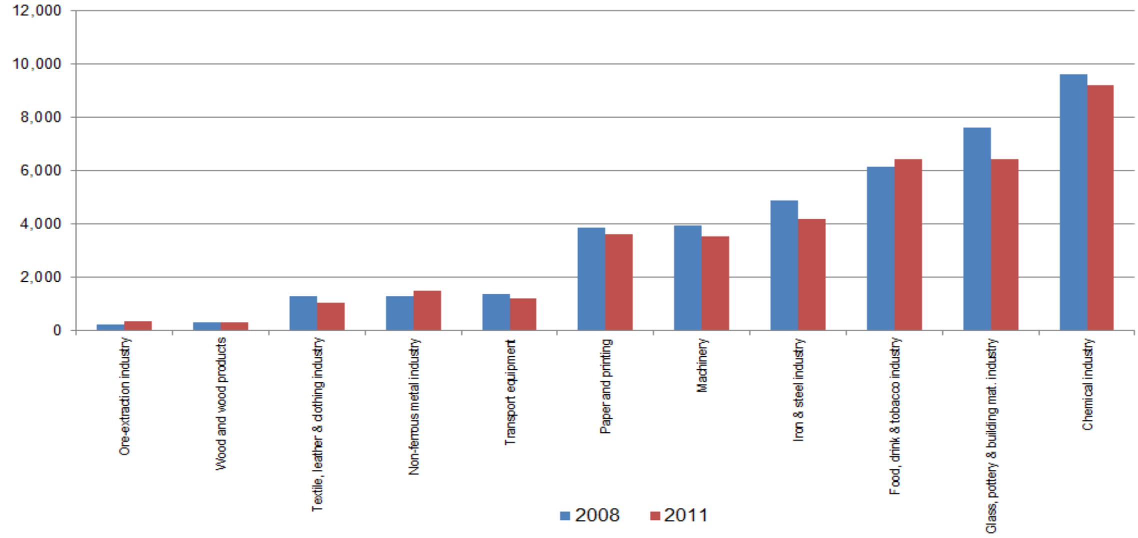
Figure 93 Estimated annual electricity expenditures in given industries in the EU, million EUR



Source: Eurostat energy balances and energy retail prices

[44] 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.
[45] 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

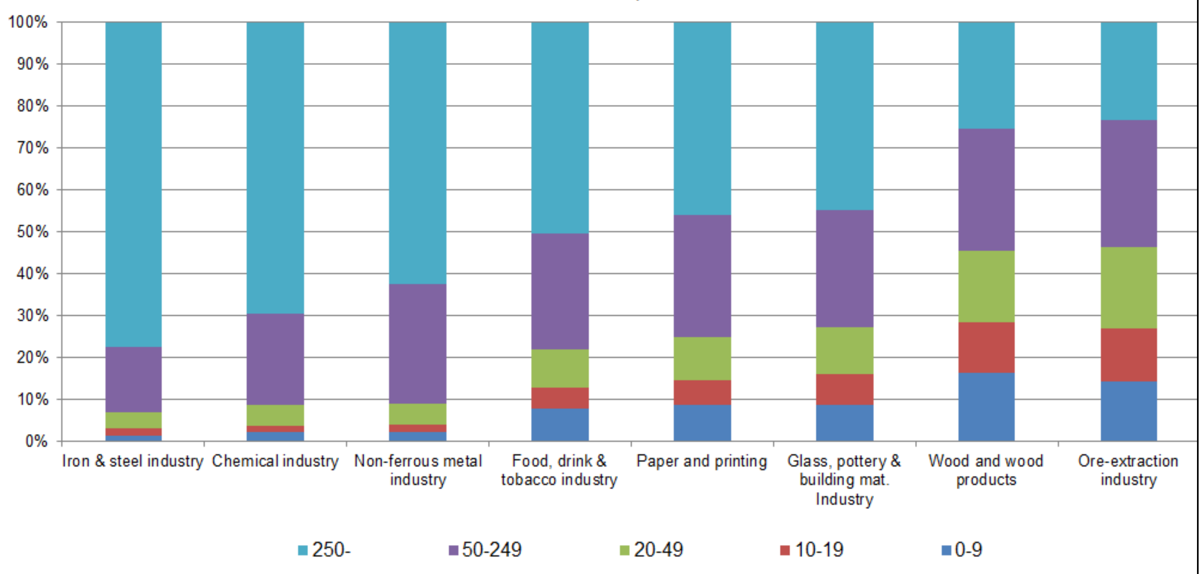
The role of small and medium size enterprises

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 1 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 1. 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[46] 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[47] 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).

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

[47] 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[48] 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[49] points that energy costs account for 10% of production costs in the clay materials manufacturing sector[50] 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[51].

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[52] calculated for the whole EU27 has increased from 2.5% to 4.8%.

[48] Source: Cerame Unie
[49] Carbon leakage evidence study, see http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/cl_evidence_factsheets_en.pdf
[50] Includes wall and floor tiles and brick and roof tiles. Based on SBS
[51] The sampled plants do not use energy sources other than electricity or natural gas.
[52] 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[53] 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

[53] 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[54] 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.[55] 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[56] 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%[57].

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%[58] 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

[54] Source: Eurostat PRODCOM database
[55] G. Timellini, 2008) http://eippcb.jrc.ec.europa.eu/reference/BREF/cer_bref_0807.pdf
[56] Includes wall and floor tiles and brick and roof tiles. Based on SBS
[57] The sampled plants do not use energy sources other than electricity or natural gas.
[58] 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[59].

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[60]. 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.[61] 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.[62] However, intense competition between companies has led to glass being transported over longer distances, ultimately limited by cost.[63] For transportation by land, 200 km is seen as the norm and 600 km as the economic limit.[64]

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%.

[59] 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).
[60] Source: CEPS, based on industrial associations data
[61] Pilkington, 2010
[62] Pilkington, 2006
[63] Ecorys, 2008
[64] 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

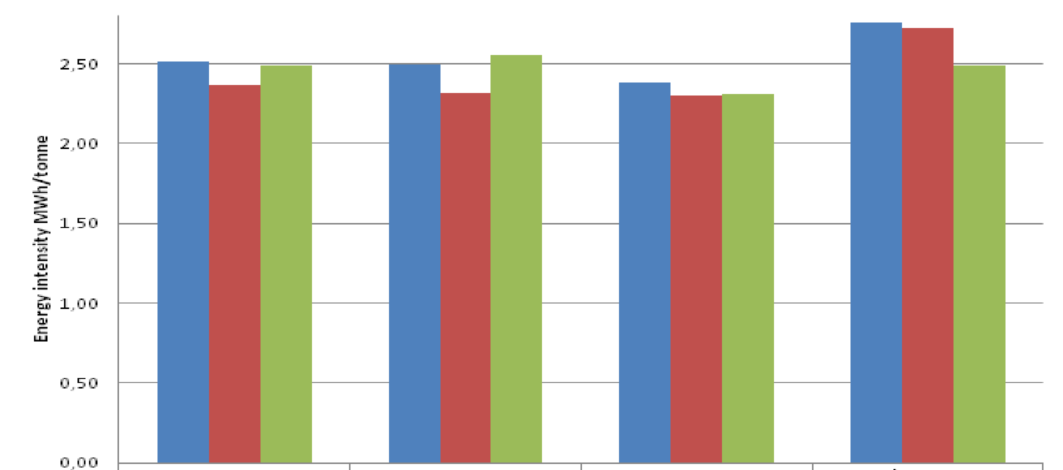
After a period of boom, between 2007 and 2012 the production value of the EU27 flat glass sector decreased by about 26%, from €4.4 to €3.2 billion. At the last count, 46 tanks were operating in the EU, 90% of which were run by four major groups: Saint Gobain, AGC, NSG Group (Pilkington) and Guardian, 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.

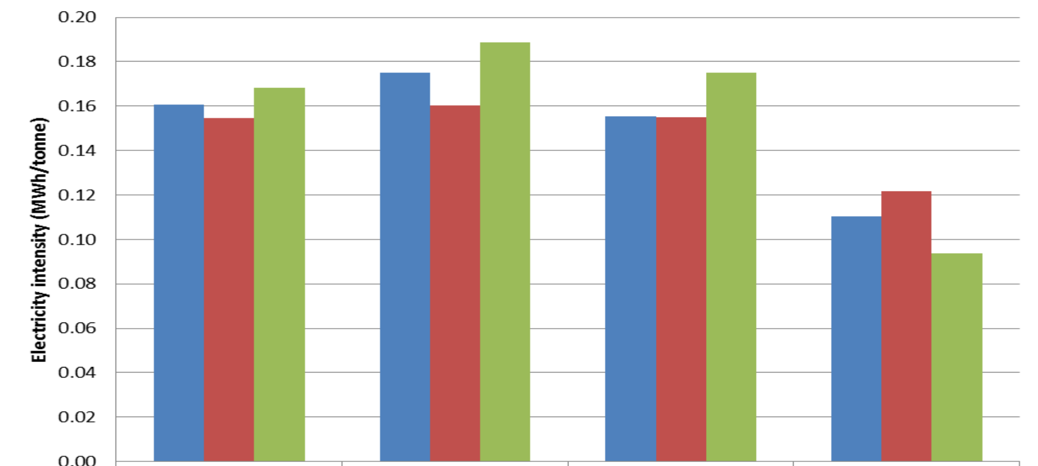
Figure 98. Energy intensities of 10 float glass producers in the EU (natural gas and fuel oil) in terms of physical output, weighted average, MWh/tonne



	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[65].

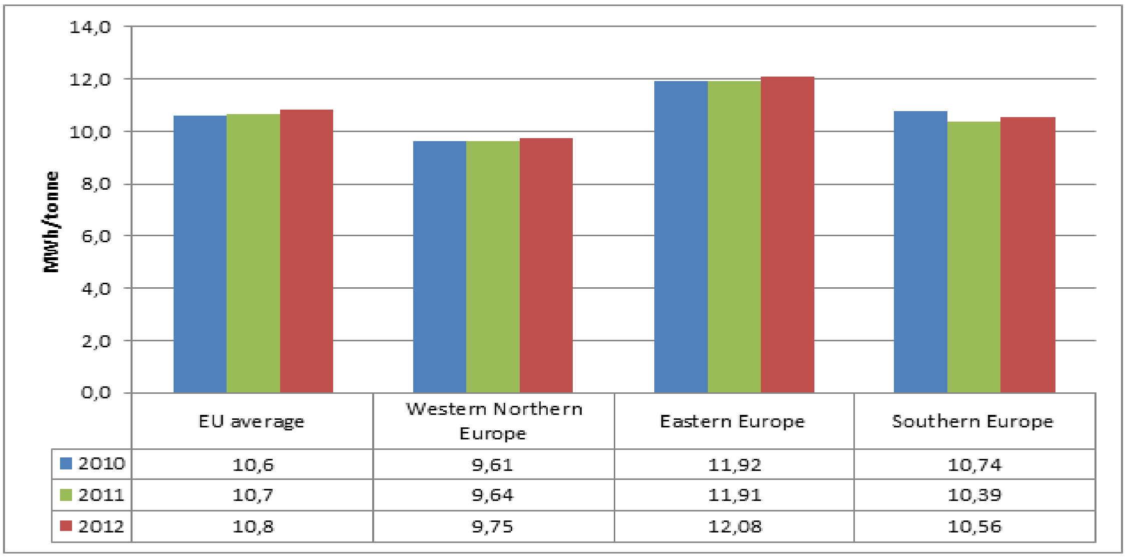
Natural gas is favoured over other feedstock due to its availability and ease of delivery as an inexpensive feedstock in some regions, its high hydrogen content, and the relative simplicity and low operative costs of plants designed for natural gas. Natural gas is usually employed both as feedstock (approximately 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[66]. Other energy inputs are represented by electricity and steam; their impact on overall production costs is

[65] CEPS case studies
[66] IEA.

limited. There have been large gains in energy efficiency for ammonia production since the 1970s[67], particularly in Europe.

Figure 100. **Natural gas intensity of EU ammonia producers (MWh/tonne)**



	EU average	Western Northern Europe	Eastern Europe	Southern Europe
2010	10,6	9,61	11,92	10,74
2011	10,7	9,64	11,91	10,39
2012	10,8	9,75	12,08	10,56

Source: European Commission estimates based on CEPS studies

[67] 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.[68]

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.[69]

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.

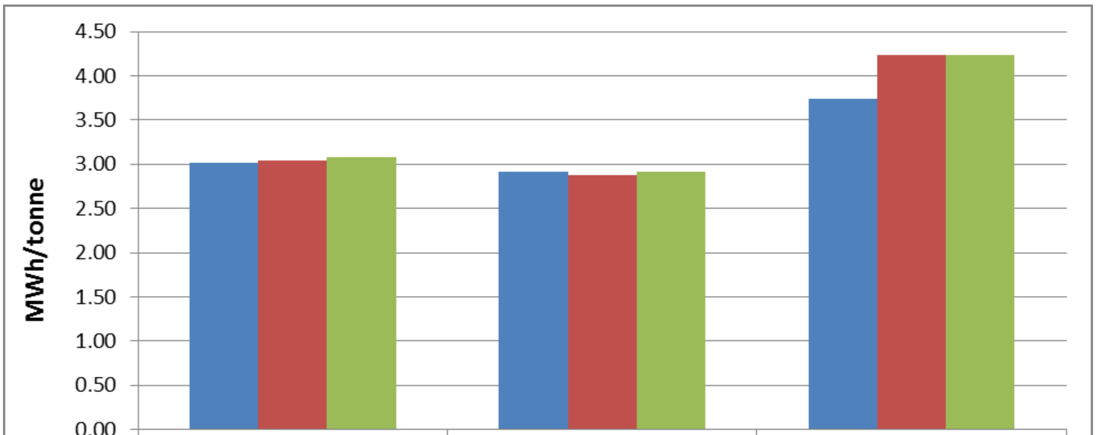
For the EU in 2012, approximately 55% of capacity was based on the most efficient membrane technology (against an average 67% worldwide), about 13% was based on diaphragm technology (22% at global level) and around 29% was still based on mercury technology (against 5% at global level).

[68] IHS, Abstract, Chlorine/Sodium Hydroxide

[69] 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)



	EU average	Central Northen Europe	Southern Western Europe
2010	3.02	2.92	3.74
2011	3.04	2.88	4.24
2012	3.07	2.91	4.24

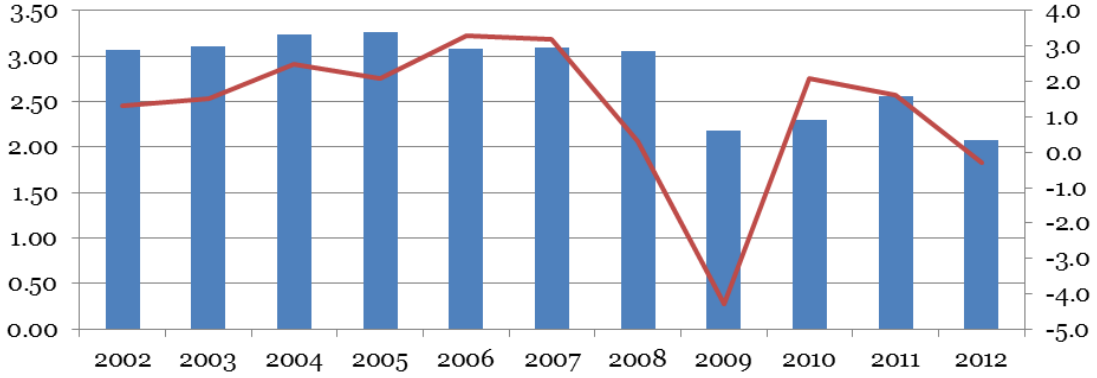
Source: European Commission estimates based on CEPS

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.

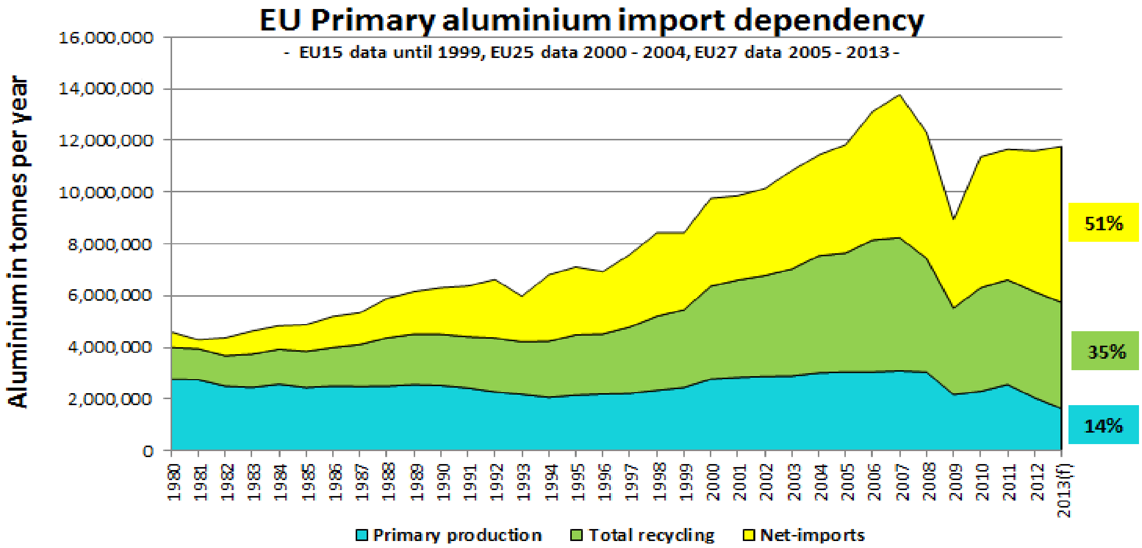
Table 42 Primary aluminium production in the EU, Norway and Iceland

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.