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# COMMISSION STAFF WORKING PAPER

## 2010 Annual Report of the Market Observatory for Energy

## Volume II

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### *3.1.5. Evolution of EU oil production and demand*

#### 3.1.5.1 Oil production developments at world level, in the EU and in Norway

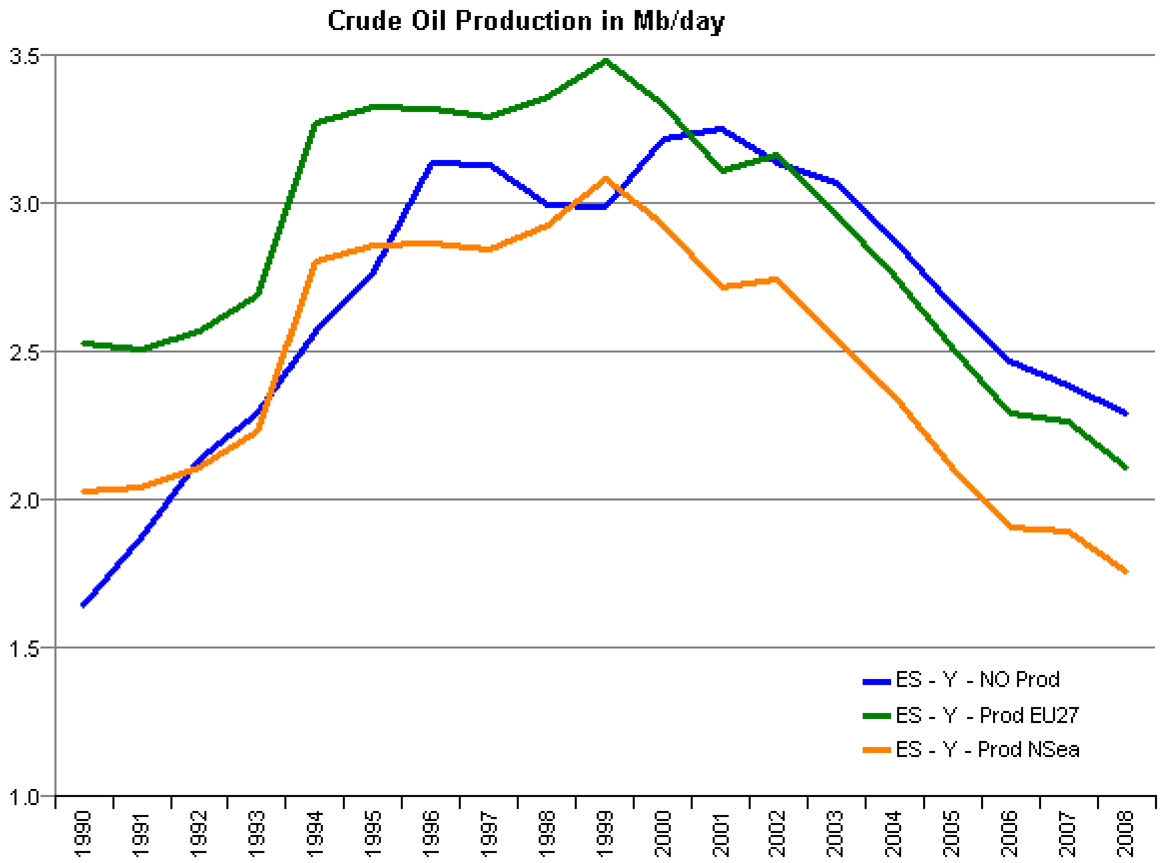
Global oil production fell in 2009 by 1.5 million bbl/d which is more than the decline in consumption of approximately 1.3 million bbl/d that same year. This decline in production was primarily the consequence of OPEC's supply management during the year. OPEC made three successive production cuts in late 2008, in response to the sharp drop in oil prices; those cuts remained in effect throughout 2009.

OPEC production fell by 2.3 million bbl/d in 2009 of which Saudi Arabia made up nearly 1 million bbl/d. Production outside OPEC increased, notably in the US by around half a million bbl/d (the strongest increase since 1970), led by offshore production in the Gulf of Mexico. Russia managed to increase further its oil production in 2009 compared to the previous year (+0.1 million bbl/d) and overtook Saudi Arabia with its 9.9 million bbl daily production (which latter produced 9.8 million bbl per day).

In the EU, on the basis of Eurostat cumulated monthly data, crude oil production declined by about 6% in 2009 and is estimated at around 2 million b/d which represents about 2.4% of world oil production. This decrease can mainly be attributed to the decline in North Sea production (the United Kingdom, Denmark, and the Netherlands) which represents some 80% of total EU production.

Norwegian oil production, one of the main EU crude oil supply sources, fell by 3% in 2009, representing half of the EU North Sea production fall (in percentage terms).

Figure 43: EU-27 and Norway and North Sea, Crude oil production (in Mb/d) (1990-2008)



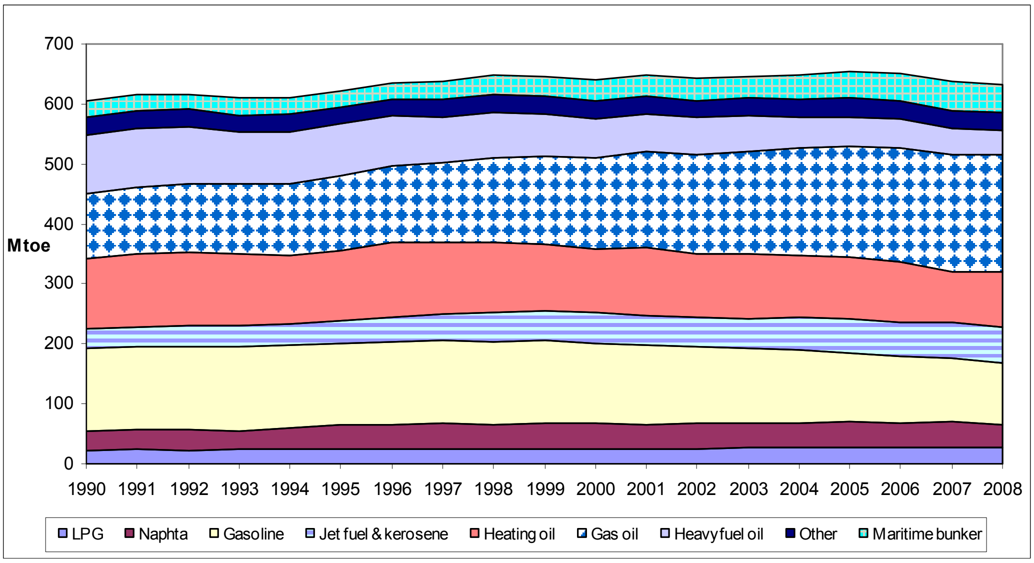

Source: Eurostat (2010)

### 3.1.5.2 Evolution of oil consumption in the EU

It is widely considered that the EU petroleum product market is a mature market which has more than likely already hit its peak. On top of long-lasting effects of the global financial and economic crisis, EU regulations to tighten fuel specifications, reduce emissions from refineries and cars as well as to provide support for the development of non-fossil fuel vehicles point towards a future of diminishing demand for petroleum-based products. The demand for certain products, in particular middle distillates such as jet fuel and diesel fuel, including marine gas oil, is however expected to continue to grow in the years to come. On the other hand, gasoline demand in the EU is widely expected to fall further.

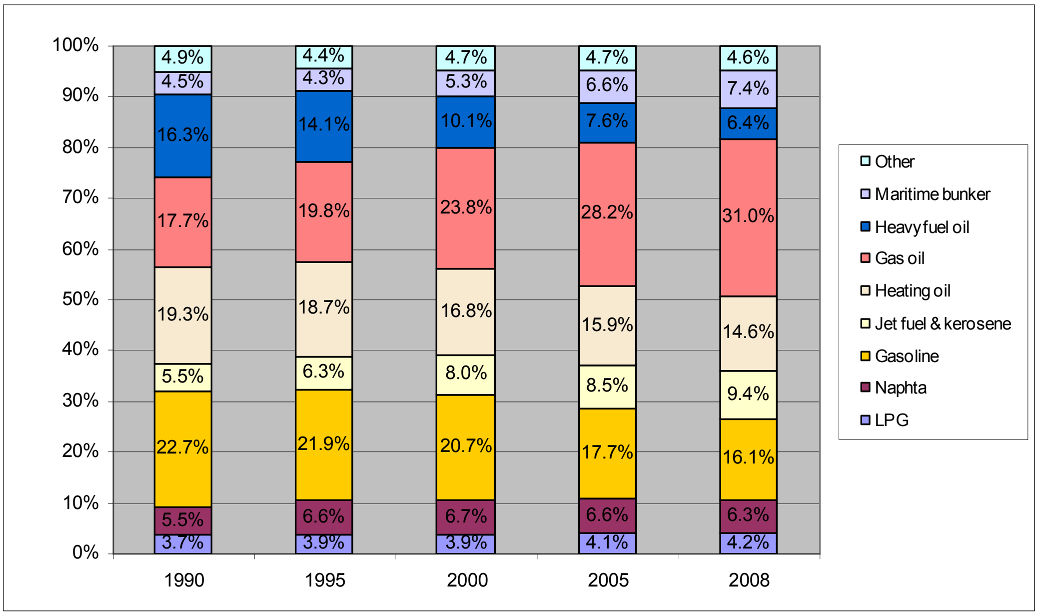
Between 1990 and 2008, the evolution of EU demand in individual petroleum products reveals very different trends: jet fuel & kerosene consumption almost doubled; consumption in diesel fuel registered a steady and sustained growth; demand for naphtha registered an initial increase and then a fall; demand for gasoline and heating oil fell quite sharply, while demand for residual fuel oil fell significantly. This decline in heating oil and residual fuel oil is partly due to the penetration of natural gas in the households and industrial sectors.

Figure 44: EU 27, Petroleum products demand evolution (in Mtoe) (1990-2008)




Source: Eurostat (2010)

Figure 45: EU 27, Petroleum product demand mix (in %) (1990-2008)

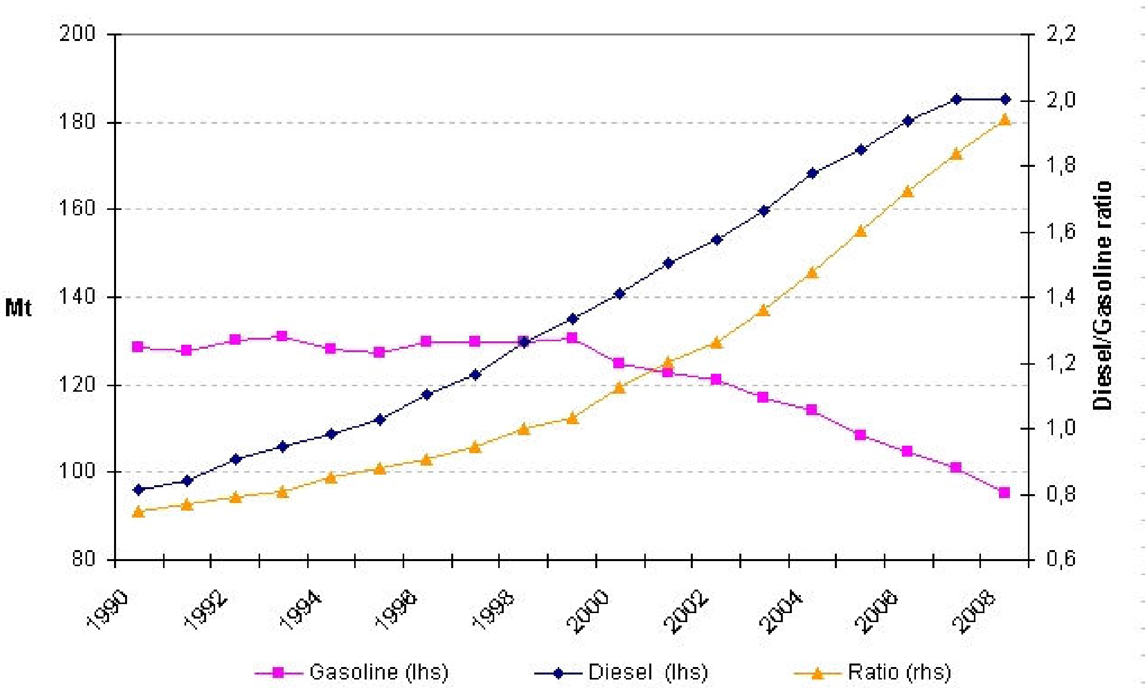



Source: Eurostat (2010)

According to Eurostat cumulated monthly data, EU gross inland oil consumption fell by 4.5% in 2009 versus 2008 due to the recession, reaching a level of 610 Mtoe or about 12.2 Mb/d, equivalent to 15% of world oil consumption. The main petroleum products registered a decrease: 2% for gasoline, 6.3% for jet fuel & kerosene, 4.7% for gas/diesel oil and 6.7% for residual fuel oil. The share of these main petroleum products in 2009 EU total inland deliveries was as follows: gasoline: 16.8%, jet fuel & kerosene: 9.6%, gas/diesel oil: 48% and residual fuel oil: 5.6%.

Regarding road fuel demand in the EU, it can be seen from the graph below that diesel oil has registered continuous growth between 1990 and 2009, whereas gasoline demand was flat between 1990 and 1999 and then it fell subsequently by about 25% between 1999 and 2009. This is probably related to favourable taxation conditions of diesel oil compared to that of gasoline.

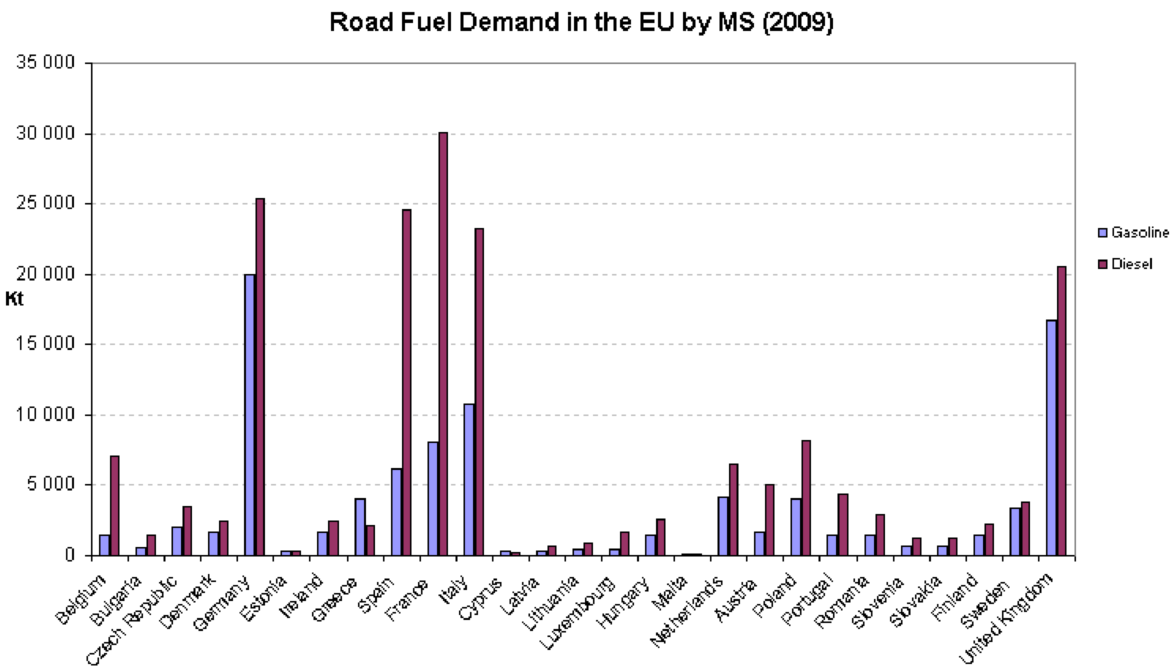
Figure 46: EU-27, Evolution of road fuel demand (in Mt) (1990-2008)




Source: Eurostat (2010)

As can be seen from the graph below, more road diesel fuel was consumed in 2009 than gasoline in all EU countries with the exceptions of Greece and Cyprus.

Figure 47: EU-27, Road fuel demand by Member States (in Kt) (2009)




Source: Eurostat (2010)

With regard to biofuels, biodiesel remained by far the main biofuel produced and marketed in the EU in 2009 with an output of 9 million tonnes versus approximately 1.5

million tonnes of biogasoline. The EU remained the leading biodiesel-producing region worldwide, representing about 65% of global output.

The share of biofuels in total final consumption of petrol and diesel oil for transportation purposes has been progressing in the EU over recent years to reach a level of around 3.7% in 2009. The Renewable Energy Directive[23] is creating a strong framework for the development of the biofuels industry in the EU, with the landmark decision to introduce a 10% binding target in 2020 for renewable energy use in transport. In addition, biofuels could provide a genuine solution not only to reduce greenhouse gas (GHG) emissions but also to alleviate the increasing EU diesel deficit.

### *3.1.6 Refining sector developments in the EU[24]*

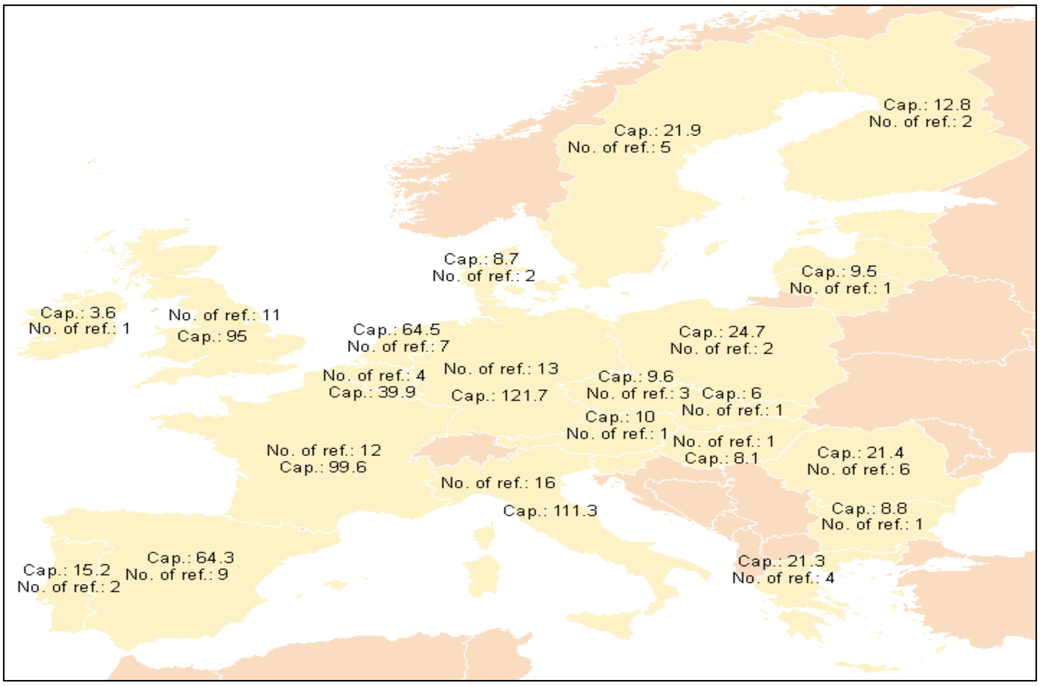
The EU nominal refining capacity (atmospheric distillation) currently represents 778 million tonnes (15.5 million barrels per day), equivalent to 18% of total global capacity. This EU capacity level has been fairly stable over the past decade. However, the refining capacity in service in the EU is currently noticeably below the nominal capacity.

In May 2010, there were around 104 refineries operating in the EU with at least one plant in all EU countries with the exceptions of Cyprus, Estonia, Latvia, Luxembourg, Malta and Slovenia.

Map 2: Number of operating refineries and refinery capacity in million tonnes in the EU by Member States

[23] COM 2009/28/EC.

[24] It is worth noting here that more information can be found on the EU refinery sector in the COMMISSION STAFF WORKING PAPER ON REFINING AND THE SUPPLY OF PETROLEUM PRODUCTS IN THE EU published on 17 November 2010.



*Source: European Commission*

While EU nominal refining capacity is more than sufficient to cover total EU gross consumption (inland consumption + bunkers) which amounted to around 660 Mtoe in 2009, (i.e. 85% of the nominal refining capacity), the quantities of crude oil and other feed-stocks processed in the EU refineries amounted to 660 Mt in 2009 as against 709 Mt in 2008[25]. Lower crude runs, due to falling demand for petroleum products in 2009, in conjunction with stable nominal refining capacities, have pushed down EU level refinery utilisation rates to below 80%, representing a continued increase in unused capacity.

Refining margins also fell to very low (in some instances even negative) levels in 2009, both for simple and complex plants.

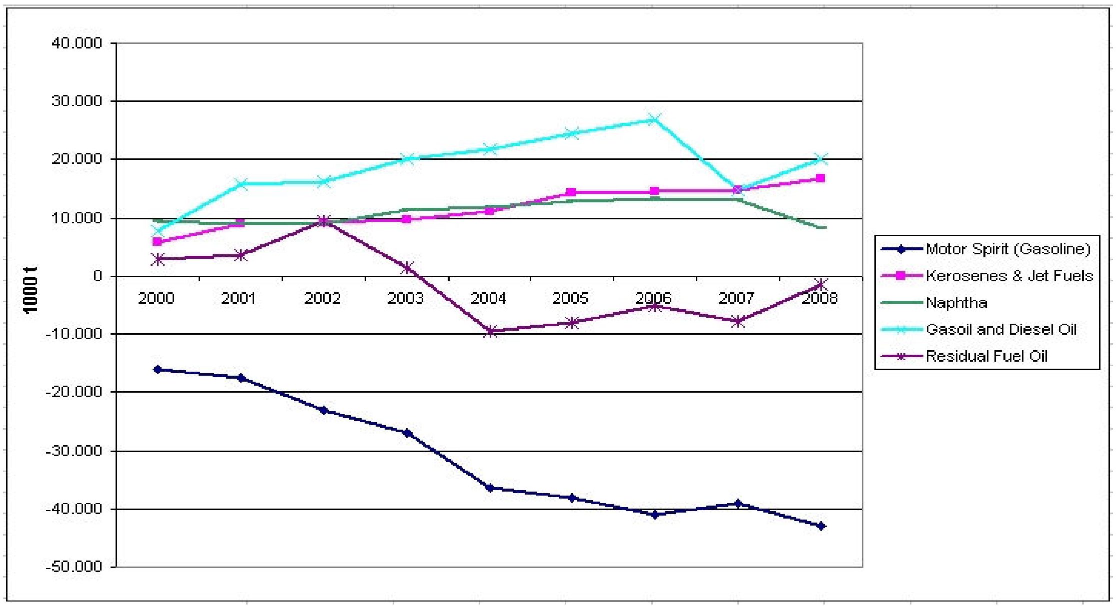
And while total refinery production capacity is well in excess of total gross consumption in the EU, the situation is quite different at the level of individual products. There have been growing production/consumption imbalances notably for gasoline and middle distillates (kerosene/jet fuels and gas/diesel oil) in the EU in recent years. In particular, the rapid shift of motor fuel demand from gasoline to diesel oil (see *Figure 45 - evolution of road fuel demand*) – the latter favoured by the taxation policy in place in most EU countries as already highlighted – has resulted in a growing production deficit for gas/diesel oil and surplus for gasoline at the EU level.

These growing imbalances have led the EU to become more and more dependent on trade in order to balance out supply and demand. The gas/diesel oil deficit is covered to a large extent by imports from Russia (35% of gasoil/diesel imports in 2008) while a large proportion of the excess gasoline is exported to the USA (37% in 2008). When compared to EU gross consumption (inland consumption + bunkers), the deficit of the EU refinery production amounted to 7% in 2008 for gas/diesel oil and to 20% for kerosenes and jet fuels. If the middle distillates are considered as a whole (gas/diesel oil + kerosenes & jet fuels), then the deficit reached 10% of the EU gross consumption in 2008, causing an

[25] Eurostat cumulated monthly data

amount of net imports of some 36 Mt. For the same year, gasoline production surpassed consumption by 43 Mt or 40%.

Figure 48: EU-27, Evolution of net imports/exports in key petroleum products (in 1000 t) (2000-2008)




*Source: Eurostat*

Should EU demand for middle distillates continue to grow (which is generally expected) and should the current structure of EU refining remain unchanged, the EU's import deficit in middle distillates will tend to extend further. This is not only a problem for the EU, in terms of growing import dependency for such products, but also for the EU refining industry for disposing of growing gasoline excess to other markets, which is not obvious given expected future developments in world demand for gasoline and diesel oil. In the US, for instance, it is widely predicted that gasoline consumption would tend to significantly decrease in the years to come.

Overall crude quality evolution and, in particular, falling North Sea crude production, might also impact the EU refining industry in the future. North Sea crude production (from Norway, UK and Denmark) fell from 6.4 to 4.3 million barrels per day between 2000 and 2008. Over the same period, the supplies to Europe of heavier, sourer/more sulphurous crude oils, from Russia and Africa have been growing. The result has been an increase in the proportion of heavy and sulphurous crude oils coming into EU refineries as well as a higher dependency on oil imports from third-party countries which represented 80% of EU crude refinery intake in 2008 against 75% in 2000.

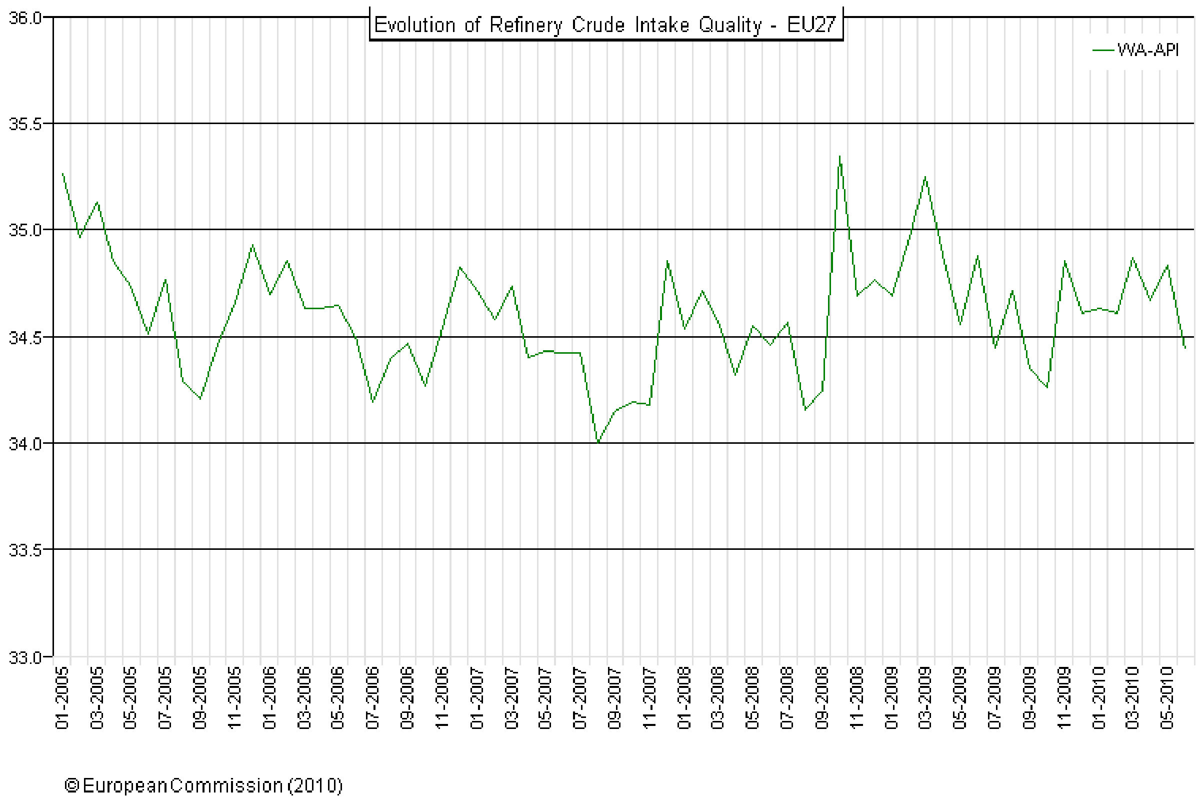
The impact on the EU refining industry of lighter crude being replaced by heavier crude has varied according to region, with North-Western European (NWE) refineries being especially concerned. Conversely, in Central Europe, refineries are often located on the Druzhba pipeline, and the great majority of their intake is Urals crude. In the Mediterranean area, the larger proportion is Arabian Gulf, which is again heavier than Urals crude, with similar API but higher sulphur content, followed by Urals crude.

Falling productions of North Sea crude in an environment of growing demand for lighter distillates represents a major concern for the NWE refining industry. Lighter crude oils such as North Sea crude produce a higher share of more valuable, light products (such as naphtha and gasoline) that can be recovered with simple distillation, while heavier crude oils produce a greater share of lower-valued products (such as fuel oil) with simple distillation and therefore require additional processing to produce higher value products.

The quality of crude oil thus dictates the level of processing and re-processing to achieve the optimal mix of product output, with a trend towards heavier and more sulphurous crude oils leading to a more complex and costlier refining process, such as via the use of deep conversion and/or desulphurisation units, also leading to higher $CO_2$ emissions.

Progressively, it is expected that NWE crude intake from the Urals, Africa, the Caspian region and the Middle East will gradually come to represent growing proportions. This trend may become a key challenge for refiners mainly in the NWE region, pushing them towards investments for the adaptation of their plants in order to refine the changing flow of crude.

Figure 49: EU-27, Evolution of refinery crude intake quality (in API – weighted average) (1/2005-5/2010)




### *3.1.7 EU crude oil and petroleum products imports and exports in 2009*

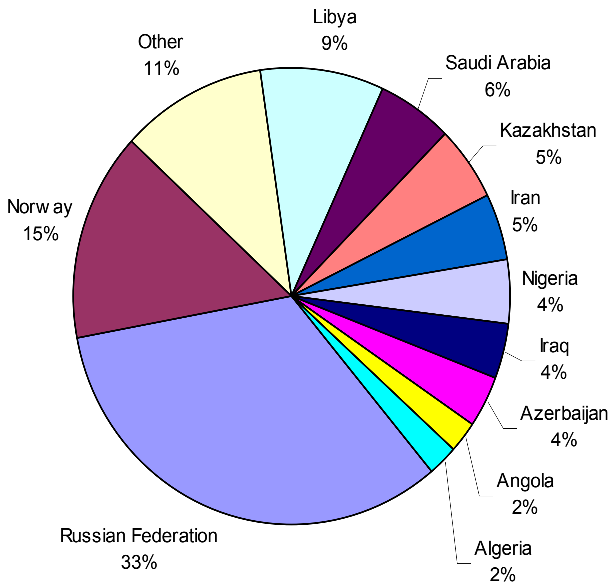
EU Member States import crude oil (and feed-stocks) from a large number of third-party countries. Thirty-two countries of origin were identified in 2009. Among them, Russia was the main supplier with a share of 33% of the crude imported by the EU, followed by Norway (15%) and Libya (9%). Three other countries: Iran, Kazakhstan and Saudi Arabia, have a share between 5 and 7% and the remaining twenty-seven countries have a share below 5%.

By geographical zone, the Former Soviet Union has a share of 42% of the crude imported by EU Member States followed by Africa (22%), non-EU Europe (18%), Middle East (15%) and Americas (3%).

In 2009, OPEC countries represented 38% of the EU crude oil imports from third-party countries.

Figure 50: EU-27, Imports of Crude Oil from Third-Party Countries (in %) (2009)

**Total: 532.8 Mt**

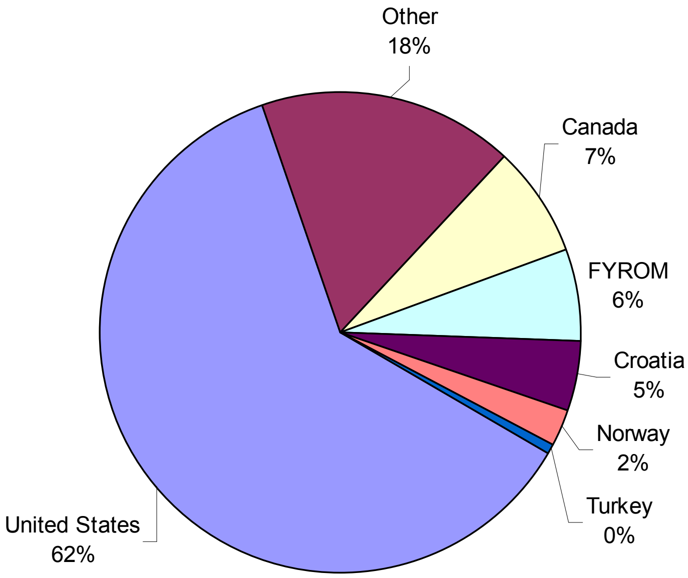



Source: Eurostat (2010, monthly aggregated data)

EU crude oil exports to third-party countries represented about 16% of the EU crude oil production in 2009, with the United States being the recipient of 62% of the total, nearly exclusively from the UK.

Figure 51: EU-27, Exports of Crude Oil to Third-Party Countries (in %) (2009)

**Total: 16.0 Mt**



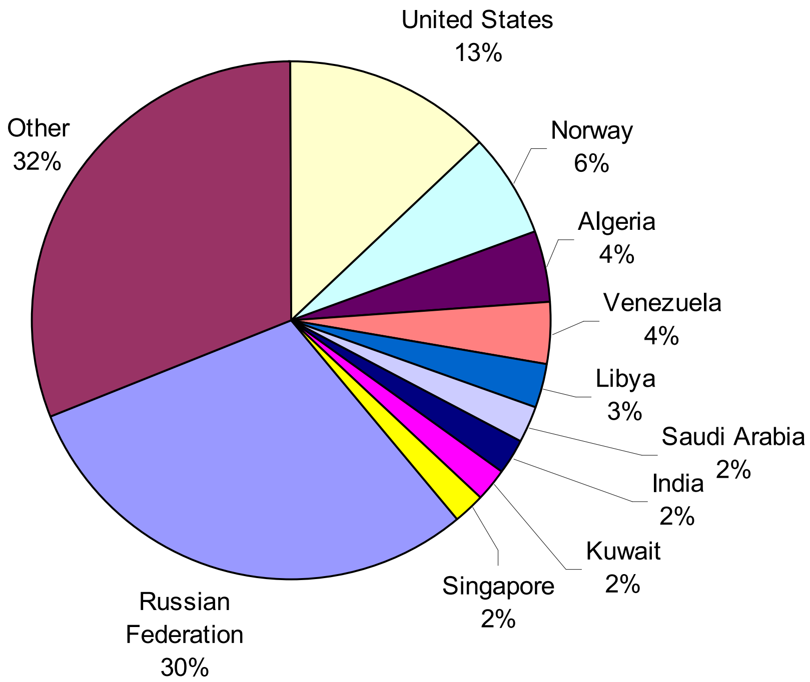

Source: Eurostat (2010, monthly aggregated data)

As was the case for crude oil, Russia was the largest supplier of petroleum products (mainly gas/diesel oil and residual fuel oil) to the EU with a 30% share in 2009. The United States was the second largest supplier (mainly because of petroleum coke), with a 13% share.

In 2009, OPEC countries represented 19% of the total petroleum products imports from third-party countries to the EU.

Figure 52: EU-27, Imports of Petroleum Products from Third-Party Countries (in %) (2009)

**Total: 127.4 Mt**

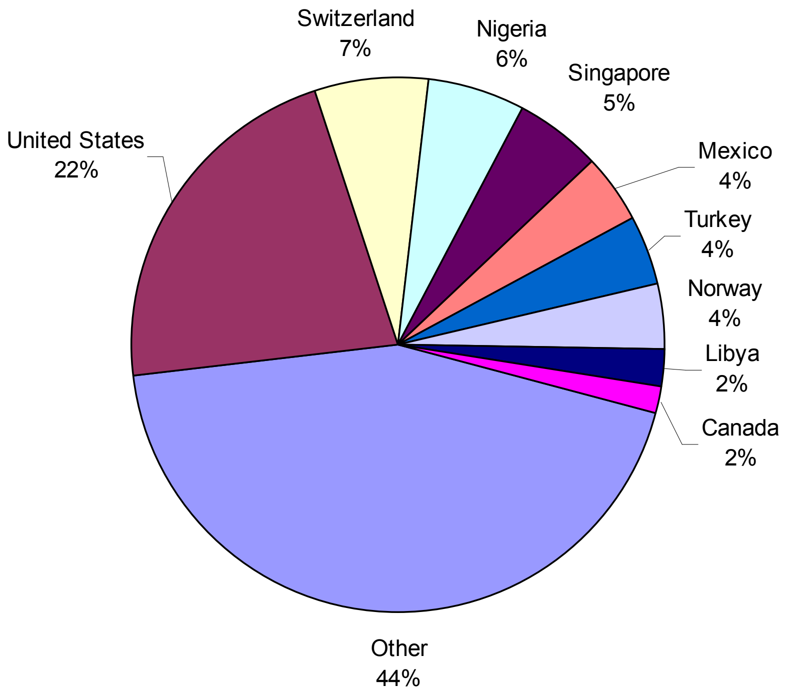



Source: Eurostat (2010, monthly aggregated data)

Again, as for crude oil, in 2009 the United States was the largest recipient of EU petroleum products exports (22%), mainly constituted of gasoline accounting for 70% of the EU petroleum products exports to the US.

Figure 53: EU-27, Exports of Petroleum Products from Third-Party Countries (in %) (2009)

**Total: 113.3 Mt**




Source: Eurostat (2010, monthly aggregated data)

## 3.2 Market developments in the gas sector of the EU

The 18 months covering 2009 and the first half of 2010 were an eventful period for the European gas sector. As other industries, the gas industry was operating in a context of difficult economic conditions. According to *Eurostat*, in Q1 2009 the EU economy registered a 2.5% decrease with respect to Q4 2008, recording a fourth consecutive quarter of negative growth. That tendency persisted until mid 2009 when the GDP of the EU started to recover slowly for the remainder of the observed period. Gas suppliers, shippers and consumers found that their traditional relations were affected by the consequences of the economic slowdown.

The start and the end of the observed period were marked by gas disputes which took place outside of the EU but nevertheless affected EU consumers. Whereas the June 2010 gas dispute between the Russian Federation and Belarus had an insignificant impact on consumers, the gas crisis between the Russian Federation and Ukraine resulted in a complete halt of supply through the Ukrainian transit routes with an estimated economic impact of almost € 1.6 billion for the EU[26]. For a couple of weeks in January 2009 a number of Member States from Eastern and Central Europe had no choice but to cut consumers from the grid in a period of colder-than-normal meteorological conditions. The situation was somewhat alleviated by the decreased amount of industrial demand resulting from the economic slowdown.

As a result, the Commission was prompted into action. One part of this action was the involvement, with the help of the European gas industry, in the resolution of the dispute of 2009 and the resumption of gas flows, including reverse flows where that was technically possible. Another aspect of the action was the launching of the European Energy Programme for Recovery (EEPR), designed especially to finance projects helping to enhance the interconnectivity of gas systems of the EU Member States. The European Commission sidelined € 1.39 billion towards a number of gas infrastructure projects as part of its € 3.98 billion stimulus package of investment in energy-related projects in 2009 and 2010[27].

The Commission also strengthened the legal framework on security of gas supply in the EU in December 2010[28]. The focus lies on prevention and crisis management in the internal energy market and it ensures that in case of a crisis gas supplies are guaranteed to protected customers, in particular to households. The Regulation requires all Member States to take effective action well in advance to prevent and mitigate the consequences of potential disruptions to gas supplies by establishing national preventive and emergency plans. It establishes infrastructure and supply standards aiming to provide incentives for investment in infrastructure necessary for security of supply in the internal

[26] According to preliminary results from DG ENER and the Gas Coordination Group.

[27] More on information on the EEPR can be found here :

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0191:FIN:EN:PDF

[28] Regulation No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC entered into force on 2 December 2010: http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2010:295:SOM:EN:HTML

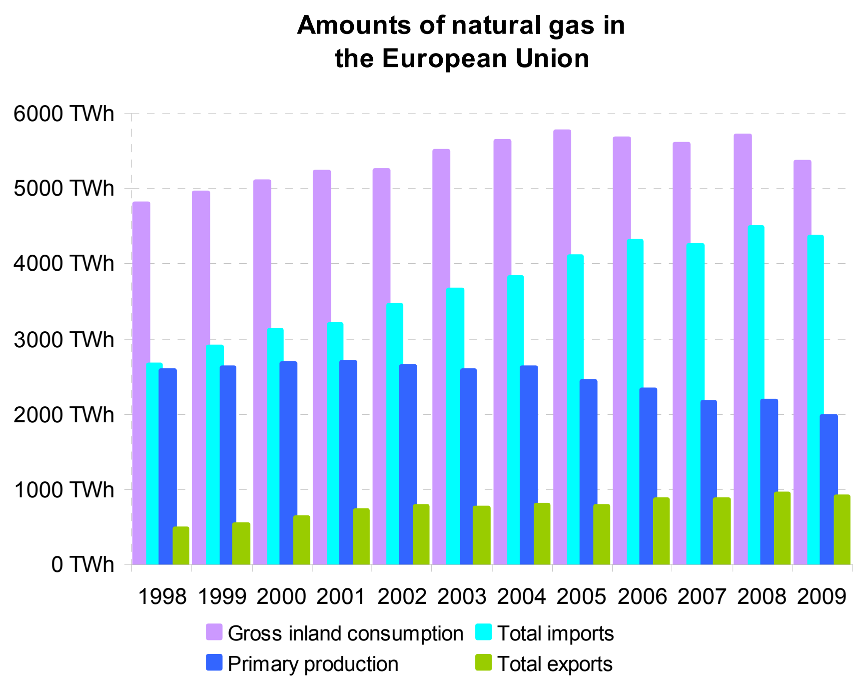
energy market. At the EU level, the Regulation supports regional cooperation and strengthens the role of the Gas Coordination Group as a mechanism for Member States and industry to work together to deal effectively with any major gas disruptions which might arise.

The construction of a reliable, transparent and interconnected energy market in the EU is the cornerstone put in place to deal with a variety of complex issues, including security of supply. The third legislative package in the domain of energy policy was adopted in 2009. It includes Regulations and Directives of the European Parliament and of the Council aiming to ensure that all European citizens can take advantage of the numerous benefits provided by a truly competitive energy market.

With regard to gas market developments, the decline in EU domestic production of natural gas outpaced the reduction of gross inland consumption as more and more production fields were entering into post-peak phase. For example, between 2005 and 2009, consumption fell by 7% whereas domestic production decreased by 19%. The EU's annual gas balance continued to deteriorate slowly as total imports rose steadily. In that five year period the part of total imports covered on average 76.5% of the gross inland consumption of natural gas in the EU.

The consequences of the recent recession were apparent on the recorded volumes for gross inland consumption and imports in 2009. Whereas both registered a fall of 6% and 3% with respect to the corresponding 2008 levels, the general trend of increasing reliance on external supply sources was confirmed.

Figure 54: Amounts of natural gas in the EU (in TWh) (1998-2009)

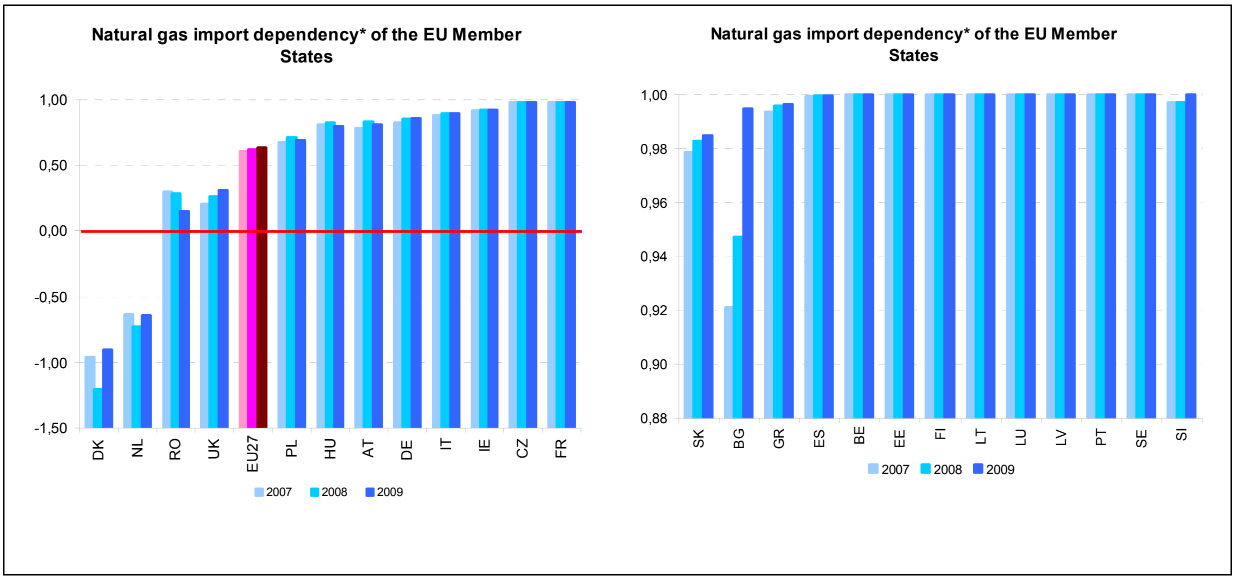



*Note : Data for 2009 is based on provisional monthly balances for production, consumption, imports, exports and changes of stocks.*
*Source : Eurostat Energy Statistics*

According to *Eurostat* data, EU gas imports amounted to 347.5 bcm in 2008, the most important trading partners being the Russian Federation (38.8%), Norway (28.5%) and Algeria (14.3%). The combined part of Nigeria, Libya, Qatar, Egypt and Trinidad & Tobago was less than 12%.

The EU's import dependency[29] increased from 48% in 2000, to 58% in 2005, to 64% in 2009. Import dependency is increasing in most of the Member States. For the period covering 2007-2009 some of the more notable evolutions took place in the UK[30] and Bulgaria[31].

Figure 55: EU-27, Natural gas import dependency by Member State (2007-2009)



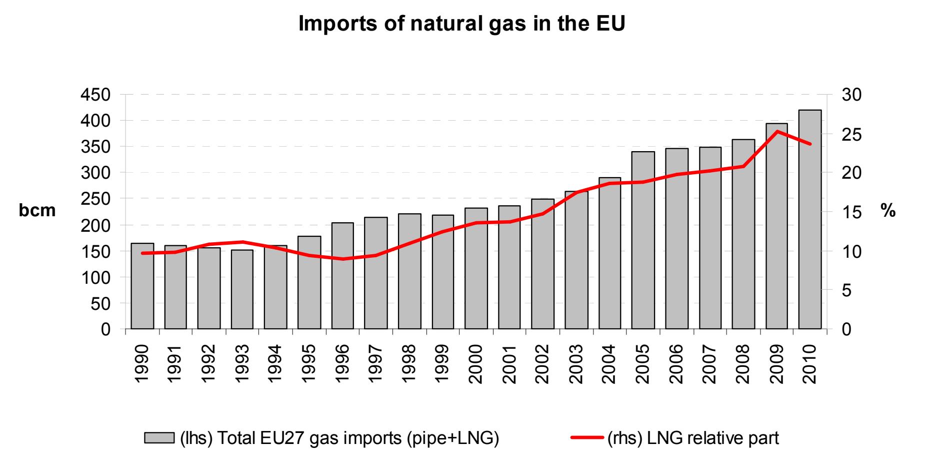

As the volume of imported gas into the EU is gradually increasing, Member States are trying to diversify the supply sources and routes as much as possible. The next graph illustrates that tendency. In the last 20 years, the relative part of liquefied natural gas (LNG) deliveries in the total volume of imported natural gas in the EU rose from 10% to 25% before registering a small decrease in the first half of 2010.

Figure 56: EU-27, Imports of natural gas (in bcm, %) (1990-2010)

[29] Import dependency is defined by Eurostat as the ratio of net imports to the sum of gross inland consumption and the change in storage levels. Data for 2009 is based on provisional monthly balances for production, consumption, imports, exports and changes of stocks. Source: Eurostat Energy Statistics

[30] The import dependency rose from 0.20 to 0.31 resulting from an increase of imports (+32%) and fall in production (18%).

[31] The import dependency went from 0.92 to 0.99 as a consequence of a significant reduction of domestic production which outpaced the fall of imports and consumption (respectively 25%and 30%) resulting from the gas crisis in January 2009. According to *Eurostat* data the year-on-year production fell by 95.3% as the offshore Galata gas field was depleted and is now being converted into a gas storage facility.




*Note. The 2010 values are indicative, based on data for the first six months of the year.*
*Source : Gas Strategies*

The number of EU trading partners in the domain of LNG is growing with supplies coming from Norway, Qatar, Algeria, Libya, Egypt, Nigeria, Equatorial Guinea, Trinidad and Tobago, Oman, Malaysia, Australia, the United Arab Emirates and recently Yemen. Some of these partners have committed significant upstream investment in order to increase their production capacity and the number of liquefaction facilities. The number of LNG entry points in the EU is growing as well with new regasification plants coming on stream in France (Fos Cavaou), Italy (Adriatic LNG), UK (Dragon LNG, South Hook Phase I and II).

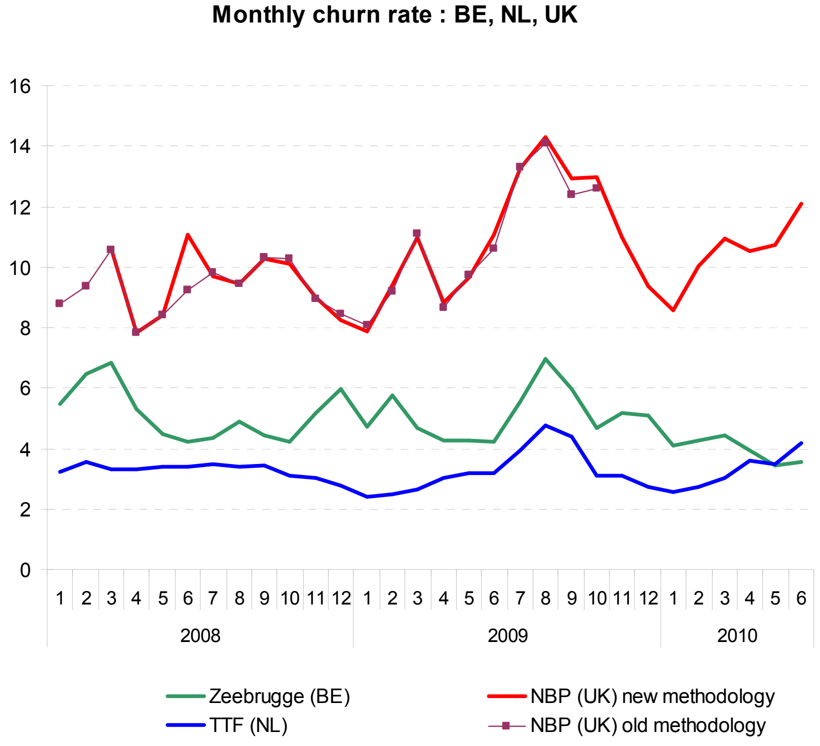
### 3.2.1 Wholesale markets

Between January 2009 and June 2010, market participants continued to exchange volumes of natural gas on the European hubs. While new trading places emerged in Central Europe[32] and the German venues were in the process of consolidation[33], the traditional hubs in North Western Europe – NBP (UK), TTF (the Netherlands) and Zeebrugge (Belgium) remained the most active trading places.

Figure 57: BE, NL, UK, Monthly churn rates (1/2008-6/2010)

[32] The *Central European Gas Hub* (CEGH) in Baumgarten, Austria.

[33] *NetConnect Germany* and *Gaspool*.




*Note. The definition of the UK churn rate was modified as from November 2009. Following a change in the volume categories reported by National Grid, the new churn formula uses daily nominations instead of throughput.*
*Sources : Huberator (BE), Gas Transport Services (NL), National Grid (UK), Platts*

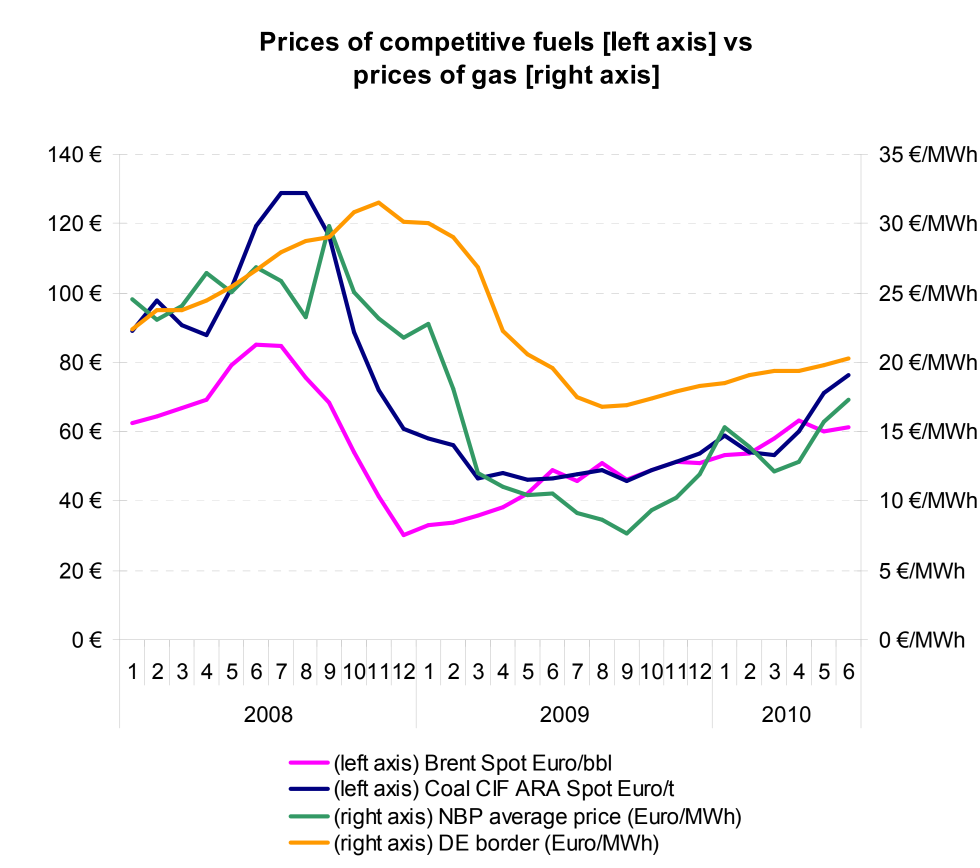
For those three hubs, the relative part of the combined day-ahead turnover with respect to gross inland consumption in Belgium, the Netherlands and the UK rose from 66.3% in the first half of 2008 to 92.1% in the first half of 2010, the most traded market being the *National Balancing Point* in the UK. Throughout 2009 and the first half of 2010, the ratio of traded volume (cleared through the exchange clearing houses) to the volume of gas physically delivered on the hub (known as the churn rate), remained in the historical ranges for Zeebrugge and TTF while it increased for the NBP. For this market, a new pattern is emerging with the churn increasing during the storage filling season in the summer.

Market participants continued to trade actively despite the difficult conditions and the decreased volumes of industrial demand during the economic slowdown. The stable levels of the churn and the rising part of the day-ahead turnover in the gross inland consumption demonstrates the confidence which participants have in the pricing signals from the market on which they are basing their economic decision-making.

*Spot markets*

European spot prices for natural gas experienced three different phases in the period covering 2008 to 2010. Until the autumn of 2008, energy prices were increasing, fuelled by a steady growth of demand, especially in South Eastern Asia. In that period, the month-ahead Brent price rose to $ 147 / bbl and the coal CIF ARA contract reached € 130 / mt. At the same time, the average monthly price for natural gas on the NBP reached € 29.42 / MWh.

Figure 58: Prices of competitive fuels and the price of gas (in EUR and EUR/MWh) (1/2008-6/2010)



*Sources : Platts (Brent, coal, NBP); BAFA (DE border)*

As the financial fallout triggered by the financial crisis in the second part of 2008 was spreading to the real economy, prices of energy commodities went through a significant correction. In a couple of months they lost roughly half of their value.

After a low point was reached at the beginning of 2009, prices of coal, oil and gas started to grow again as the world economy was embarking on a slow recovery.

During the observed period, spot gas prices in Europe were reacting to specific supply and demand conditions on the different markets. In general, market participants in Austria, France, Germany, Belgium, the Netherlands and the UK were taking on arbitrage opportunities, adjusting utilisation rates of interconnection points whenever a short term premium emerged with commercial flows increasing from a low to high price area. More detailed information on developments in the EU markets for natural gas can be found in the *Quarterly Reports on European Gas Markets (QREGaM)*[34].

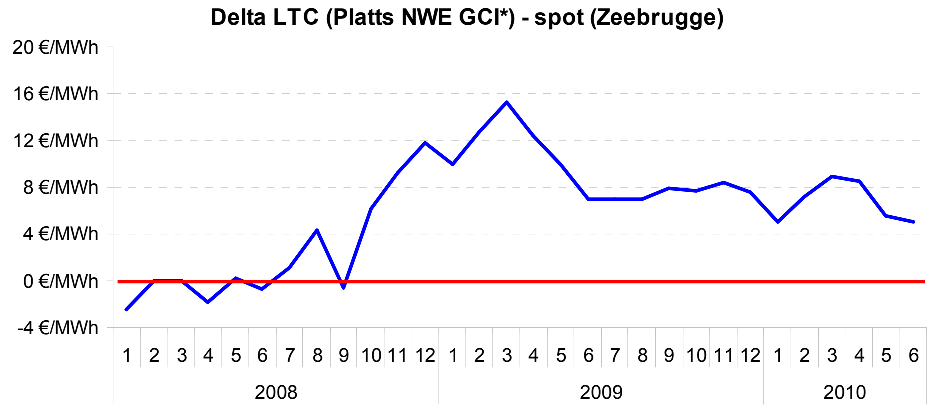
Prices of gas delivered under long term contractual obligations[35] had a similar evolution to spot prices traded on European hubs. Gas prices under long term contracts (LTC) are indexed with respect to the price of crude oil or refined products, lagged by several

[34] Publicly available at: http://ec.europa.eu/energy/observatory/gas/gas_en.htm

[35] The long term gas prices are illustrated by the German border price in the graph on the previous page.

months. This could explain the reason why LTC prices were also lagging those of the spot gas. The next graph shows the evolution of the price differential of gas delivered under LTC or on the spot. Because of the lagged parameters used in the pricing formula, the LTC gas price was at its highest value in Q4 2008 and Q1 2009. At the same time, spot prices were falling in reaction to strong demand contraction and stable supply conditions. This development prompted the emergence of a significant margin between the two pricing approaches. While spot and LTC gas were priced at similar levels in the first half of 2008, spot gas became much more competitive in the following months.

Figure 59: Difference between Delta LTC price and Zeebrugge spot price (in EUR/MWh) (1/2008-6/2010)




**Note. The Gas Contract Indicator (GCI) is used to represent the price of gas delivered under long term contractual obligation in the North Western European region. The Zeebrugge hub in Belgium is used to represent the price of gas exchanged on the spot market.*

*Source : Platts*

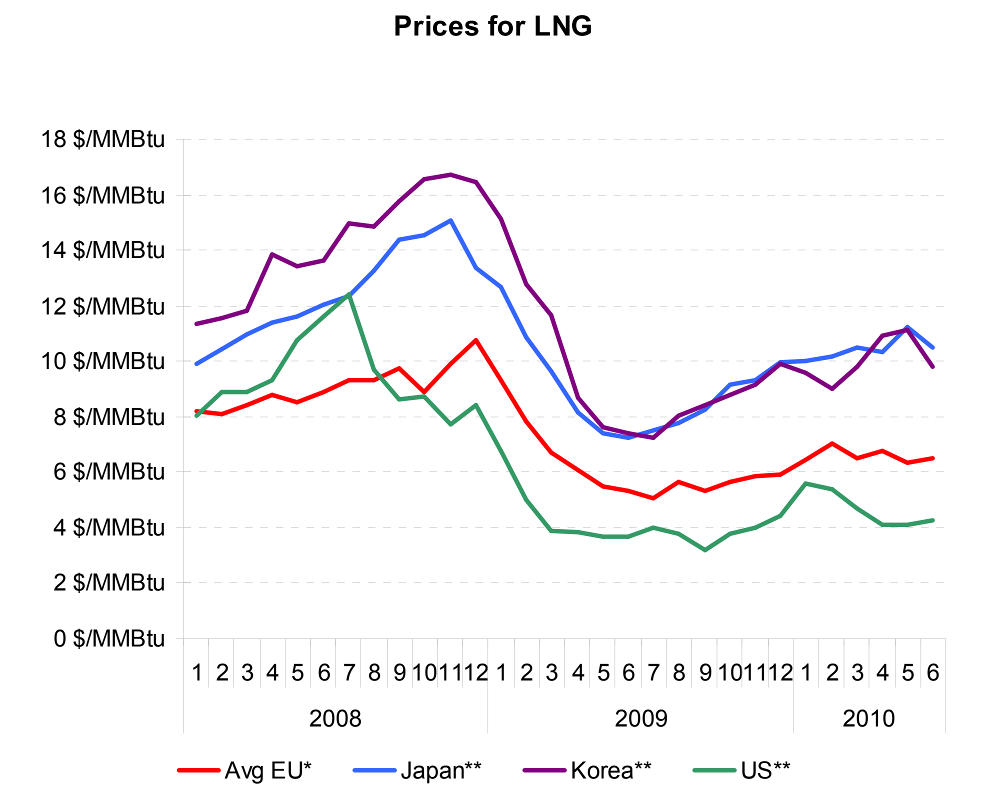
The price difference reached almost €16 / MWh in March 2009. By the end of June 2010, LTCs still exceeded spot prices by more than € 4 / MWh. The persisting price differential led more and more European companies to look for a renegotiation of their LTCs, especially in the area of reducing the amount of take-or-pay (TOP) obligations.

LNG spot deliveries played an important role as a competitive source of gas pushing down spot prices. In 2009, the US outpaced the Russian Federation as the biggest producer of national gas, due to strong growth in production from unconventional gas sources. As the United States remained well supplied in gas[36], the EU emerged as the highest price area in the Atlantic basin. This also led to a gradual decoupling of the US Henry Hub price and European spot prices.

The large number of LNG cargoes that were attracted to the relatively high EU prices brought additional supply flexibility whenever there was more need for gas. This was for example the case in the winter months of 2009 and 2010 when colder than average temperatures in North Western Europe triggered a rise in the residential demand for heating.

[36] The term "gas glut" has become common usage to describe actual global gas market conditions.

Figure 60: LNG prices (in USD/MMBtu) (1/2008-6/2010)




*Notes:*

** "Avg EU" is a weighted average price for monthly LNG deliveries in : Belgium, Portugal, Spain, UK, Italy (from January 2009) and France (from January 2010) as reported by Eurostat.*

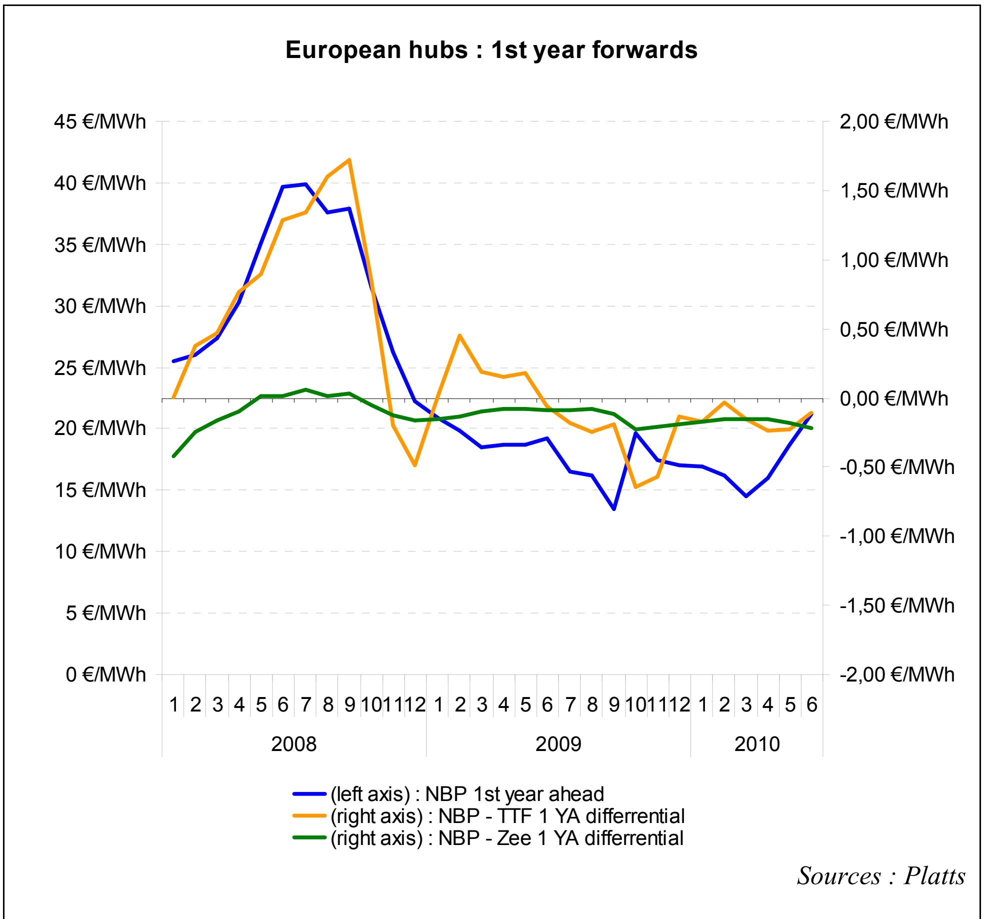
*** The formula for calculating monthly prices in Japan, Korea and the US was modified in Q4 2009. Previously these prices were an average of prices charged by different suppliers. Starting from October 2009, the averages are weighted by the monthly LNG deliveries of each supplier.*

*Source : * Eurostat COMEXT ; ** Gas Strategies*

*Forward markets*

In mid-2008 the UK and Belgian year-ahead contracts were priced at a € 1.5 / MWh premium with respect to the Dutch hub. Later on, the three contracts were traded close to each other. Among the reasons for this evolution was the relatively quicker reaction of the TTF price to the fall in demand while market operators in Belgium and the UK were, at that time, more concerned about 2009 supply. As construction of the new LNG terminals was kept on schedule and deliveries of North Sea gas were stable, supply concerns dissipated quickly and the year-ahead contracts fell from € 40 / MWh in June 2008 to around € 15 / MWh in March 2010 and then increased again to € 20 / MWh in June 2010.

Figure 61: European 1st year forward hub prices (in EUR/MWh) (1/2008-6/2010)



*Sources : Platts*

### 3.2.2 Retail markets

The prices of gas, net of taxes, for the three household bands of *Eurostat*[37] were relatively close to the average EU levels in the period from the first half of 2008 to the first half of 2010. The price ratio of the Member States with the highest and lowest price level was 5.05 for the most modest group of consumers (band D1), while the corresponding values for groups D2 and D3 were 3.14 and 2.85 respectively. Excepting

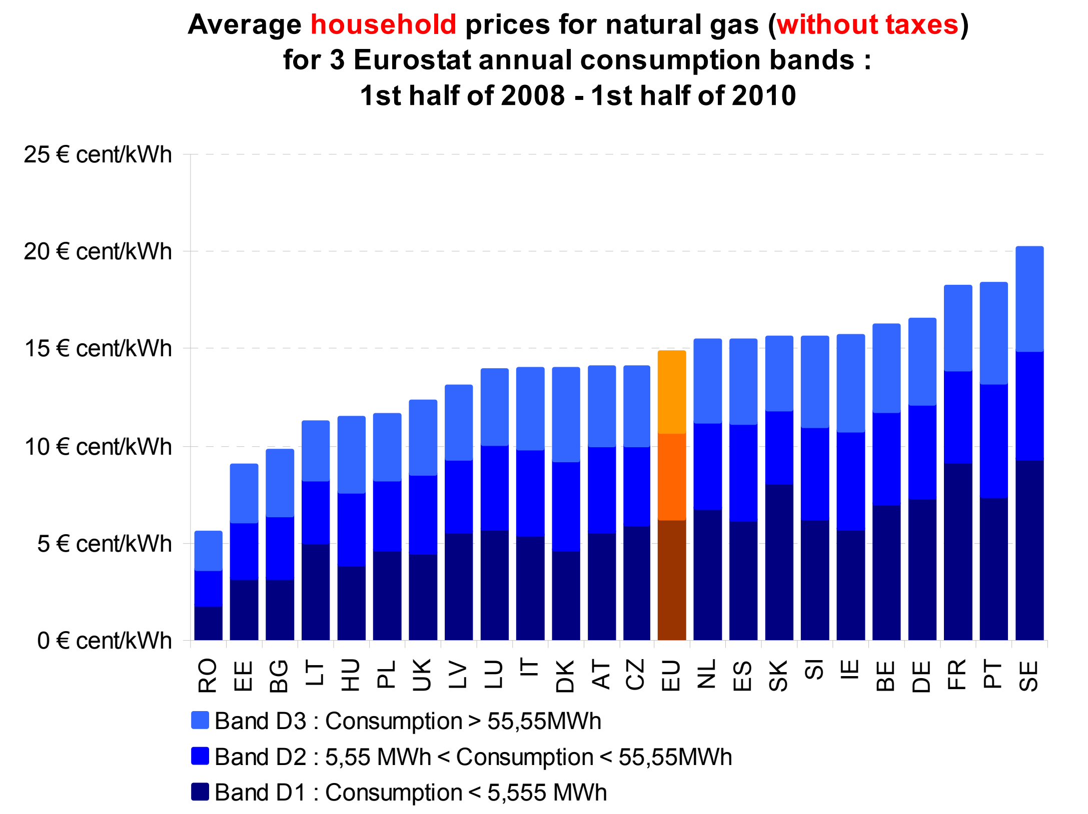
[37] See Figure 61 on the next page.

Romania, a Member State whose domestic production allows low prices to be set for retail household and industrial users, end user prices appeared even closer to the EU average[38].

When measured in eurocents per kWh, 7 out of the 8 Member States with the lowest average prices for household customers were still New Member States. Only the UK posted similar price levels. However, if the price is measured in purchasing power parity standards, these countries tend to move up the price ranking order.

Concerning the smallest consumption band D1, Danish and Irish prices appeared relatively cheaper than what would be suggested by the position of these Member States in the overall ranking. Likewise, French and Slovak consumers from bands D2 and D3 seemed to enjoy relatively low prices.

Figure 62: Average household natural gas prices (without taxes) for 3 Eurostat annual consumption bands (in EUR cent/kWh) (First half of 2008 – First half of 2010)




*Note. Data for Cyprus, Greece, Malta and Finland is missing.*
*EU average data for the first semester of 2010 is preliminary. As of the time of drafting of the report, data was still missing for Denmark, Hungary and Spain.*
*Source: Eurostat, Energy Statistics*

Similar to the results shown in the previous Annual Report[39], the dispersion of industrial gas prices, net of taxes, around the EU average was even less pronounced. The highest-

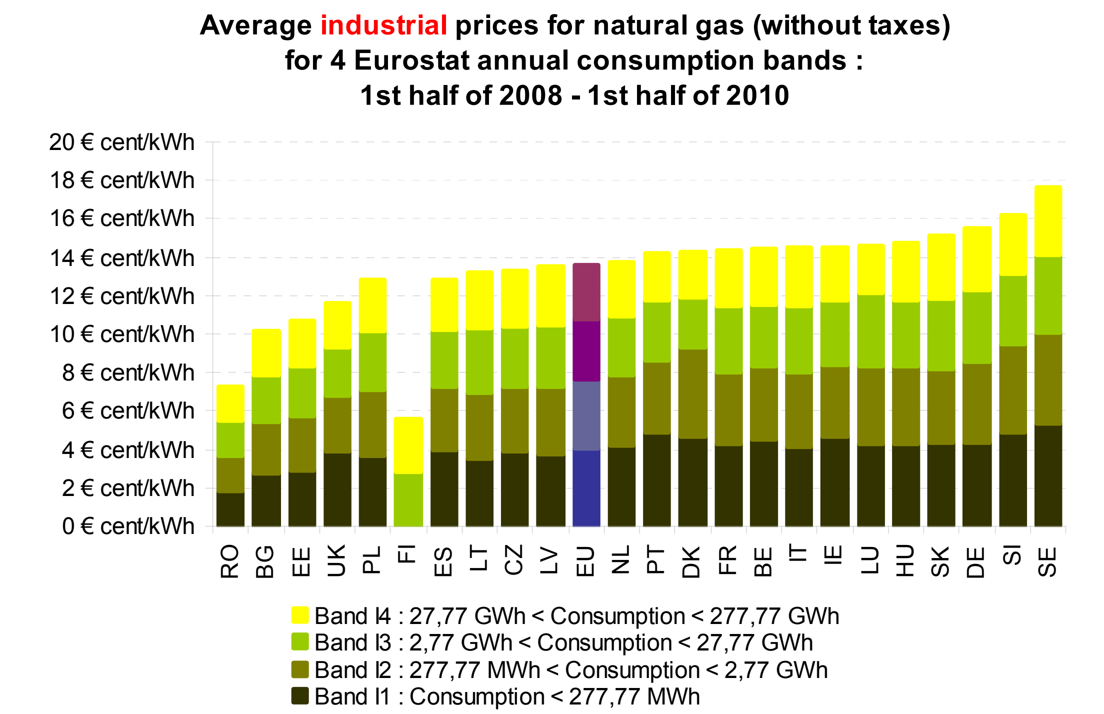
[38] The corresponding values for bands D1, D2 and D3 become 2.92, 1.98 and 1.91 respectively.

[39] http://ec.europa.eu/energy/observatory/annual_reports/annual_reports_en.htm

to-cheapest price ratios were 1.52, 1.62, 1.61 and 1.48 for the four reported bands of industrial consumers starting from the smaller (in terms of consumption volumes) consumers.

For Member States with functioning retail markets this result may suggest that industrial consumers were priced against competitors with similar profiles from other Member States. Likewise, it seems that where retail prices were still regulated, industrial users were paying according to an oil-indexed formula. The use of a similar pricing mechanism produced a harmonisation effect across consumption bands and across Member States.

Figure 63: Average industrial prices for natural gas (without taxes) for 4 Eurostat annual consumption bands (in EUR cent/kWh) (First half of 2008 – First half of 2010)




*Note. Data for Cyprus, Greece, Malta and Austria is missing. Finland reports price data on industrial bands 3 and 4, but not on industrial bands 1 and 2.*
*EU average data for the first semester of 2010 is preliminary. As of the time of drafting of the report, data was still missing for Denmark, France, Italy and Hungary.*
*Source: Eurostat, Energy Statistics*

During the observed period some Member States continued to regulate retail prices of natural gas for groups of industrial and household consumers. Cross subsidisation across consumer groups distorts prices and is usually detrimental for competition. The Commission considers these practices as very negative as they are not in line with internal market principles. It has already started a number of infringement procedures.

## 3.3 Market developments in the electricity sector of the EU

The gradual integration of EU wholesale electricity markets continued throughout 2009 and the first half of 2010. Several important developments for the functioning of a single electricity market took place during the observed period.

The third legislative package in the domain of the EU energy policy was approved by the European Parliament and the Council in July 2009. It establishes two institutions which will have a central role in the design of the single European market for electricity.

One institution is the *European Network of Transmission System Operators for Electricity* (ENSO-E)[40]. ENSO-E became fully operational in July 2009, regrouping 42 TSOs from 34 states and replacing all existing European associations of Transmission System Operators (TSO). Its main role is to ensure optimal management of the electricity transmission network and to facilitate the trade and supply of electricity across borders in the EU. The first ENTSO-E 10-year network development plan was delivered in 2010.

The other institution is the Agency for the Cooperation of Energy Regulators (ACER)[41]. From March 2011 ACER will become fully operational and will play a key role in the EU electricity and natural gas markets. Its competences include, among others, a participation in the preparation of European network rules and taking decisions on conditions for access and security of cross border infrastructure. The Agency will coordinate the work of National Regulatory Authorities (NRAs) and will give advice on various energy related issues to the European institutions.

The Commission also started work on a new initiative for the integrity and transparency of traded energy markets. A formal public consultation was launched in May 2010 concerning the information on demand and supply data, the monitoring on traded markets and transactional data requirements, the applicability of existing market abuse regulations to address market integrity issues on the energy markets and the enforcement of market conduct rules.

Alongside these developments, stakeholders in the EU electricity markets worked in close cooperation in the framework of the different Regional Initiatives. *Box 3.3.1* illustrates the activities related to linking the Central Western and the Nordic regions.

*Box 3.3.1 The coupling of the Central Western and Nordic regions*

Day-ahead market coupling and continuous cross-border intra-day platforms were identified by market participants as priority areas of work to promote market integration. The experience of two of the most advanced regions, CWE and the Nordic regions, demonstrates that good co-operation involving all stakeholders (regulators, TSOs and power exchanges) is essential to achieve

[40] Regulation (EC) No 714 / 2009 on conditions for access to the network for cross-border exchanges established the structure and functions of ENSO-E.

[41] Established via Regulation (EC) No 713 / 2009.

these goals.

After initial difficulties, the market coupling project[42] on the Danish – German border started normal operation in November 2009. Since the introduction of the Baltic cable connecting Sweden and Germany in May 2010, the market coupling has covered all the interconnections between the Nordic market and Germany.

Likewise, the Trilateral Market Coupling of the French, the Belgian and the Dutch markets was extended in November 2010 to include Luxembourg, Germany and Austria forming the Central Western European Market (CWE).

At a later step, the CWE and Nordic regions will be linked through volume coupling, based on the Nordic-German coupling, providing implicit allocation of available capacities between the CWE and the Nordic region.

*Box 3.3.2* describes the evolution of the main aggregates for electricity, together with real GDP growth in the EU. According to *Eurostat* data, electricity gross inland consumption was stable at around 3250 TWh / year for the period covering 2005-2008. In the aftermath of the economic slowdown, consumption decreased by more than 4% in 2009, much in line with EU real GDP growth.

Another important development was the steady decrease in the combined volumes of exports and imports in the EU. From 2005 to 2009 the sum of exports and imports fell from 628.7 TWh / year to 553.68 TWh / year[43].

*Box 3.3.2 Year-on-year change (%) in the EU main electricity indicators and the real GDP growth*

| | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Gross inland consumption of electricity | 0.78 | -0.11 | 0.20 | -4.61 |
| Total gross electricity generation | 1.04 | -0.28 | 0.03 | -4.68 |
| Total imports of electricity | -3.34 | 1.03 | -4.60 | -4.52 |
| Total exports of electricity | -0.69 | -0.76 | -6.57 | -5.34 |
| Real GDP | 3.2 | 3 | 0.5 | -4.2 |

*Source : Eurostat*

A number of factors could explain such a decrease.

[42] Run by the *European Market Coupling Company*, a joint venture of *Nord Pool Spot*, *European Energy Exchange (EEX)*, *50Hertz Transmission GmbH* (formerly *Vattenfall Europe Transmission*), *Transpower Stromübertragungs Gmbh* (formerly *E.ON Netz*) and *Energinet.dk*.

[43] The corresponding values for 2006, 2007 and 2008 were 615.9, 616.8 and 582.4 TWh / year.

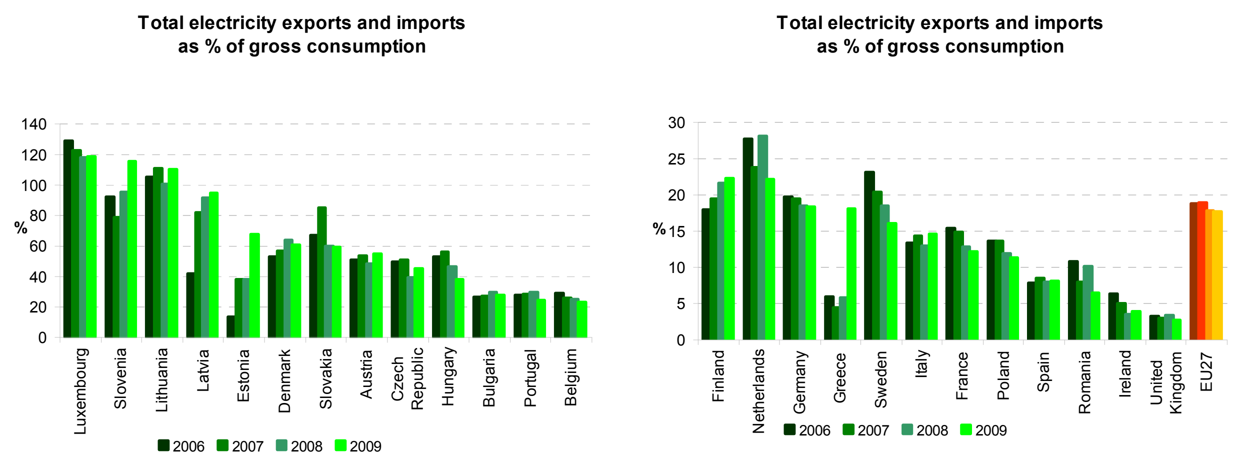
Such an occurrence may appear counterintuitive parallel to opening the EU wholesale markets and enhancing commercial exchanges across the border. However, two elements could at least partly explain such an evolution:

First, comparing 2008 to 2009 values, (i.e. pre- and in- recession data), it seems that the relative fall in exports and imports matched that of gross inland consumption[44]. It can therefore be argued that cross-border exchanges fell roughly as much as consumption. Weaker demand might also create conditions of well supplied markets where it is easier for domestic capacity to meet consumer requirements.

However, in the longer period of 2005-2009, consumption fell by less than 4% whereas exports and imports decreased by 14.7% and 12.4% respectively, implying that there may be another factor explaining this evolution. According to preliminary results from the Market Observatory for Energy, this factor may be related to the gradual tendency of EU wholesale prices to align with each other. If such is the case, incentives to trade / exchange electricity across the border may be reduced.

Whatever may be the reason behind the recent decrease in EU exports and imports of electricity, the next graph shows that the for majority of Member States the amount of energy exchanged with neighbouring countries compared to consumption remains well above 10%. Moreover, for a number of Member States like Slovenia, Finland and Greece, the relative part of external trade in the gross inland consumption of electricity is actually increasing. As a rule, the Member States which are most open to cross-border trade seem to be countries of modest size strategically positioned between big producing and consuming centres at the heart of the continent. The Baltic countries represent another interesting case. It seems that the closing down of Unit 2 of the Ignalina nuclear power plant in Lithuania increased exports and imports of electricity, especially in 2009.

Figure 64: Total electricity exports and imports (as % of gross consumption) (2006-2009)




*Source : Eurostat. Energy Statistics; Data for Malta is missing*

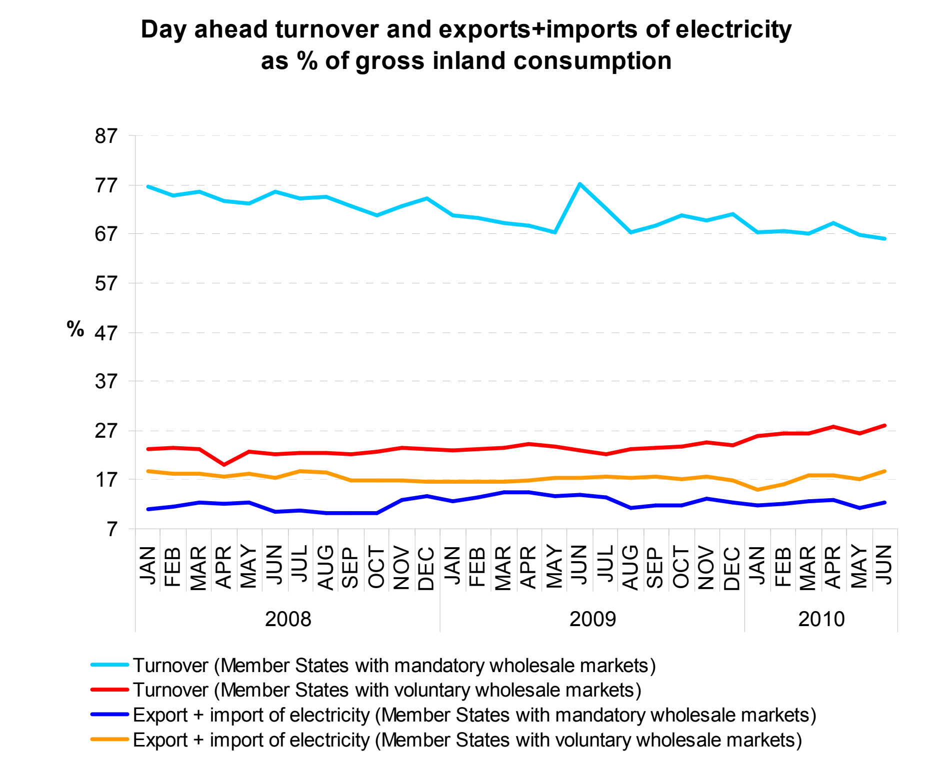
### 3.3.1 Wholesale markets

[44] The corresponding vales for consumption, exports and imports are respectively -4.8%, -5.6% and -4.7%.

For the group of Member States with functioning wholesale markets[45], it seems that the countries with voluntary trading schemes[46] are relatively more open to cross border exchange of electricity than the countries with mandatory pools[47]. For the former, the cross border ratio for 2008 – 2010 was between 16% and 19 %; for the latter it was in the 10% – 13% range. However, the amount of electricity exchanged across the border may be independent of the type of trading venue for the wholesale markets. It may have more to do with the fact that islands and peninsulas tend to be less connected to the mainland of the European continent and so the opportunities to exchange electricity are fewer.

While the relative part of external trade remained stable between 2008 and the first half of 2010, the day-ahead turnover of the organized electricity exchanges continued to increase.

Figure 65: Day-ahead turnover and the sum of exports and imports of electricity (as % of gross inland consumption) (1/2008-6/2010)




*Source: Eurostat; Platts; Operator trhu s elektrnou; Towarowa Gielda Energii S.A. ; Operatul Pietei de Energie Electrica din Romania; Hellenic TSO*
*Reported Member States with voluntary wholesale markets include : Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, the Netherlands, Poland, Romania, Slovakia, Sweden, United Kingdom and Norway*
*Reported Member States with mandatory wholesale markets include Greece, Italy,*

45 And for which data is available.

46 Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, the Netherlands, Poland, Romania, Slovakia, Sweden, United Kingdom and Norway.

47 Greece, Italy, Portugal and Spain.

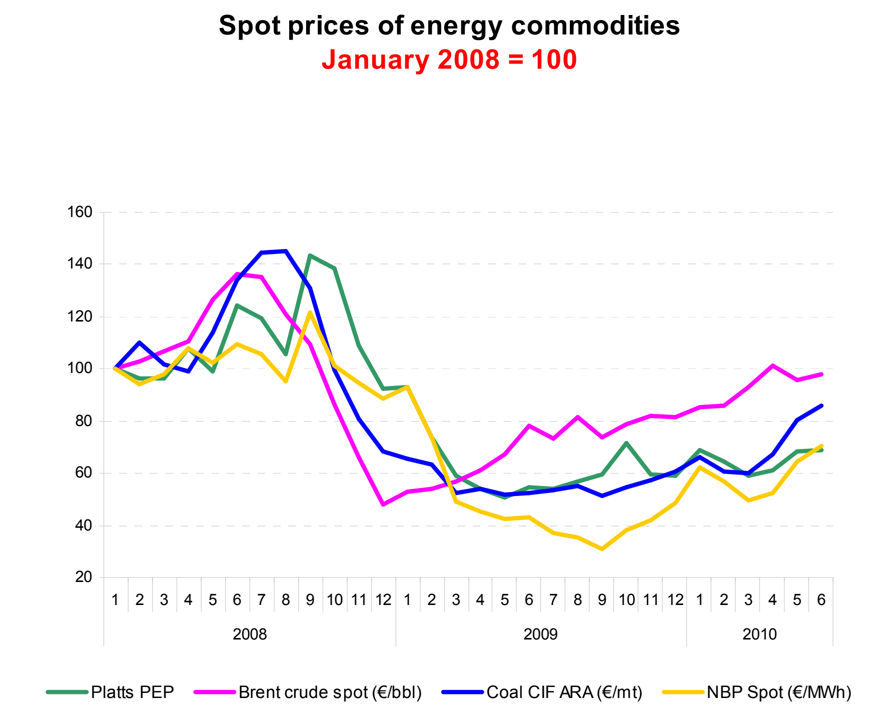
Regarding the subgroup of Member States with voluntary wholesale markets, the total traded volume on the day-ahead segment went from 270.72 TWh in the first half of 2008 to 314.30 TWh in the first half of 2010. The churn rate went from an average value of 0.22 in January 2008 to 0.28 in June 2010, representing a rise of almost a quarter within 30 months. While consumption of electricity was low in 2009, the strong performance of the churn suggests that the turnover of the exchanges remained robust despite the reduction in industrial demand for electricity.

The subgroup of Member States with mandatory wholesale markets experienced a gradual decrease of the day-ahead turnover. For example, in the first half of 2010 the day-ahead total volume of the pool markets stood at 238.16 TWh, about 6 and 40 TWh less than in the corresponding periods of 2009 and 2008. Compared to gross inland consumption, the turnover represented 66 % in June 2010, about 10% less than it did in January 2008.

*Spot markets*

Similar to the price evolution of other energy commodities in the period between January 2008 and June 2009, the electricity *Pan European Price* (PEP) index of *Platts* registered a three phase movement, including a steep rise and decline followed by a slow recovery. The scale of up and down movements was comparable across energy commodities.

Figure 66: Spot prices of energy commodities (January 2008 = 100) (1/2008-6/2010)




*Source: Platts*

Coal and crude oil were among the first commodities to peak in mid 2008, appreciating by about 35% in 6 months. Crude oil was also among the first to level after the steep fall triggered by the financial crisis. In the second half of 2008 the Brent average monthly price fell from € 85.17 / bbl to € 30.13 / bbl, falling by a factor of 2.8. By the beginning of 2009 oil prices started to recover and in March 2010 they reached the levels recorded at the beginning of 2008.

The electricity spot price followed a path which was similar to that observed for natural gas, with a rise, fall and recovery lagging by several months with respect to oil and coal. Contrary to gas however, the electricity index peaked higher and was quicker to level off after the decline, both scale and time wise. Detailed information on price developments can be found in the *Quarterly Reports on European Electricity Markets* of the Market Observatory for Energy[48].

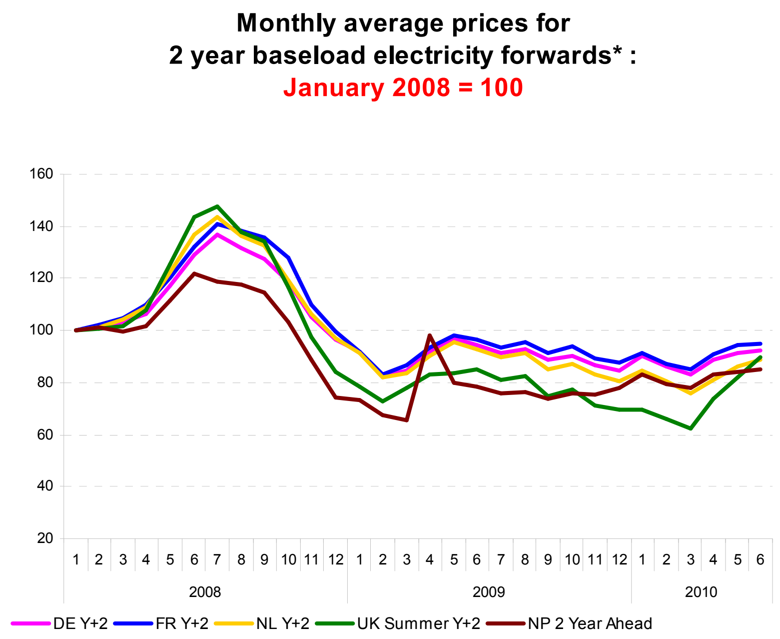
From January to September 2008, the average monthly PEP index rose by € 30, reaching € 95.83 / MWh while the NBP contract for natural gas appreciated from € 24.52 to € 29.84 / MWh. Later on, the PEP reached a low value of € 36.13 / MWh in June 2009 (-46% with respect to the start of 2008) whereas the NBP spot was traded at € 7.61 / MWh in September, losing about 70% of its January 2008 value. This development suggests that supply conditions were tighter and the demand recovered faster in the wholesale market for electricity than that for gas.

*Financial markets*

The volatility on the far end of the forward curves for EU electricity contracts was comparable but smaller than that observed for spot prices.

Figure 67: Monthly average prices for 2 year baseload electricity forwards (January 2008 = 100) (1/2008-6/2010)

[48]Publicly available here: http://ec.europa.eu/energy/observatory/electricity/electricity_en.htm




**Note. The yearly baseload contracts for Germany. France. the Netherlands. as well as the summer season contract for UK. are roll-over calendar forwards. The baseload contract for the Nordpool region is a standard year – ahead.*

*Source: Platts*

Excepting the benchmarks for the UK and the Nordpool regions, the two year-ahead contracts appreciated much like the corresponding day-ahead contracts in the first part of 2008. Contrary to the spot prices, in the decline phase, the two year ahead forwards lost less than 20 % of their values from the start of 2008. By the end of June 2010 they were also closer to the January 2008 levels than spot prices.

In 2009 and 2010, forward prices remained mostly in contango[49], implying that market participants were more optimistic about future prospects of the EU electricity markets than the current post recession situation.

### 3.3.2 Retail markets

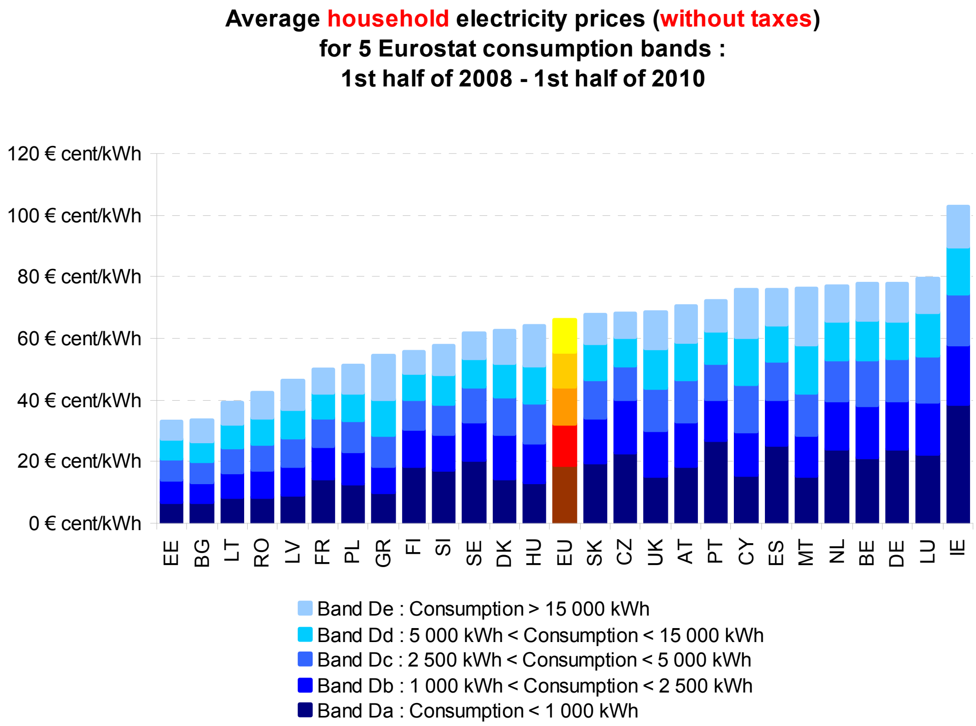
Average end consumer prices for industrial and household users increased during the observed period, reflecting with some lag the evolution of wholesale prices. Some of the exceptions to that rule were France and Ireland with lower domestic and industrial prices in the first half of 2010 than in the first half of 2008.

Household electricity prices, net of taxes, for the five reported consumption bands of *Eurostat* were quite dispersed across Member States. For example, an average consumer from the lowest consumption band *Da* paid an average price in the range of € 0,07 / kWh - € 0,39 / kWh for the period covering January 2008 to June 2010 depending on his or her country of residence.

[49] A situation of contango arises when the closer to maturity contract has a lower price than the contract which is longer to maturity on the forward curve.

The ratio of the lowest (Bulgaria) to highest (Ireland) price paid by a consumer from band *Da* stood at 5.7. For higher consumption bands the ratio of most expensive to cheapest price decreased, going from 2.9 and 2.5 for bands *Db* and *Dc* to 2.4 and 3.2 for bands *Dd* and *De*. The price dispersion was reinforced by the policies of some Member States to keep prices regulated for some industrial and household consumers.

Figure 68: Average household electricity prices (without taxes) for 5 Eurostat consumption bands (in EUR cent/kWh) (First half of 2008 – First half of 2010)



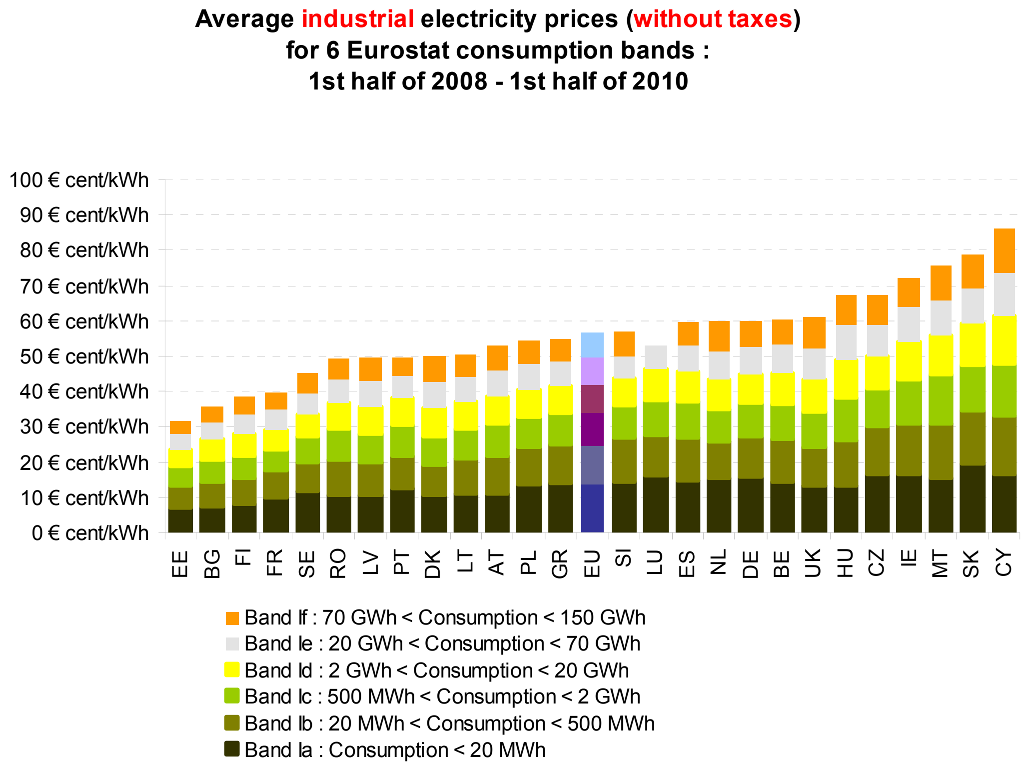

*Note. Retail electricity price data (without taxes) for households is not available for Italy. EU average data for the first semester of 2010 is preliminary. As of the time of drafting of the report, data was still missing for Greece. Denmark. Hungary. Spain and Malta.*
*Source: Eurostat. Energy Statistics*

In the UK, retail consumers from the lowest band (band *Da*) paid relatively cheaper prices than what would be suggested by the overall position of that Member State. The same was also true for the biggest household consumers (band *De*) in the Czech Republic, Luxembourg, Finland and Belgium as well as for consumers from the middle bands (*Db, Dc* and *Dd*) in Portugal, Germany and Spain.

Seven of the ten countries with lowest prices for household consumers were New Member States. However, the ranking changes significantly if purchasing power parity standards are used instead of euros as a metric for the monetary unit. In that case, Member States from Eastern and Central Europe tend to move up in the ranking.

The price dispersion between cheap and expensive prices, net of taxes, for industrial electricity consumers covering the period from the start of 2008 until mid-2010, was in general smaller than the one observed for household prices.

Figure 69: Average industrial electricity prices (without taxes) for 6 Eurostat consumption bands (in EUR cent/kWh) (First half of 2008 – First half of 2010)




*Note. Retail electricity price data (without taxes) for industrial users is not available for Italy.*
*Data for industrial users. band "If" for Luxembourg is not available.*
*Source: Eurostat. Energy Statistics*

Industrial consumers from the lower consumption bands[50] were more closely distributed around the EU average than the big industrial users of electricity. For example, the most expensive to cheapest price ratio for consumers in band *Ia* and *Ib* were respectively 2.72 and 2.73. When it comes to bands *Ie* and *If*, the corresponding price ratios varied from 3.01 and 3.34. The reason for this development may be the fact that larger consumers in open and non-regulated retail markets may find it easier to switch suppliers, choosing from different competing offers.

Denmark and the UK were among the countries where industrial prices for low consumption bands were relatively cheaper when compared to the overall position of the respective Member State. Big industrial users in Slovenia were enjoying a similar situation.

[50] As defined in the Eurostat Energy Statistics database.

## 4. IMPORTANT ENERGY TRADE PARTNERS OF THE EU

This chapter of the 2009 annual report focused on those countries that play important role either as key suppliers to the EU (such as Russia, Norway, Algeria) or as important emerging supplier and transit counties (such as the Caspian Region and Central Asia, Turkey, Brazil) The current report continues to present the most important energy and economic features of some countries playing a major role in supply and trade of energy products with the EU. Four countries have been chosen to be presented briefly, namely the United States, Canada, Qatar and Libya.

The EU has different kinds of cooperation with these countries.

The cooperation between the USA and the EU in the energy domain is coordinated within the framework of the EU-US Energy Council, a bilateral energy dialogue, focusing on the questions of energy security, technologies and policies.

Energy cooperation between Canada and the EU takes place in the framework of EU-Canada High Level Cooperation and under the Euratom Agreement in areas of peaceful uses of atomic energy, enrichment, nuclear and fusion related scientific research.

A chapter on cooperation in energy matters has been included in the Free Trade Agreement (FTA) negotiations with Libya.

### 4.1 The United States of America

In 2008, the United States of America (USA) was the world's largest energy consuming country[51]**.** In that year the gross inland energy consumption of the USA was 2313 Mtoe (millions of tons of oil equivalent), compared to 1799 Mtoe for the EU.

In 2008, 26% of gross inland consumption was imported, amounting to 601 Mtoe[52].

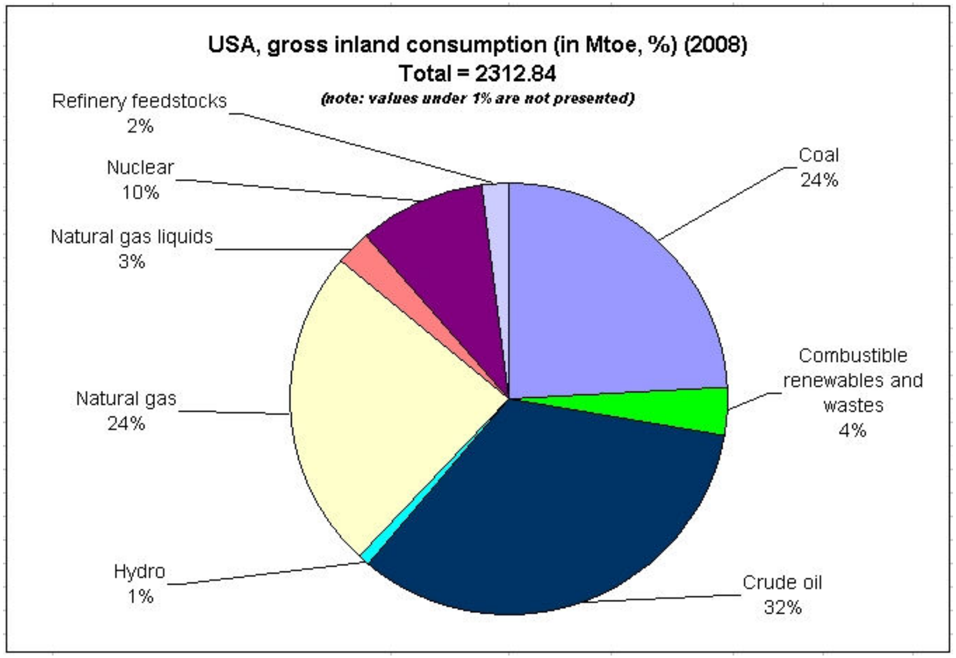
84% of the US's energy imports were crude oil and petroleum products while natural gas imports amounted to 13% in 2009. The volume of energy exports of the USA was about one fourth of that of imports in 2009. It exports mainly petroleum products (53%), coal (22%) and natural gas (15%).

As the next chart shows, the energy mix of the USA is predominantly based on the consumption of fossil fuels, making up 85% of all energy consumption in 2008.

Figure 70: USA, gross inland consumption of energy (in Mtoe, %) (2008) Total = 2312.84 Mtoe

[51] It is worth mentioning that the IEA's World Energy Outlook 2010 suggests that according to preliminary data China overtook the US in energy consumption

[52] Source: US Energy Information Administration - EIA

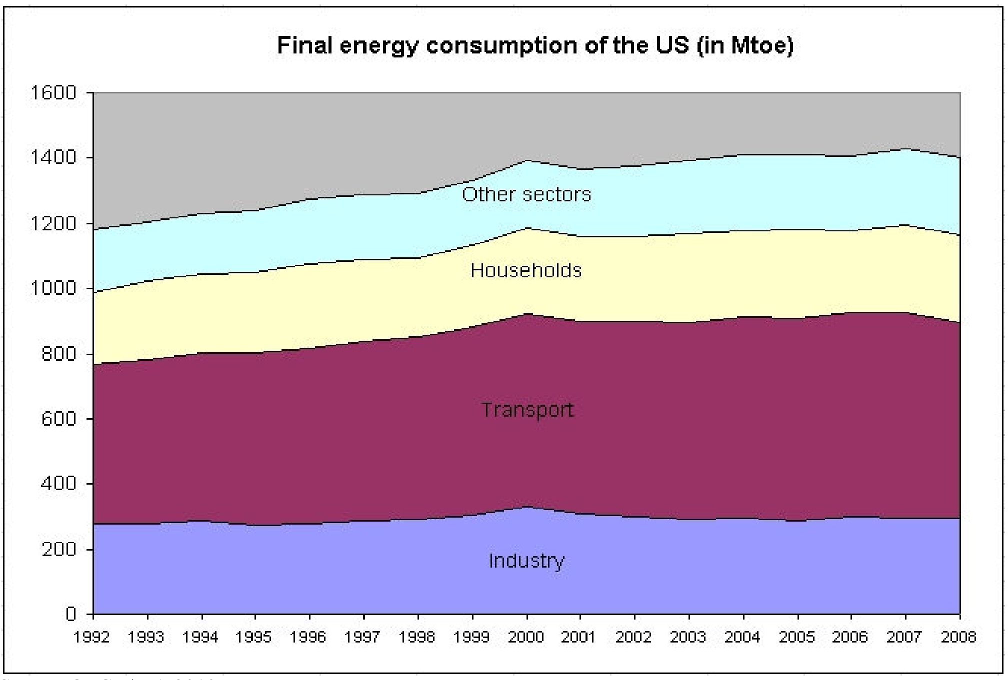


Source: OECD/IEA 2010

Compared to the energy mix of the EU-27, solid fuels (namely coal) represented a higher share in the energy mix of the USA while the proportion of crude oil was less than in Europe. The importance of nuclear energy (10%) or renewable energy sources (5%) is less than in the EU-27 (13% and 8%, respectively). The share of coal was especially high in electricity generation (46%) in 2008 in the US as opposed to that of the EU-27 (26.7% in the same year).

During the last two decades, the final energy consumption of the USA experienced an almost permanently increasing trend, although in 2008 annual consumption was less than the preceding year. The largest fall in consumption occurred in the transport sector (-4.3% compared to 2007) which might have been in conjunction with high fuel prices in 2008.

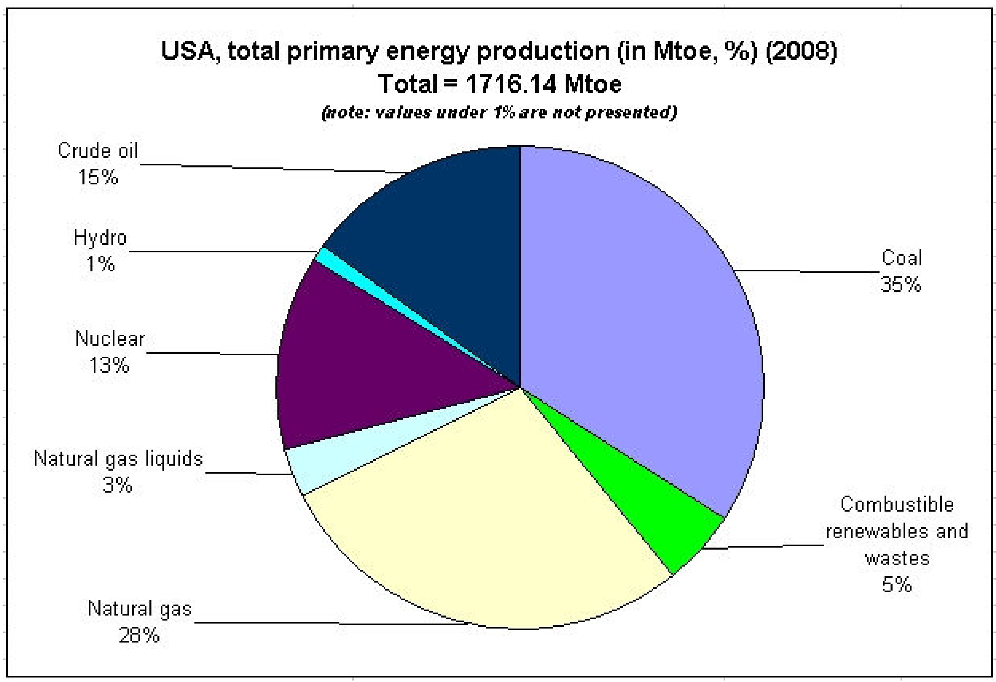
Figure 71: USA, Final energy consumption (in Mtoe) (1992-2008)



Source: OECD/IEA 2010

As the chart showing total primary energy production reveals, the importance of coal in production is even higher than in gross inland consumption (while crude oil based energy consumption is heavily import-dependent, giving less importance to crude oil in production than in consumption).

Figure 72: USA, total primary energy production (in Mtoe, %) (2008) Total = 1716.14 Mtoe



Source: OECD/IEA 2010

The USA's more fossil fuel-dominated energy mix leads to higher greenhouse gas emissions: in 2007 the US emitted 19.1 Mt $CO_2$/capita compared to 9.0 Mt $CO_2$/capita in the EU.

Besides significant energy consumption and production the USA has huge reserves of energy. The country possesses 1.4% of the world's proven crude oil reserves, ranking it twelfth in the world. Regarding natural gas reserves the US possesses the sixth largest reserve (proven or probable reserves, see figure 88) in the world, with 3.7% of the global stocks and amounting to 6900 bcm at the end of 2008. If the 'technically recoverable' reserves are also taken into account, the total reserves amount to 48 Tcm of which more than 60% is unconventional gas[53].

According to data of the Energy Information Administration (EIA) of the USA, in 2008 the country possessed the largest recoverable reserve of coal in the world (262.000 Mt or 28.7% of the total world reserves).

Taking a look at production figures on the next chart, the USA was the second largest natural gas producer behind Russia in the world in 2008. As a consequence of decreasing Russian production and further increase in that of the USA the country became the number one natural gas producer in 2009. The country was the third largest oil producer in both 2008 and 2009.

Figure 73: USA, evolution of oil and gas production and reserves (in Mbbl, bcm) (2006-2008)

| OIL | 2006 | 2007 | 2008 |
|---|---|---|---|
| ANNUAL PRODCUTION (Mbbl) | 2.500 | 2.500 | 2.500 |
| PRODUCTION TO DATE (Mbbl) | 224.100 | 226.700 | 229.100 |
| RESERVES (PROVEN OR RPOBABLE) (Mbbl) | 29.400 | 30.500 | 28.400 |

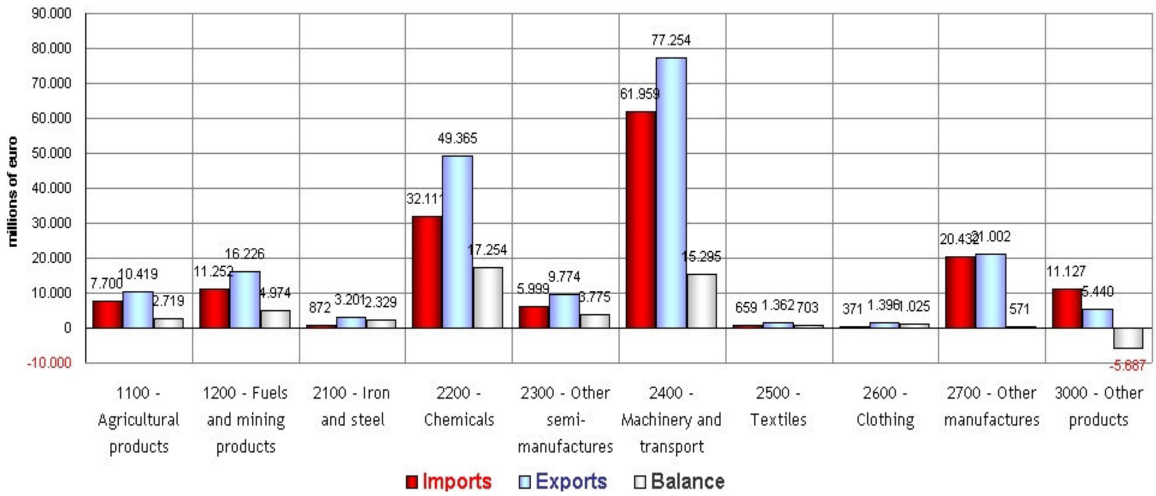
| GAS | 2006 | 2007 | 2008 |
|---|---|---|---|
| ANNUAL PRODCUTION (Bcm) | 520 | 540 | 580 |
| PRODUCTION TO DATE (Bcm) | 28.800 | 29.400 | 30.000 |
| RESERVES (PROVEN OR RPOBABLE) (Bcm) | 6.000 | 6.700 | 6.900 |

Source: © Petroconsultants SA (2010) (rounded values)

The United States is also an important energy trading partner for the EU-27. The import share of fuels and mining products from the US (€ 11.3 billion) was 7.1% in 2009, the EU's exports of energy products (€ 16.2billion) that year accounted for 7.9% of overall exports to the US.

Figure 74: EU, Trade with United States (in EUR million) (2009)

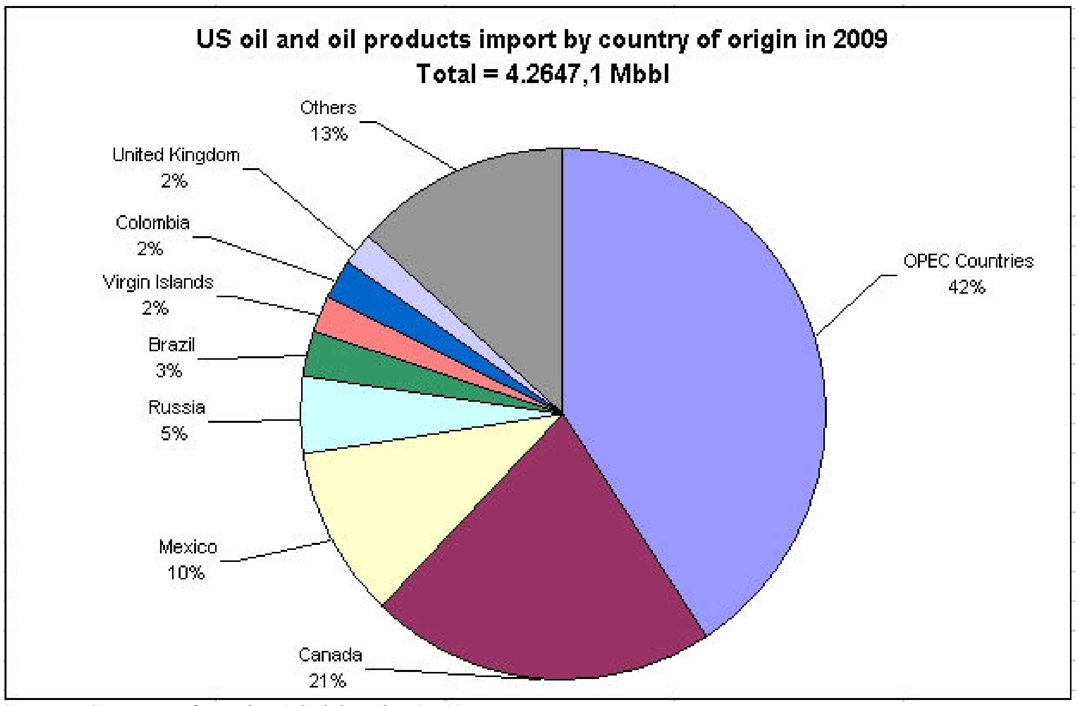
[53] Source: US Energy Information Administration - EIA




Taking a closer look at individual energy products, coal is the most traded energy product between the USA and the EU. According to IEA data, about 51% of all hard coal exported from the US was shipped to the EU while more than 14% of the EU-27's hard coal import originated from the US.

As mentioned previously, the country heavily depends on foreign crude oil sources and refined petroleum products also play a major role in its energy product exports. Looking at the country of origin import structure of oil products, the OPEC countries are the major suppliers of the USA (with a 42% share in the overall import volume), followed by Canada, Mexico and Russia. The countries of the EU-27 had a minor share in 2009 (5.8%).

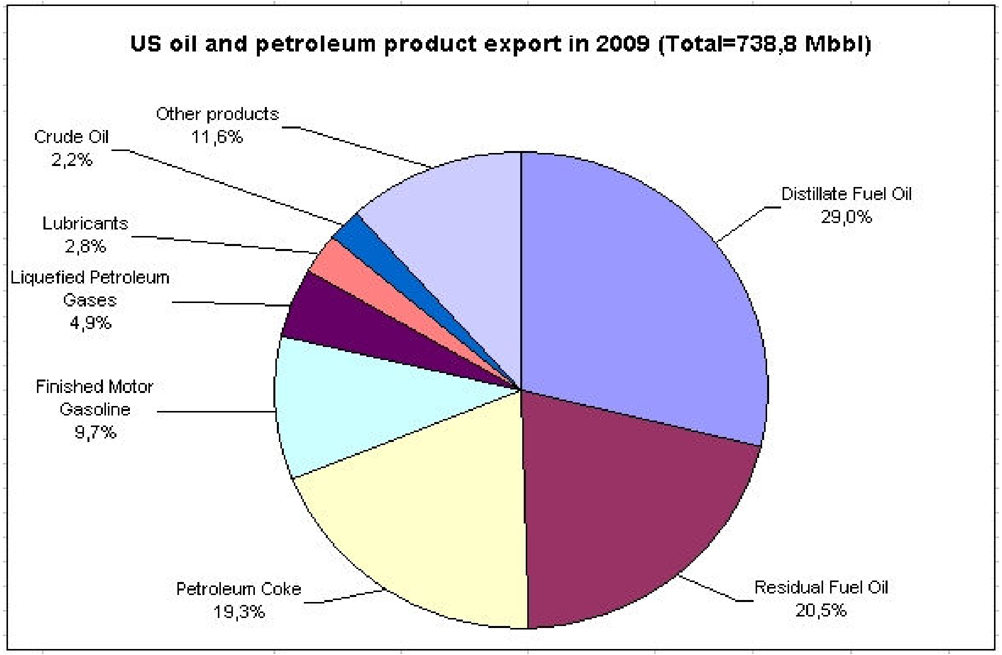
Figure 75: USA, oil and oil products import by country of origin (in %) (2009) Total = 42,647.1 Mbbl




Source: US Energy Information Administration (EIA)

While the share of crude oil import was nearly 80% within petroleum products in both 2008 and 2009, the structure of oil products exports show a completely different picture, with an almost negligible share of crude oil.

Figure 76: USA, oil and petroleum product export (in %) (2009) Total = 738.8 Mbbl

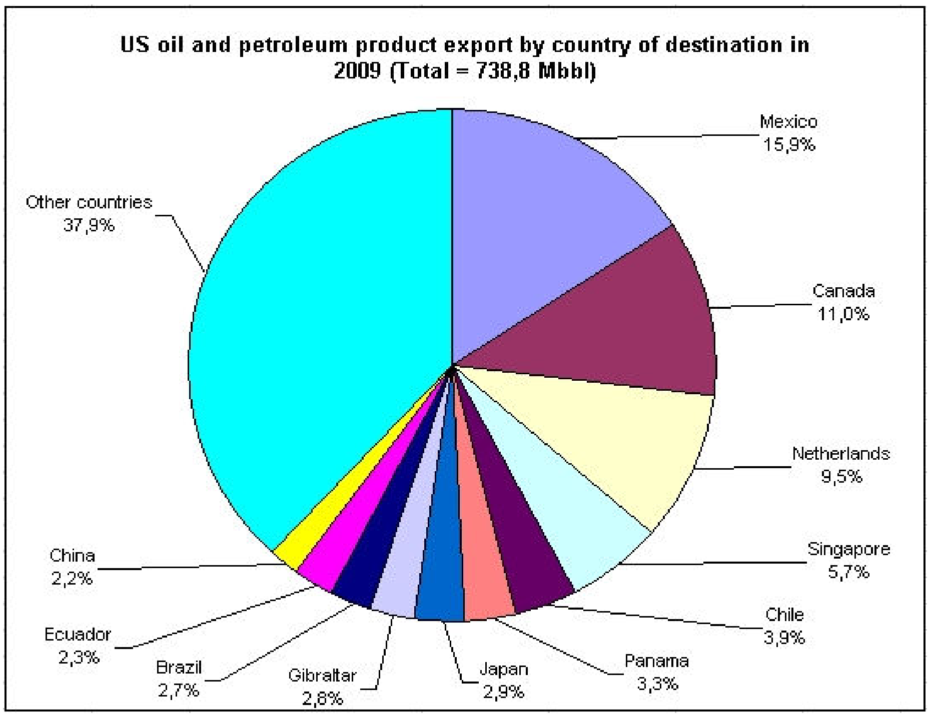



Source: US Energy Information Administration (EIA)

Refined products, such as distillate and residual fuel oil, petroleum coke and finished motor oil, dominated the exports of US petroleum products in 2009, while the share of crude oil was small (2.2%).

In the case of crude oil imports, the USA primarily depends on OPEC member states. In contrast, the country's petroleum product export structure was more diversified, although Mexico and Canada are the two major trade partners, similarly to the case of crude oil imports.

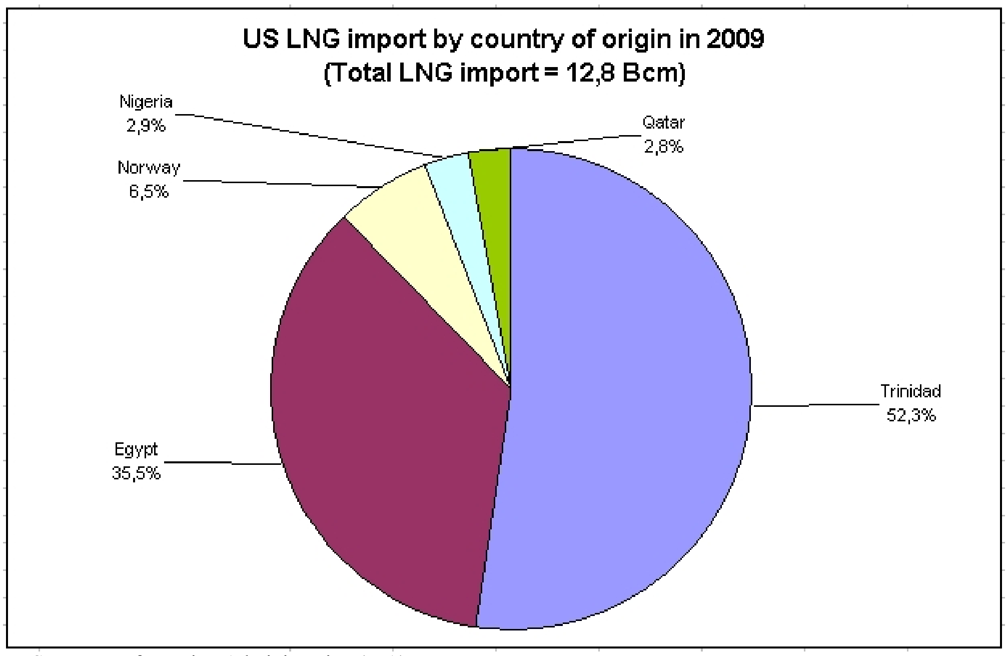
Figure 77: USA, oil and petroleum product export by country of destination (in %) (2009) Total = 738.8 Mbbl



Source: US Energy Information Administration (EIA)

Almost all natural gas export (97%) from the USA in 2009 was through pipelines to the two neighbouring countries (Canada and Mexico). The import of natural gas was also dominated by pipeline trade (with an 88% share in 2009).

Figure 78: USA, LNG import by country of origin (in %) (2009)            Total = 12.8 bcm



Source: US Energy Information Administration (EIA)

The import sources of LNG shipped to the US show a duopolistic structure, with the two major players, Trinidad and Tobago and Egypt. Qatar, which is the world largest LNG producer country, played only a marginal role in US import supply.

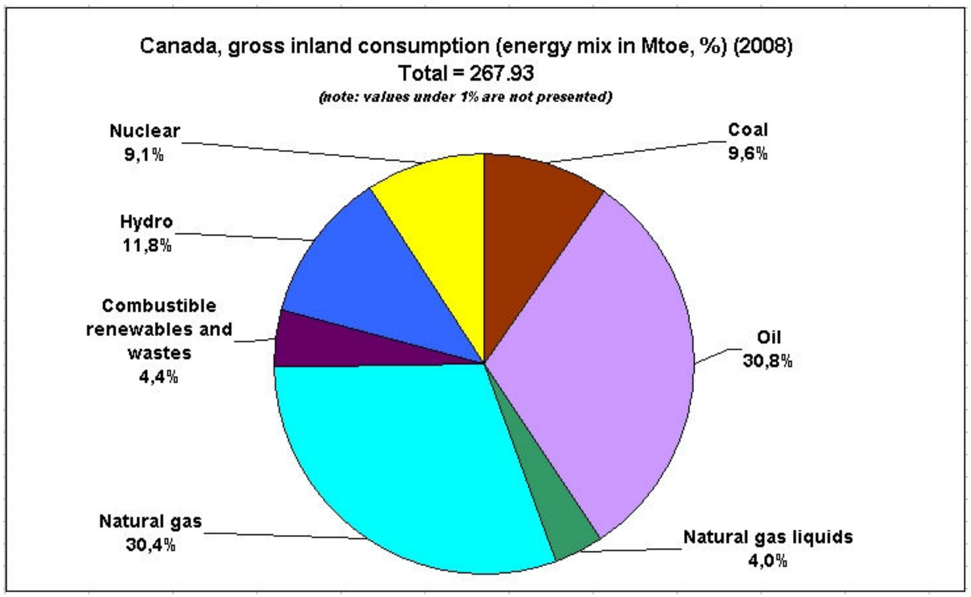
Within US gas production the share of unconventional gas has been steadily growing during the last two decades. In the beginning of the 1990s its share was around 10-15% and in the last two years (2008 and 2009) the proportion of unconventional gas reached almost 50% of all US natural gas production.

## 4.2 Canada

Energy-intensive activities make up an important part of the Canadian economy (e.g.: aluminium manufacturing, paper and pulp industries), with the result that Canada uses almost twice as much energy to produce one unit of GDP than the economies of the EU-27. This energy intensity can also be seen in gross inland energy consumption or electricity consumption per capita figures which are significantly higher than those of the EU-27 average (with values some 2.5 times the respective EU value). The carbon-dioxide emission per capita (Mt $CO_2$/per capita) value of the country was above 17.0 in the last couple of years, compared to 9.0 for the EU.

The country's energy mix in 2008 was dominated by oil and natural gas, each representing more than 30% of gross inland energy consumption. Coal and nuclear fuels were of minor importance, although both fuels exceeded 9% in the energy mix. Hydropower represented 12% of consumption which is higher than the respective value of both the EU-27 and the US. Indeed, hydropower represented 59% of electricity generation in 2008.

Figure 79: Canada, gross inland consumption (energy mix) (in Mtoe, %) (2008) Total = 267.93

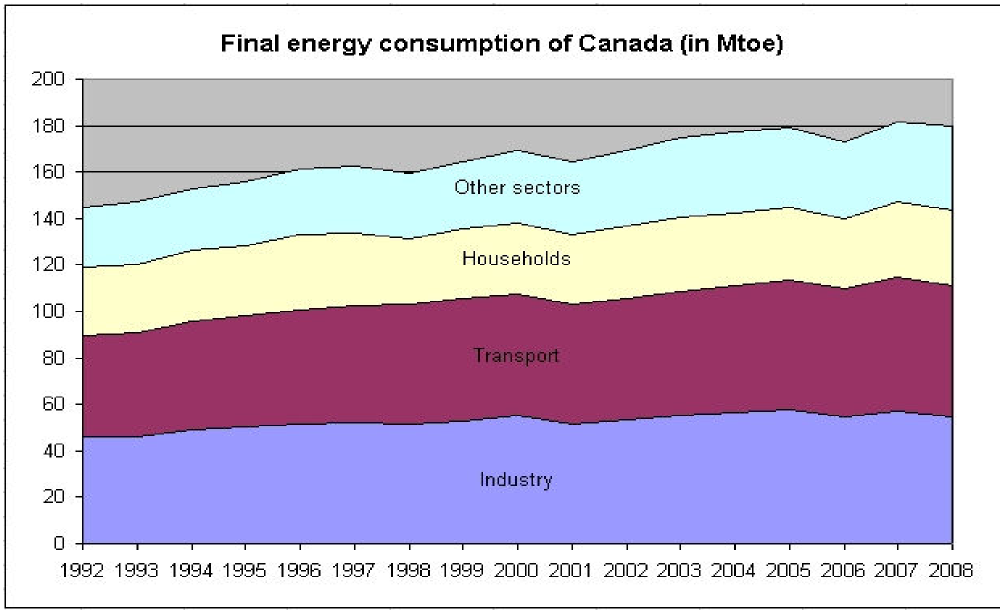



Source: OECD, IEA 2010

The importance of fossil fuels is much higher in the country's primary energy production than in that of the energy mix (89.4% of total produced energy comes from fossil fuel resources whereas the share of fossils is only 74.7%) which explains the country's strong net energy exporter position. In 2008, Canada exported more than 133 Mtoe of energy products.

The evolution of Canada's final energy consumption between 1992 and 2008 can be seen on the next chart. The change in the annual final consumption in 2008 (a 1% decrease) was mainly driven by the fall in the industrial and transport sectors that made up more than 60% of the country's final energy consumption in 2008. The relative importance of households in the final energy consumption slightly declined during this period while that of the other sectors slightly increased.

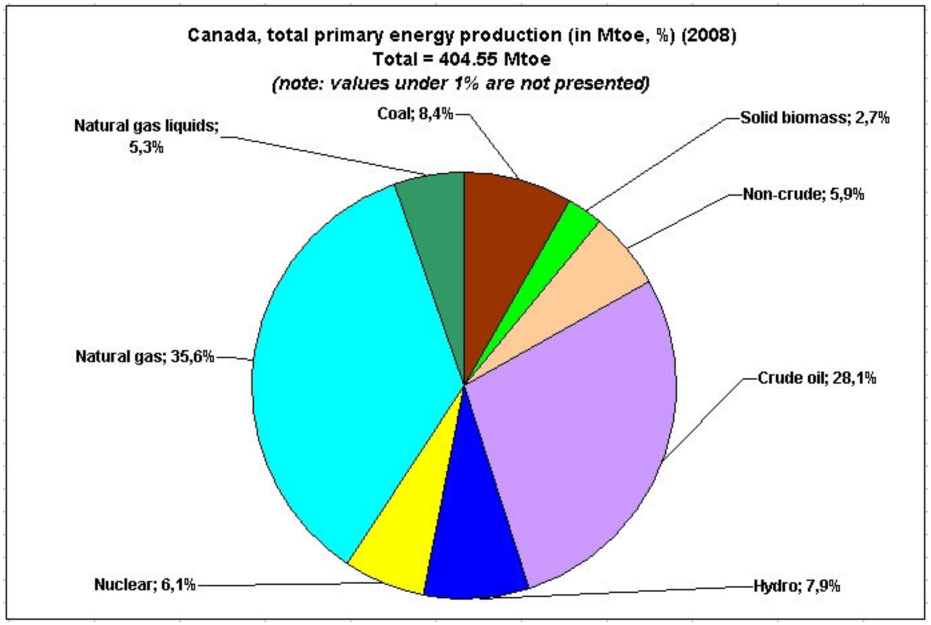
Figure 80: Canada, Final energy consumption (in Mtoe) (1992-2008)




Source: OECD, IEA 2010

The vast majority (97-98%) of Canada's fossil fuel exports are destined to the US, with which the country has very strong inter-linkages in energy markets. An example of this integrated nature is in terms of the electricity supply sources of the North-Eastern part of the US as the largest cities on the shore of the Atlantic are supplied by Canadian power sources.

Figure 81: Canada, total primary energy production (in Mtoe, %) (2008) Total = 404.55




Source: US Energy Information Administration (EIA)

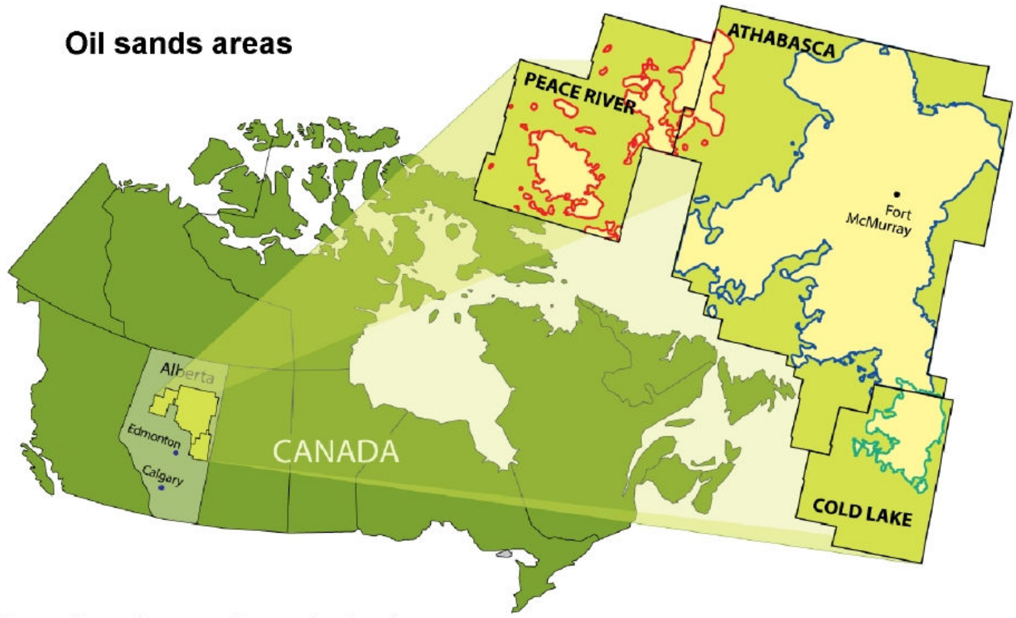
Canada's importance from an energy point of view mainly lies in its huge unconventional crude oil reserves. As of January 2009 the country's crude reserves amounted to 178 billion barrels, of which only 5% is traditional crude oil, while the vast majority can be found in tar sand deposits. This ranks Canada second behind Saudi Arabia in the world in terms of crude oil reserves.

Most of the oil sands of Canada are located in three major deposits in northern Alberta. The Alberta deposits also contain at least 85% of the world's total bitumen reserves. The largest bitumen deposit, containing about 80% of Canada's bitumen deposits, and the only one suitable for surface mining, is the Athabasca Oil Sands.

Canada’s oil production (including all liquids) was 3.22 million bbl/day in 2009. This is the sixth biggest daily production in the world (about one third of the value of top oil producer Russia). Canada’s oil production has steadily risen over the past two decades (in 1990 it slightly exceeded 2 million barrels per day), as new oil sands and offshore projects have come on-stream to replace aging, mature fields.

In 2008, oil sands production represented approximately half of Canada’s total crude oil production. The Athabasca oil sands deposit in northern Alberta is one of largest oil sands deposits in the world. There are also sizable oil sands deposits on Melville Island in the Canadian Arctic, and two smaller deposits in northern Alberta near Cold Lake and Peace River. Most of the oil sands development to date has focused on the Athabasca deposit.

Map 3: Canada's oil sands areas



Source: Energy Resources Conservation Board

Canada possessed around 1.750 billion cubic metres (bcm) of natural gas as of January 2010, which is less than 1% of the world's proven reserves. However, its annual production was more than 170 bcm in 2008, amounting to 5.5% of the world's production in 2008. The country uses about half of its indigenous production; the other half is exported, almost exclusively to the US. Similarly to oil production, the majority of gas extraction is concentrated in Alberta and in the Arctic regions, namely in the Valley of Mackenzie. The production of Liquefied Natural Gas (LNG) and unconventional gases such as shale gas was begun in the past decade, although the construction of most of the planned facilities is still in embryonic phase.

Coal and solid fuels play a less important role among fossil fuels in the energy mix of Canada; the relative importance of this fuel type in power production (16% in 2008) is less than that of the EU-27 (21%) and that of the US (46%). Canada only possesses 0.8% of the world's hard coal reserves and its consumption amounted to 1% of the world total in 2008.

Although the share of nuclear fuel in Canadian power production (9%) is relatively modest, Canada was the second largest uranium-producing country in the world in 2009, after Kazakhstan. Kazakhstan's world share of production amounted to 27.4% in 2009, compared to 20.1% for Canada. Canada's uranium production grew by 13% in 2009, compared to 62% in Kazakhstan, compared to 2008. Kazakhstan's rapid production growth was a key factor in taking Canada's number-one position, which was unrivalled until 2008.

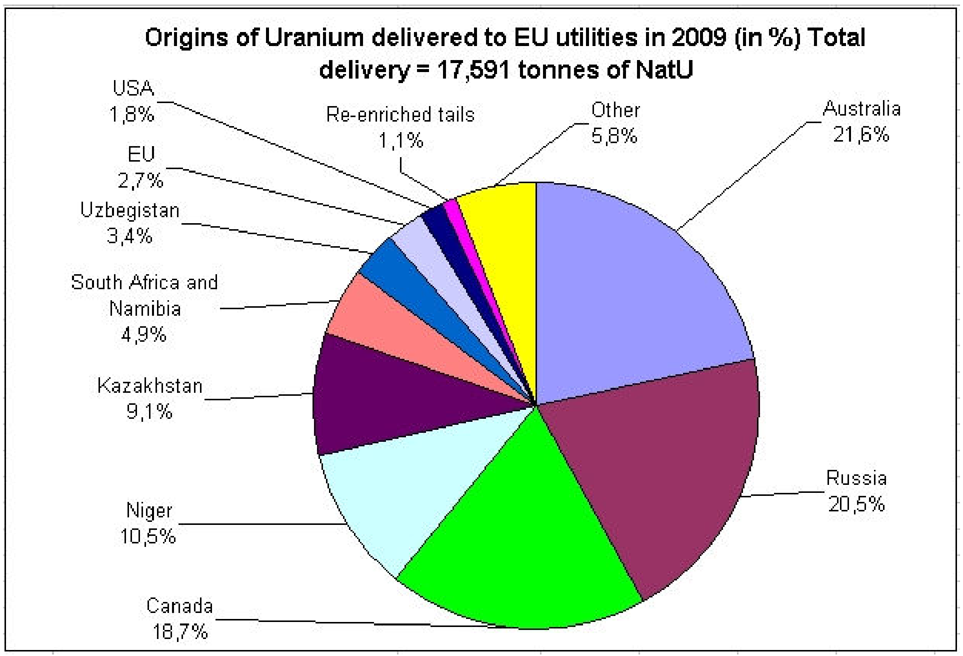
Figure 82: Natural uranium production (in tonnes) (2008-2009)

| Natural uranium production in 2009 (compared with 2008, in tonnes of uranium) | | | | | |
|---|---|---|---|---|---|
| Region/ Country | Production 2009 (tonnes) | Production 2008 (tonnes) | Share in 2009 (%) | Share in 2008 (%) | Change 2009/2008 (%) |
| Kazahkstan | 13.820 | 8.521 | 27,36% | 19,43% | 62,19% |
| Canada | 10.173 | 9.000 | 20,14% | 20,52% | 13,03% |
| Africa | 8.536 | 8.053 | 16,90% | 18,36% | 6,00% |
| Australia | 7.928 | 8.430 | 15,69% | 19,22% | -5,95% |
| Russia | 3.564 | 3.521 | 7,05% | 8,03% | 1,22% |
| Uzbekistan | 2.429 | 2.338 | 4,81% | 5,33% | 3,89% |
| USA | 1.453 | 1.430 | 2,88% | 3,26% | 1,61% |
| Others | 2.616 | 2.560 | 5,18% | 5,84% | 2,19% |
| Total | 50.519 | 43.853 | 100,00% | 100,00% | 15,20% |

Source: WNA

Until 2008, Canada was the most important external uranium supplier of the EU's nuclear reactors until 2009 when Australia supplied 21.6% of the EU's external uranium supplies, amounting to 3800 Natural Uranium (NatU), while Russia supplied 20.5% (3599 NatU) and Canada supplied 18.7%, or 3.286 tonnes of natural uranium. Beside these three countries Niger (10.5%) Kazakhstan (9.1%) and South Africa & Namibia (together: 4.9%) could be deemed to be significant uranium suppliers to the EU in 2009.

Figure 83: Origins of Uranium delivered to EU utilities (in %) (2009) Total = 17,591 tonnes of NatU



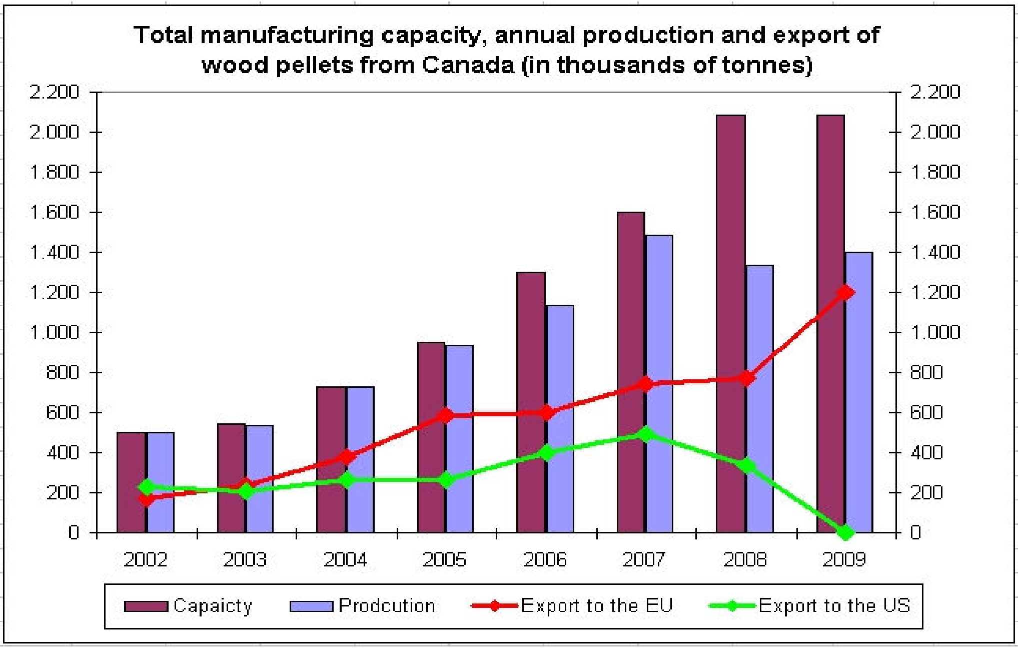

Source: Euratom Supply Agency Annual Report 2009

Canada is a significant supplier of wood pellets to the EU. In 2002, 46% of Canadian pellet production was exported to the US and 34% to Europe. By 2008, exports to the US doubled but only comprised 25% of Canadian pellet production, while 58% of the production went to Europe that same year, including the Netherlands, Sweden, Denmark, Belgium, Italy, Ireland and Germany.

By 2009 most of the pellet shipments were destined to Belgium, the UK and the Netherlands. In 2009, 1200 tonnes were shipped to the EU, satisfying about 15% of the EU's pellet annual consumption (8 millions of tonnes).

Though plant capacity in Canada reached 2 million tonnes in 2009, production did not rise appreciably due to the lack of mill residues. In 2009, the impact of the Biomass Crop Assistance Program in the US provided US pellet producers with a $50/tonne cost advantage over Canadian plants. This advantage led to virtually zero Canadian exports to the US. The fall-out in exports to the US was compensated by boosting shipments to Europe that raised the export share of the EU market to 85% in 2009. In 2009 as a new market approximately 100,000 tonnes of pellets were shipped to Japan.

Figure 84: Total manufacturing capacity, annual production and export of wood pellets from Canada (in thousands of tonnes) (2002-2009)

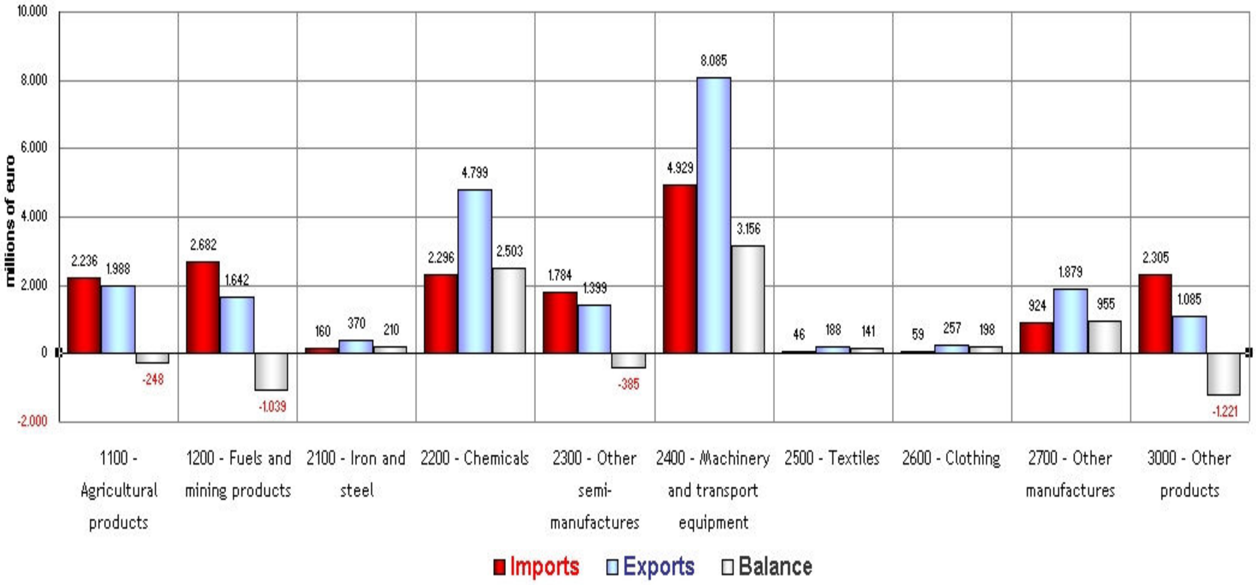



Source: Canadian report on bioenergy 2010, European wood pellet atlas

As the next chart shows, fuels and mining products are important trade goods between the EU and Canada. In 2009 fuels and mining products accounted for 15% (€ 2.7 billion) of all EU imports from Canada, and these products covered 7% (€ 1.6 billion) of all exports from the EU to this country.

Figure 85: EU Trade with Canada (in EUR million) (2009)

**EU trade with Canada**



### 4.3 Qatar

Situated in the Persian Gulf, Qatar plays a major role in supplying many countries in the world with fossil fuels and possesses significant proven hydrocarbon reserves. According to the data in the table below, the country's natural gas reserves amount to 28 trillion cubic metres (tcm), equating to more than 140 years taking into account both currently operating gas production and planned facilities capacities, the latter representing annual capacity of 185.7 billion cubic metres (bcm). Qatar's oil reserves amounted to 33.3 billion barrels which translates into almost 90 years of stock value assuming a daily production of 801 kbbl[54].

Figure 86: Qatar, evolution of oil and gas production and reserves (in Mbbl, bcm) (2006 and 2008)

| OIL | 2006 | 2007 | 2008 |
|---|---|---|---|
| Annual production (Mbbl) | 400 | 390 | 400 |
| Production to date (Mbbl) | 7.000 | 7.400 | 7.800 |
| Reserves (proven and probable) (Mbbl) | 34.100 | 33.700 | 33.300 |

| GAS | 2006 | 2007 | 2008 |
|---|---|---|---|
| Annual production (bcm) | 46 | 53 | 64 |
| Production to date (bcm) | 550 | 600 | 660 |
| Reserves (proven and probable) (bcm) | 28.500 | 28.500 | 28.400 |

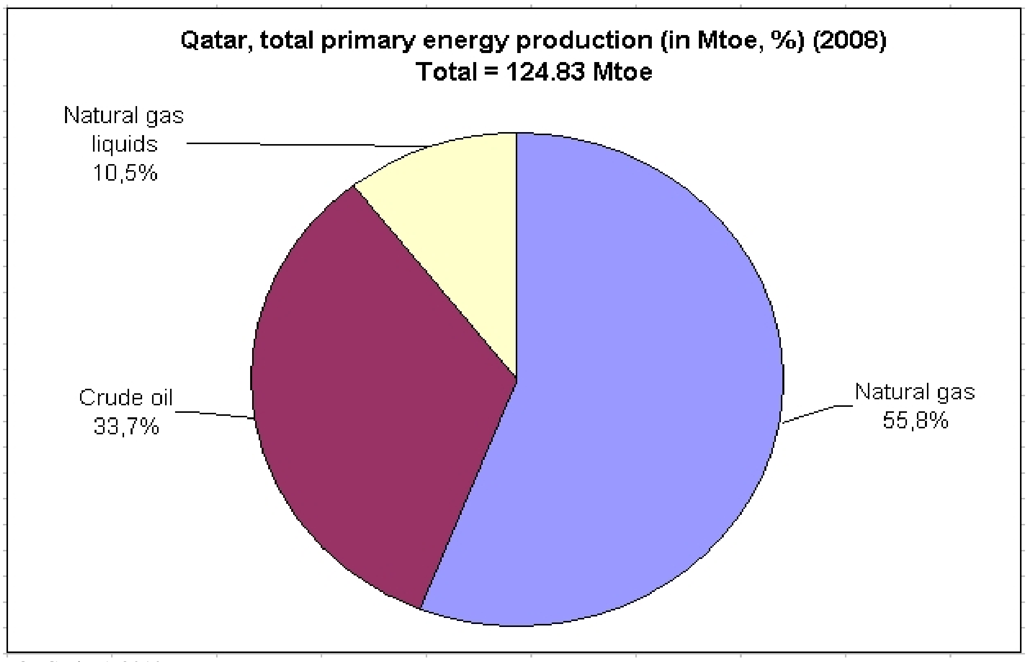
Source: © Petroconsultants SA (2010) (rounded values)

Although the Non-Oil and Gas Sector accounted for more than half of Gross Domestic Product (GDP) of Qatar in 2009 (56.8%), both gas (24.5%) and oil sectors (21.7%) also play a major role in the development of the country. QNB's data confirm the trend which could be first observed in 2008 that the gas sector overtook that of the oil sector regarding its contribution to the overall GDP.

On the following chart the structure of the energy production shows the relative importance of natural gas production to that of crude oil:

Figure 87: Qatar, total primary energy production (in Mtoe, %) (2008) Total = 124.83 Mtoe

[54] Estimation made by the Qatar National Bank

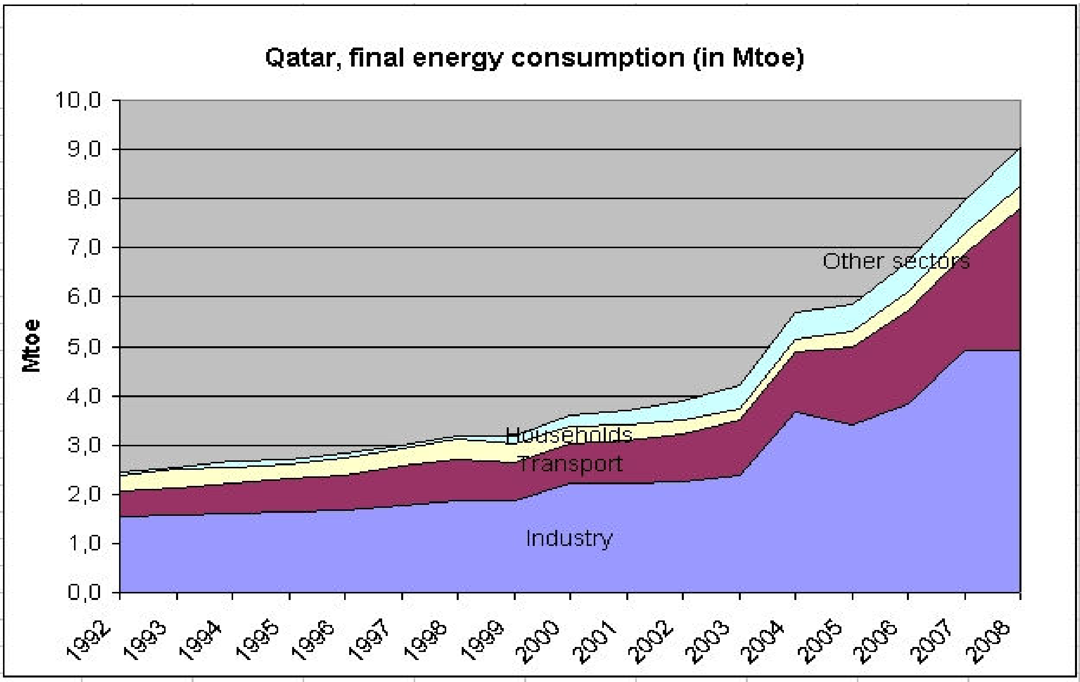



Source: OECD/IEA 2010

Between 2005 and 2009, Qatar possessed one of the fastest growing economies in the world with an annual average GDP increase of 17.4% and despite the looming economic crisis in 2009 it was still able to deliver 8.7% in growth. Fast economic growth is coupled with a rapidly growing population, of 20% per year, which was mainly due to the increase in number of immigrant workers the economy permanently needs.

Rapid growth in energy demand has resulted from such economic developments, which led to a doubling of final energy consumption between 2003 and 2008.

Figure 88: Qatar, final energy consumption (in Mtoe) (1992-2008)



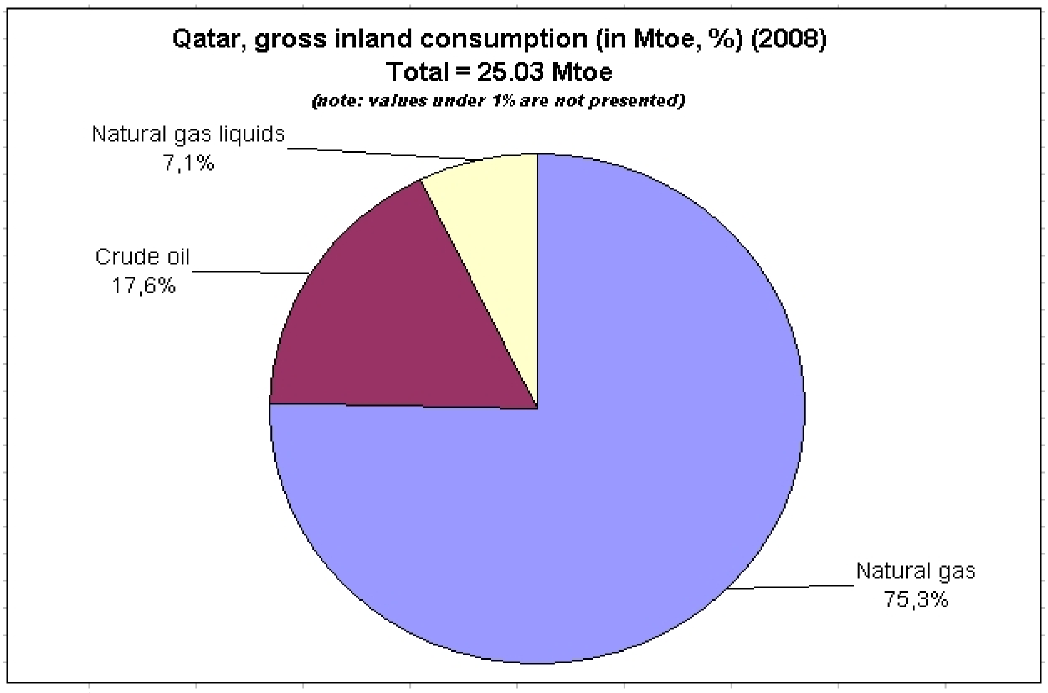

Source: OECD/IEA 2010

The main driver of growth in final energy consumption was the industrial sector, followed by transport activities. Although Qatar's population grew rapidly in the last five years, contributing to a doubling of households' final energy consumption between 2003 and 2008, households contributed only a modest amount to the overall final consumption (5.2%) during this period.

The rapid growth in energy consumption might also have been influenced by fossil fuel consumption subsidies. According to the World Energy Outlook 2010 of the IEA the global value of such subsidies in 2009 amounted to $312 billion. Although Qatar's fossil-fuel consumption related subsidy expenditure is not extremely high in absolute figures in an international comparison, it spent 3% of its GDP for this purpose in 2009, which cannot be deemed insignificant.

Qatar's gross inland energy consumption is broadly based on natural gas and gas liquids; almost 83% of the country's energy consumption is based on gas, reinforcing the role of this fuel.

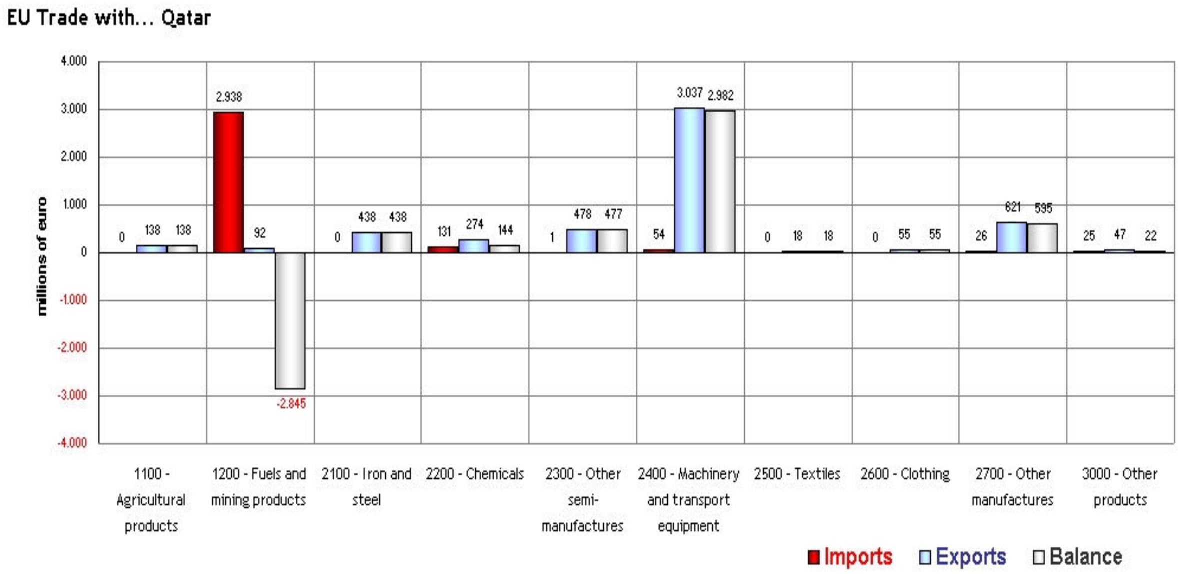
Figure 89: Qatar, gross inland consumption (in Mtoe, %) (2008) Total = 25.03 Mtoe




Source: OECD/IEA 2010

The EU-27's trade with Qatar can be characterised as highly concentrated among certain economic branches. The EU imports mainly fuels and mining products from Qatar while the EU mainly exports machinery and transport equipment to the country.

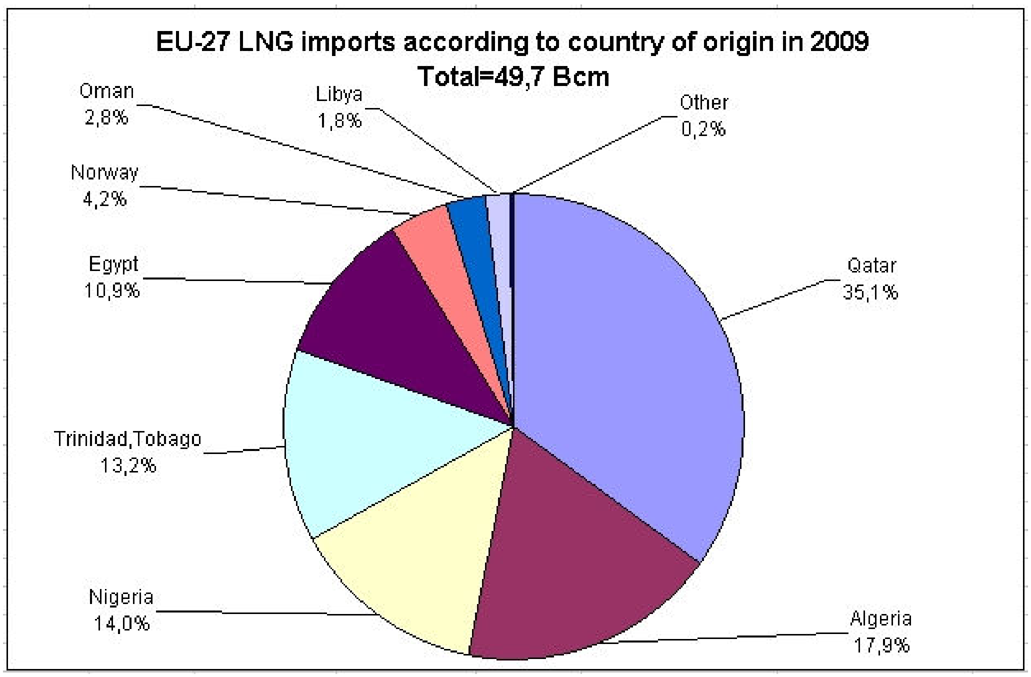
Figure 90: EU Trade with Qatar (in EUR million) (2009)




Source: DG TRADE

EU exports to Qatar represented 0.5% of overall EU-27 exports while 0.3% of the EU-27's imports of products originated from Qatar in 2009. These relatively low numbers mask the importance of energy trade relations between Qatar and the EU-27. In 2008 2.3% of the EU-27's natural gas imports originated from Qatar, increasing to 5% in 2009 according to preliminary data of Eurostat. Qatar is the EU's leading supplier of liquefied natural gas (LNG), supplying 35% of all LNG imports in the EU in 2009, compared to between 23 and 24% in 2007 and 2008. In certain EU countries (e.g.: Belgium and the UK), Qatar's contribution to LNG imports exceeded 50%.

Figure 91: EU-27, LNG imports according to country of origin (in %) (2009)



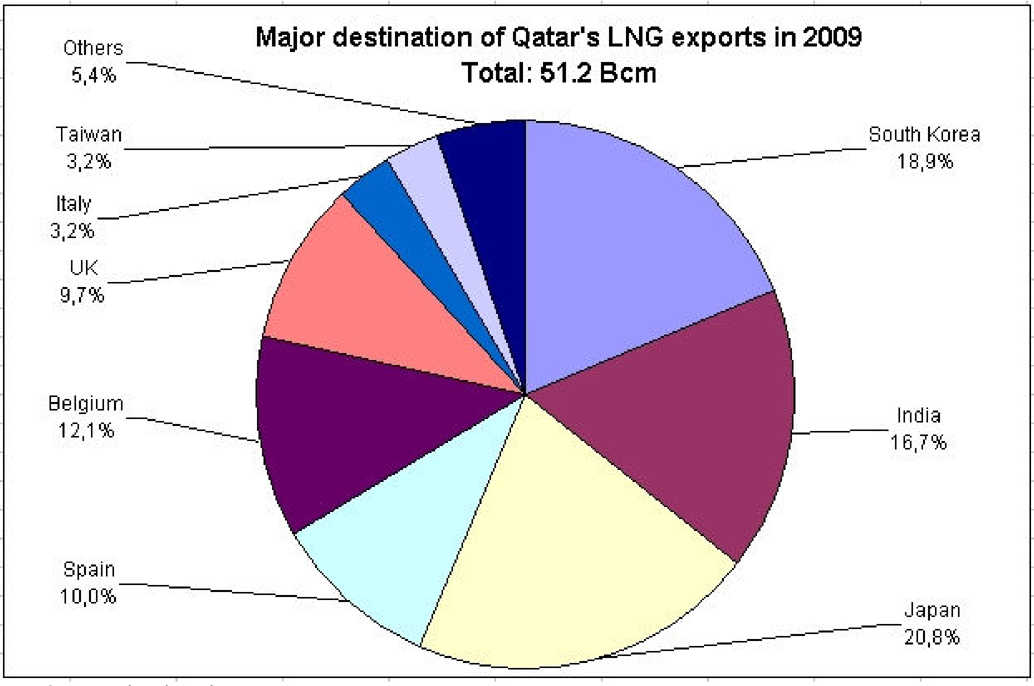

Source: Eurostat's COMEXT database

Besides Qatar, Algeria, Nigeria, Trinidad and Tobago and Egypt were all important LNG suppliers to the EU-27 in 2009.

Looking at the destination breakdown of Qatar's LNG exports, it reveals that the most important export trade partners are Japan, the Republic of Korea and India, altogether representing more than 57% of market destinations. The most important European partners are Belgium (12.1%), Spain (10.0%), the UK (9.7%) and Italy (3.2%).

Qatar's LNG exports grew by 22% in 2009, to reach 51.1 bcm, up from 41.9 bcm in the previous year. The volume of annual contracted values to 2012 (103 bcm) presages further rapid growth in Qatar's LNG exports and makes it probable that it will remain the world's most important LNG supplier in the near term.

Figure 92: Qatar, Major destinations of LNG exports (in %) (2009) Total = 51.2 bcm




Source: Qatar National Bank

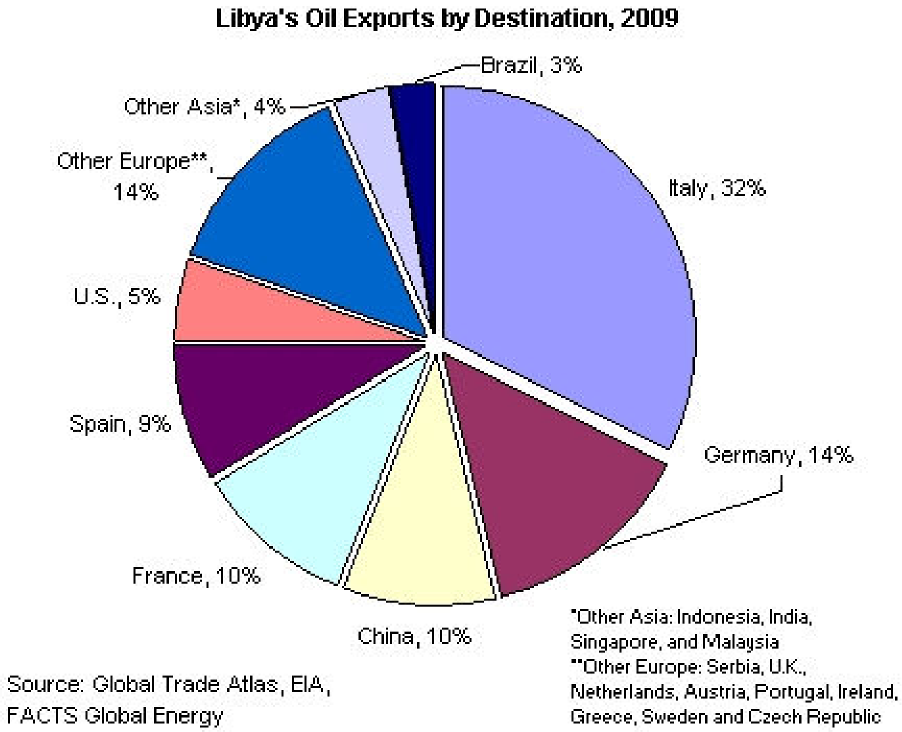
## 4.4 Libya (Libyan Arab Jamahiriya)

Libya is an important supplier of oil and natural gas to the EU due to its geographical proximity to Europe and its fossil fuel reserves. Situated in Northern Africa in the neighbourhood of Tunisia, Algeria and Egypt, the country is part of the Mediterranean electricity grid, which has the potential to bind together a future integrated Mashreq-Maghreb power grid in the Southern Mediterranean.

Libya also possesses the largest proven oil reserves of the African continent and it exports nearly 80% of its annual production to the EU, with Italy, Germany, France and Spain being the main Libyan oil importers.

The trade dependence of Libya to the EU is very significant. Over 70% of Libya's total exports are directed to the EU market when the EU relies on Libya for less than 1% of its exports. In 2009 more than 40% of Libya's total GDP depended on crude oil exports to the EU.

Figure 93: Libya, oil exports by destination (in %) (2009)




In 2008, 10.2% of the total crude oil import of the EU-27 originated from Libya, which has become the third most important crude oil supplier to the EU (compared to Russia: 32% and Norway: 15.5%). Among the OPEC countries, Libya was the most important oil supplier to the EU-27. Provisional Eurostat data show that in 2009 the share of Libya in EU-27 crude oil import slipped slightly below 10% but its third place in the import supply ranking order still holds.

Libya is also a significant gas supplier to the EU, although its share in overall EU-27 imports is less than that for crude oil. In 2008, the country exported 10 bcm natural gas to the EU, representing 3% of overall EU-27 gas imports. The majority of this amount (95%) was exported through the Green Stream pipeline to Italy, and the remaining 5% was shipped as LNG.

Figure 94: Libya, evolution of oil and gas production and reserves (in Mbbl, bcm) (2006-2008)

| OIL | | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| ANNUAL PRODCUTION (Mbbl) | 670 | 675 | 675 |
| PRODUCTION TO DATE (Mbbl) | 25.800 | 26.500 | 27.200 |
| RESERVES (PROVEN OR RPOBABLE) (Mbbl) | 27.300 | 27.000 | 26.400 |

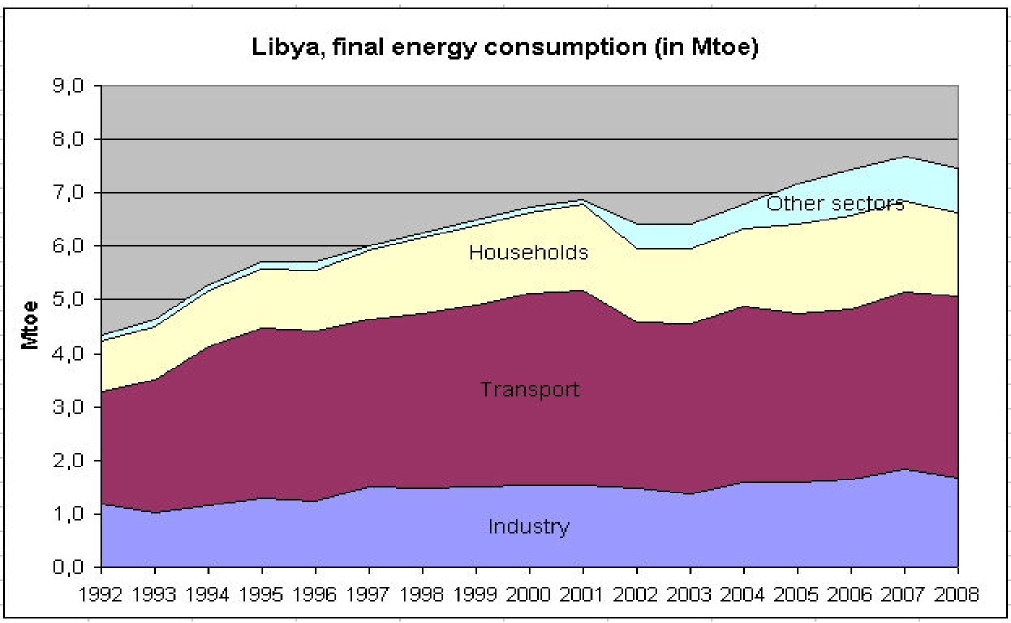
| GAS | | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| ANNUAL PRODCUTION (Bcm) | 23 | 26 | N/A |
| PRODUCTION TO DATE (Bcm) | 420 | 450 | 450 |
| RESERVES (PROVEN OR RPOBABLE) (Bcm) | 2.100 | 2.000 | 2.100 |

Source: © Petroconsultants SA (2010) (rounded values)

In parallel with increasing energy prices, Libya's economy experienced rapid growth between 2004 and 2008, registering an average 6.2% annual GDP growth during this period according to IMF data. In 2009, a minor contraction occurred (2.3%) in the performance of the economy as fossil fuel prices became significantly lower as a consequence of the worldwide economic slowdown.

The evolution of Libya's final energy consumption mirrors relatively rapid GDP growth in the last couple of years, and being driven in particular by the newly arising energy demand in other sectors (mainly services).

Figure 95: Libya, final energy consumption (in Mtoe) (1992-2008)

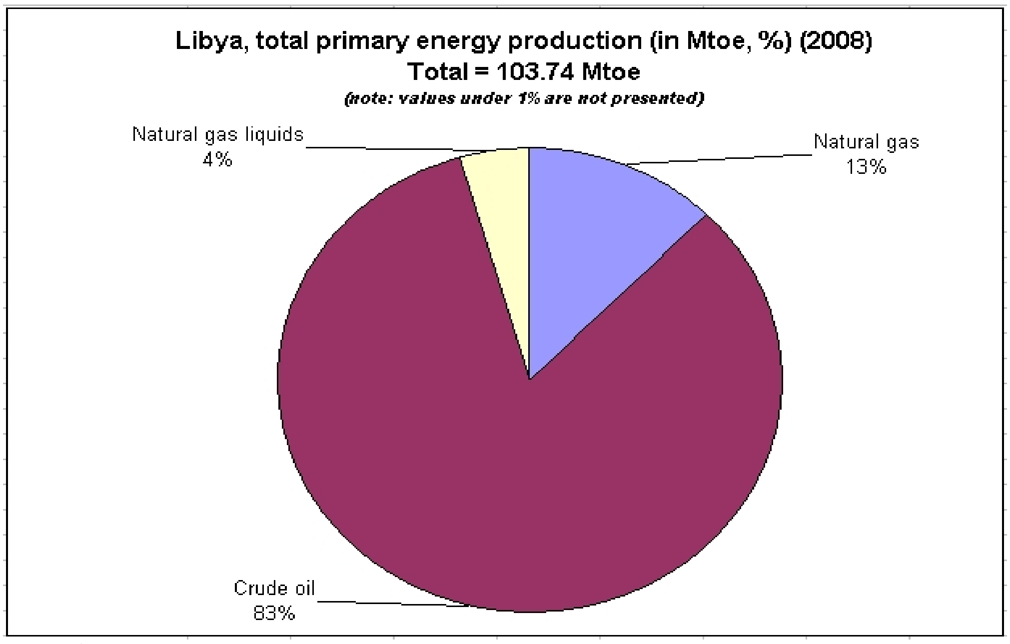



Source: OECD/IEA 2010

Similarly to Qatar, Libya spent 3% of its GDP on fossil fuel consumption subsidies in 2009 that might have also contributed to the rapid growth of its final energy consumption.

The next chart shows the structure of primary energy production in Libya in 2008 according to Eurostat annual energy data

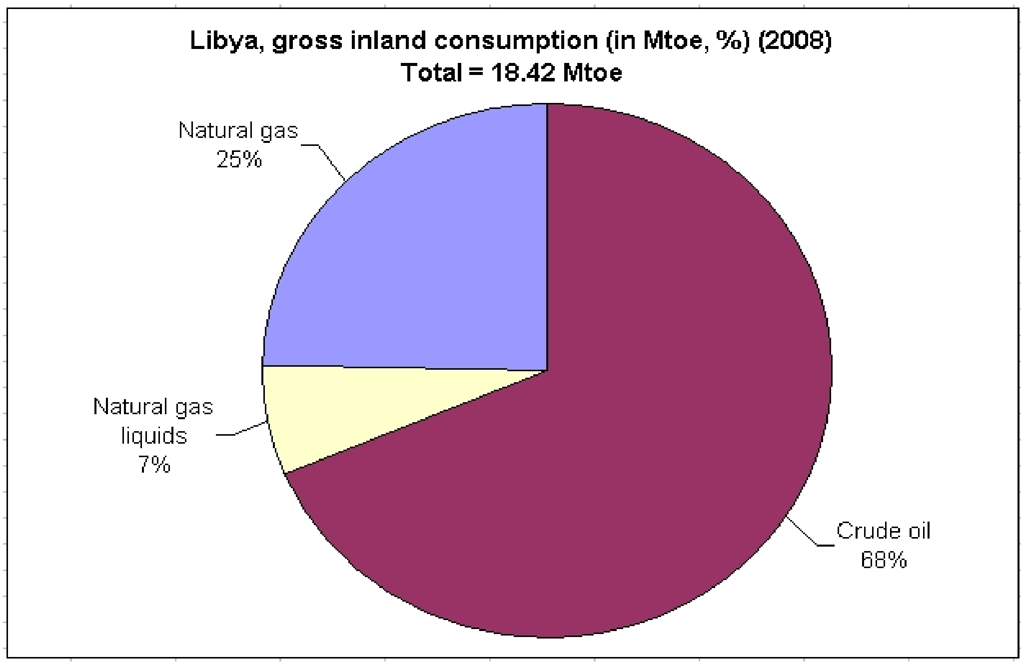
Figure 96: Libya, total primary energy production (in Mtoe, %) (2008) Total = 103.74 Mtoe




Source: OECD/IEA 2010

The predominance of oil is evident, given its 83% share in primary energy production. However, natural gas and liquid gas respectively have a significantly higher share in the gross inland consumption of the country as a higher proportion of oil production is exported than natural gas.

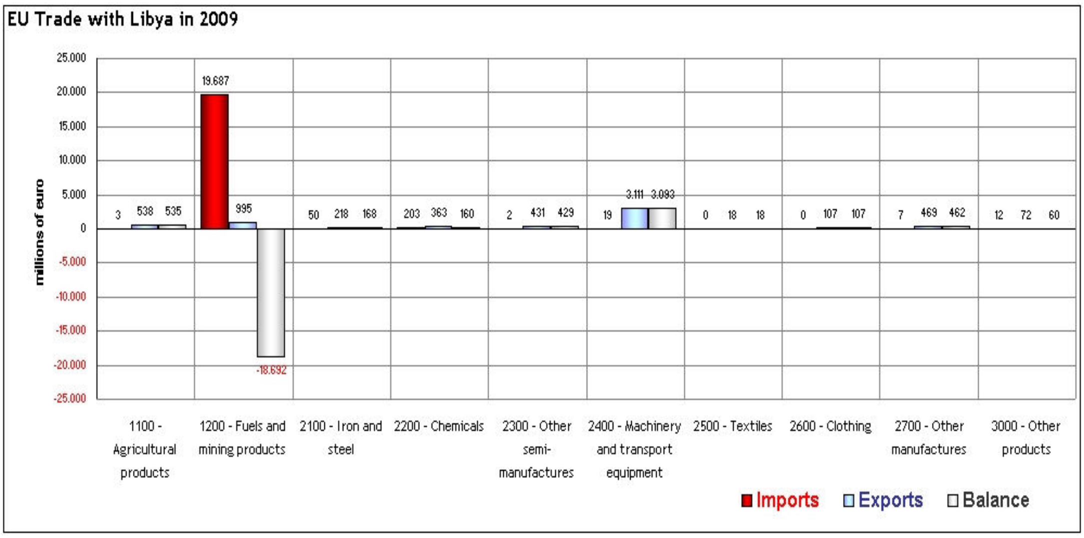
Figure 97: Libya, gross inland consumption (in Mtoe, %) (2008) Total = 18.42 Mtoe




Source: OECD/IEA 2010

EU imports from Libya amounted to € 20 billion in 2009 and exports were equivalent to € 6.4 billion. The majority of imports consisted of oil (85%) and gas (13%). EU-27 exports to Libya were dominated by machinery and transport equipments and other machinery products (73%).

Figure 98: EU trade with Libya (in EUR million) (2009)




Source: DG TRADE

## Annotations

**Total primary energy supply** – shows the share of energy sources in the energy mix. It is the quantity of energy consumed within the borders of a country. It is calculated using the formula: primary production + recovered products + imports + stock changes - exports - bunkers (i.e. quantities supplied to sea-going ships).

**Total final consumption – (Mtoe)** – is the energy finally consumed in the transport, industrial, commercial, agricultural, public and household sectors. It excludes deliveries to the energy conversion sector and to the energy industries themselves.

**Electricity mix** – shows the share of the various energy sources used for electricity generation.

**Electricity generation – (TWh)** – is the quantity of electricity produced within the borders of a country.

**Indigenous production** – shows the share of energy sources extracted and used from domestic natural sources. The precise definition depends on the fuel involved.

**Coal** – quantities of fuels extracted or produced, calculated after any operation to remove inert matter. In general, production includes the quantities consumed by the producer during the production process (e.g. for heating or operation of equipment and auxiliaries) plus any quantities supplied to other on-site producers of energy for conversion or other uses.

**Crude oil** – quantities of fuels extracted or produced within national boundaries, including offshore production. Production includes only marketable production and excludes any quantities returned to formation. Production includes all crude oil, natural gas liquids (NGL), condensates and oil from shale and tar sands, etc.

**Natural gas** – quantities of dry gas, measured after purification and extraction of natural gas liquids and sulphur. Production includes only marketable production, and excludes any quantities re-injected, vented and flared, and any extraction losses. Production includes all quantities used within the natural gas industry, in gas extraction, pipeline systems and processing plants.

**Nuclear** – quantities of heat produced in a reactor. Production is the actual heat produced or the heat calculated on the basis of the gross electricity generated and the thermal efficiency of the nuclear plant. All nuclear production is set as fully indigenous.

**Geothermal** – quantities of heat extracted from geothermal fluids. Production is calculated on the basis of the difference between the enthalpy of the fluid produced in the production borehole and that of the fluid disposed of via the re-injection borehole.

**Biomass/Waste** – in the case of municipal solid wastes (MSW), wood, wood wastes and other solid wastes, production is the heat produced after combustion and corresponds to the heat content (NCV) of the fuel. In the case of anaerobic digestion of wet wastes, production is the heat content (NCV) of the biogases produced. Production includes all quantities of gas consumed in the installation for the fermentation processes, and excludes all quantities of flared gases. In the case of biofuels, production is the heat content (NCV) of the fuel.

**Hydro** – electricity generated by hydro power plant includes small hydro. Tide, Wave, Ocean power plants are included as well, because Eurostat is using it in this way.

**Wind** – electricity generated by onshore and offshore wind power plants. Figures are set for the end of 2004, while there was a significant increase of new installed Wind Power Plants in 2005.

**Net imports by fuels (Mtoe) –** share of all energy sources imported, excluding all nuclear, which is set as indigenous by Eurostat. Net electricity imports are included.

**Imports of crude oil** – imported crude oil divided by countries of origin, EU-27 is counted without imports inside the EU.

**Imports of natural gas** – imported natural gas divided by countries of origin, EU-27 is counted without imports inside the EU.

**Imports of hard coal** – imported hard coal divided by countries of origin, EU-27 is counted without imports inside the EU.

**Final energy intensity –** is calculated as final energy demand divided by value added at basic prices. For some industrial sectors, like the iron and steel industry, the non-ferrous metals industry and the engineering industry, it was not possible to calculate energy intensity values, as the value added at basic prices is not given for these definitions of sectors in the national accounts data from Eurostat. In contrast to primary energy intensity, final energy intensity does not consider the efficiency of the energy transformation sector.

**$CO_2$ emissions per capita** – are calculated as total $CO_2$ emissions divided by total population.

**$CO_2$ intensity –** is calculated by dividing the total $CO_2$ emissions by the gross inland energy consumption. It is an indicator for the carbon intensity of the energy system.

**Import dependency** – net imports of a country or region divided by the sum of the gross inland consumption and bunkers of that energy carrier. 'All Fuels' shows the import dependency for oil, gas, solid fuels, electricity and renewable energy sources in total. The aggregate 'renewables' considers all forms of renewable energy carriers, like electricity from wind or hydro power as well as biofuels and biomass in general. A negative import dependency has to be interpreted as net exports.

**Industry** – the sector is defined according to the following NACE Rev. 2 codes: B (Mining and quarrying) C (Manufacturing) + D (Electricity, gas, steam and air conditioning supply).

**Non-Metallic Mineral Products Industry** – the sector is defined according to the NACE code CG 'Manufacture of rubber and plastics products, and other non-metallic mineral products'.

**Chemical Industry** – the sector is defined according to NACE Rev.2 code CE 'Manufacture of chemicals, chemical products'.

**Food, Drink and Tobacco Industry** – the sector is defined according to NACE Rev.2 code CA 'Manufacture of food products; beverages and tobacco products'.

**Paper and Printing Industry** – the sector is defined according to NACE Rev.2 code CC 'Manufacture of wood and paper products and printing'.

**Services** - the sector is defined according to the following NACE Rev. 2 codes: from G to S.

**Transport** – the sector covers all types of transport (NACE Rev. 2 H 49-52). To calculate energy intensity the final energy consumption in transport was divided by the value added at basic prices of the whole economy.

## Abbreviations

API degree – American Petroleum Institute (API) degree
bcm – billion cubic meter
Cap – capita
CIF Price – cost, insurance and freight price
Dutch TTF – Dutch Title Transfer Facility
EUR – euro
EUR/bbl – euro per barrel
GDP – Gross Domestic Product
GWh – gigawatt Hour
IEA – International Energy Agency
LNG – Liquefied Natural Gas
Mb/d – million barrels per day
Mbbl – million barrels
MMBtu – thousand thousand British Thermal Units
Mt – million tonnes
Mtoe – million tonnes of oil equivalent
MWh – megawatt hour
NBP – National Balancing Point (UK)
OECD – Organisation for Economic Cooperation and Development
OPEC – Organisation of the Petroleum Exporting Countries
Platts PEP – Platts Pan European Power index
pp – percentage point
TJ – terajoules
Toe – ton of oil equivalent
TSO – Transmission System Operator
TWh – terawatt Hour
USD – US dollar