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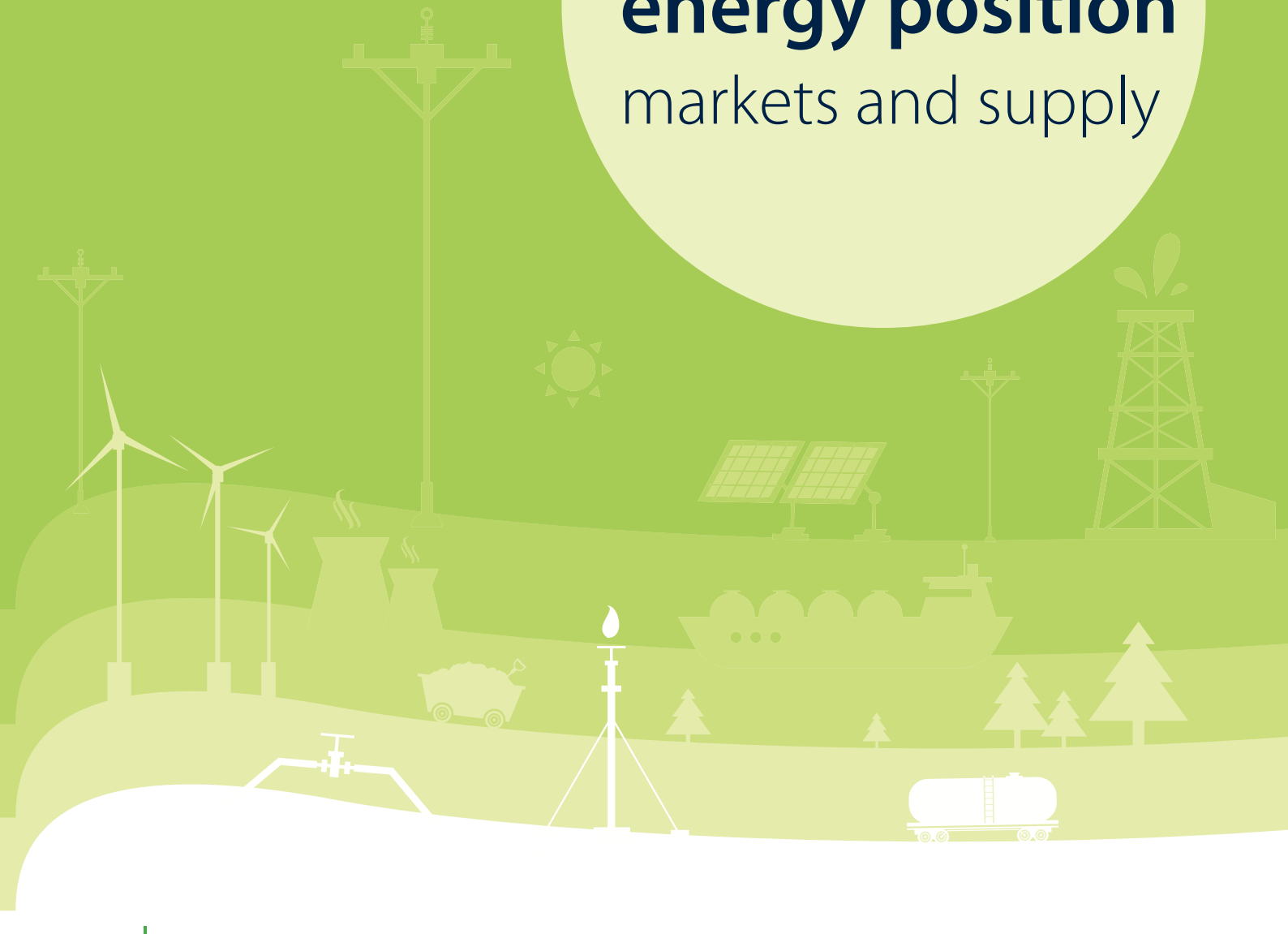
Europe's energy position

markets and supply



MARKET OBSERVATORY FOR ENERGY
REPORT 2009

Directorate-General for Energy

EUROPEAN COMMISSION

Market Observatory for Energy

Europe's energy position – markets & supply

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1. Introduction

The 2009 Annual Report of the Market Observatory for energy analyses the energy position of the European Union (EU). This second edition of the Annual Report takes a closer look at energy market developments (oil, gas and electricity) over a period covering 2008 and the first half of 2009, and the situation concerning some important supplier and transit countries. Following the recent adoption of Directive (EC) n°2009/28 on the promotion of renewable energy sources (RES), the report puts also an emphasis on investment in new RES production capacities.

From 2008 to mid 2009, the EU energy position was challenged by various crises and upheavals in energy markets. Of high resonance were the oil price spike in July 2008 and the cut of gas supply from Russia via Ukraine for 22 days in January 2009 which had severe effects in some Member States. The biggest challenge however was the global financial and economic crisis which had a marked impact on energy markets and on the EU energy position.

Against this background, this Annual Report focuses on the effects of the crisis on the EU energy sector and on the transition towards a low-carbon energy system. Based on, whenever possible, the latest official EU statistics, the following can be said:

1. While, after years of growth, the EU had managed to stabilize its energy consumption in 2006 and in 2007, EU energy demand fell between 2008 and 2009.

   Gross inland consumption for oil fell by 1.5 % in 2008 compared to 2007 and by almost 6 % in the first semester of 2009 compared to the same period in 2008. The consumption of electricity was down by more than 5 % in the first semester of 2009 compared to the same period in 2008. In this period, the consumption of natural gas declined by 10 %.

   In the second quarter of 2009, EU monthly electricity consumption recorded its lowest levels since 2003, the first complete year of common statistics for the 27 Member States. Year-on-year, consumption fell by more than 10 %, 6 % and 5 % in April, May and June respectively. As of June 2009 consumption was down by more than 23 % compared to the beginning of the year.

   EU consumption of gas fell by 16 % in the second quarter of 2009 with respect to the same period of 2008. In April 2009, it was about 30 TWh below the lowest level ever recorded (2003) and almost 25 % below the corresponding 2008 value.

2. This dampened demand resulted in a decline in greenhouse gas (GHG) emissions in the EU: as a result of lower CO_2 emissions from fossil fuel combustion in the energy, industry and transport sectors, it is estimated that emissions of GHG in 2008 were about 1.5 % lower than in 2007. In the verified emissions from the EU Emission Trading Scheme (EU ETS) for 2008, total EU-27 emissions of GHG decreased by 3.9 % between 2007 and 2008. It is anticipated that CO_2 emissions of the EU energy sector will further decrease in 2009. Given the fall in emissions in 2008, the carbon price on exchange markets in 2008 fell from EUR 23/ton in January to EUR 16/ton in December. During the first semester of 2009, the carbon price ranged between EUR 13 and 16/ton.

3. Energy prices experienced a period of high volatility. By the end of the observed period, they reached 2007 levels.

   Using monthly averages, the crude oil price (Dated Brent) fell from approximately USD 140 per barrel in mid July 2008 to around USD 70 per barrel by the end of June 2009. At the beginning of 2009 the monthly average price was as low as USD 43 per barrel.

   Between January 2008 and June 2009:

   – The gas price decreased by 57 %, from EUR 24.54 to 10.54/MWh, on the NBP ([1]) spot market and by 25 %, from EUR 25.50 to 19.25/MWh, on the year-ahead NBP forward market. Taking into account the highest and the lowest recorded prices, the gas price fell by 65 % on the NBP spot market (EUR 29.93/MWh in September 2008 and EUR 10.45/MWh in May 2009) and by 54 % on the NBP forward market (EUR 39.90/MWh in July 2008 to EUR 18.49/MWh in March 2009).

   – The electricity price decreased by 45 %, from EUR 66.78 to 36.54/MWh, on the spot market (Platts Pan-European Power Index) and by 6 %, from EUR 60.24 to 56.90/MWh, on the forward market (DE Y+2). Taking into account the highest and the lowest recorded prices, the electricity price decreased by 65 % on the spot market (EUR 95.83/MWH in September 2008 and EUR 33.88 MWh in May 2009) and by 40 % on the forward market (DE Y+2) (EUR 82.36/MWh in July 2008 and EUR 49.75/MWh in February 2009).

4. Investment in new energy infrastructure has been severely hit and financing conditions have weakened. Companies with a strong balance sheet are still investing but some companies have announced a review of their investment strategies both in the EU and in producing countries. Many infrastructure projects have been delayed or cancelled. For RES, new investment only rose by 2 % in 2008 and it was expected that 10 to 15 % of wind energy projects would be delayed or cancelled in 2009.

([1]) *National Balancing Point – United Kingdom.*

The structural transformation of the EU energy system, and consequently of the EU energy mix, is at risk of slowing down. Dampened demand due to the economic crisis provides a window of opportunity in terms of time gains to re-direct many investment projects towards low-carbon projects. However, as a result of this crisis, the price of carbon dioxide and of fossil fuels has decreased and the positive side effects of the EU Emission Trading Scheme (which allows for the exchanges of CO_2 allowances) and of high fossil fuel prices, such as stimulating investment in new and/or in low-carbon capacities, appear temporarily diminished. Up to now, national support schemes for RES have cushioned the impact of the crisis to a certain extent.

Given the marked impact of the economic recession, temporary factors prevailed over structural changes in the EU energy system. This was already the case in 2007 when mild weather and high energy prices played a major role. Without the implementation of the additional measures and policies proposed and enacted by the EU, energy demand and energy imports are therefore likely to rise again when the economy will rebound.

During the observed period, the EU has adopted major decisions which pave the way for the evolution of the EU's future energy position and its energy markets. Three important milestones were:

- In December 2008, the 'Climate/energy package' was approved, setting out the EU strategy to reduce greenhouse gas emissions and increase the share of RES; in this context, the Commission stressed the importance of energy savings.

- In March 2009, the 'Third internal market package' for gas and electricity was approved with a view to foster functioning and competitive energy markets which will eventually enhance Europe's energy security.

- In April 2009, the 'European Energy Programme for Recovery' was adopted by which the EU dedicated EUR 4 billion to support new energy infrastructure ([2]). Projects, among which off-shore wind, carbon capture and storage demonstration sites as well as gas and electricity inter-connectors, will foster security of supply, competitive internal electricity and gas markets and the transition to a low carbon energy system.

([2]) Regulation (EC) n° 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the field of energy.

2. Energy position of the EU ([3])

2.1. EU energy consumption

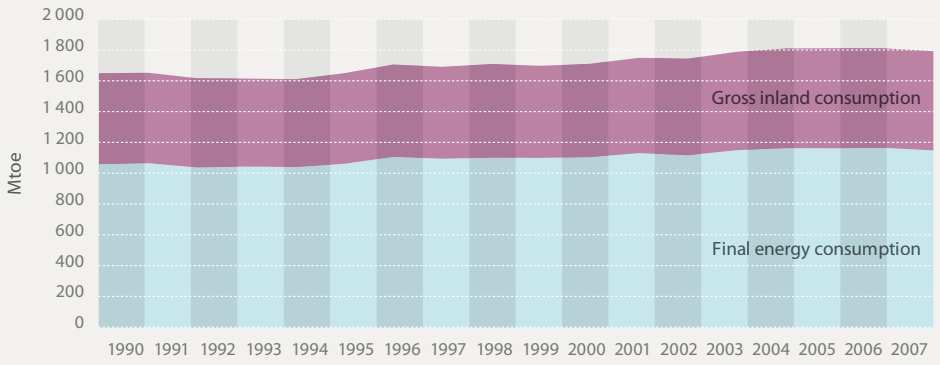
2.1.1. Total energy consumption

Energy consumption decreased slightly in 2007 compared to 2005 and 2006. In 2007, gross inland energy consumption in EU-27 was 1 806 Mtoe while it was 1 826 Mtoe in 2005 and in 2006. 2007 provides further confirmation that growth of energy consumption has stopped. 2007 consumption, down by 1 % from 2006, is comparable to the 2003 level (1 803 Mtoe).

Final energy consumption ([4]) has followed the same trend, decreasing by 1.5 % from 2006. In 2007, total final energy consumption was 1 158 Mtoe while it was 1 176 Mtoe in 2006. 2007 final consumption remained slightly below the 2003 level.

According to preliminary data, a slight decrease in gross inland energy consumption in 2008 (0.9 %) contrasts with the moderate increase in GDP of 0.9 % between 2007 and 2008. This could, to a certain extent, provide a further confirmation of decoupling of energy consumption and economic growth.

FIGURE 1



EU-27, GROSS INLAND CONSUMPTION AND FINAL ENERGY CONSUMPTION (in Mtoe) (1990-2007)

Source: Eurostat

2.1.2. Gross inland consumption and energy mix

Oil remained the most used energy source in the EU in 2007. However, for the second consecutive year, gross inland consumption of oil has dropped and according to 2008 monthly aggregated data, a further 1.5 % contraction occurred. In 2007, it accounted for 657 Mtoe, down by 2.4 % year-on-year, which was comparable to 2000 consumption. As for its share in the EU energy mix in 2007, oil accounted for 36.4 %, down by 0.5 percentage point (hereafter pp) with respect to 2006. In 1990, oil accounted for 38.1 % with 633 Mtoe.

As in the case of oil, consumption of gas and nuclear energy decreased slightly in 2007 respectively for the second and third consecutive year. Gas consumption, totalling 432 Mtoe in 2007, fell by 1.3 %, to slightly below the 2004 level. Nuclear energy consumption fell by 5.5 %, to 241 Mtoe which is slightly below the 2000 consumption. Gas remains the second most used energy source in the EU in 2007 with a stable share in the energy mix of 24 %. The share of nuclear energy is down by 0.6 pp, from 14 % to 13.4 % of the energy mix in 2007. It remains the fourth energy source in the EU gross inland consumption. In 2008, the consumption of natural gas increased (2.7 %) while for nuclear energy further decline could be observed (0.9 %).

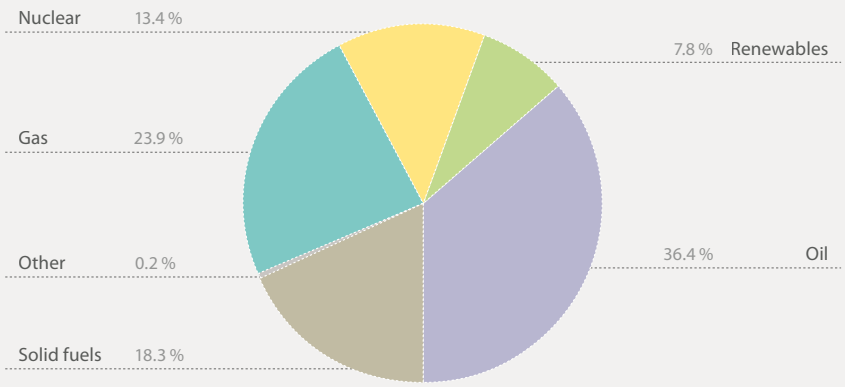
1/ One kilowatt-hour

- is consumed in six hours by the average EU citizen;
- creates around 420 g of CO_2 (with the current EU electricity mix);
- is produced by a big wind power plant in one second during a strong breeze.

([3]) *Based on 2007 Eurostat data and on provisional 2008 Eurostat data.*

([4]) *Final energy consumption includes all energy delivered to final consumers in the industry, transport, household and other sectors for all energy uses. It excludes deliveries for transformation and/or own use of the energy producing industries, as well as network losses.*

FIGURE 2



EU-27, GROSS INLAND CONSUMPTION (in %) (2007)
Total = 1 806.38 Mtoe

Source: Eurostat

While solid fuels have been gradually replaced by natural gas in particular since 1990, solid fuels consumption has been increasing since 2005. In 2007, it amounted to 331 Mtoe, i.e. +1.9 % with respect to 2006, which was at the same level as 2003 consumption. Solid fuels gained 0.5 pp in the energy mix and remained the third energy source with a share amounting to 18.3 %. According to monthly aggregated data, in 2008 the combined consumption of hard coal and lignite dropped again significantly (5.6 %).

RES consumption continued growing in 2007, by 8.5 % from 2006, and accounted for 141 Mtoe while it was 130 Mtoe in 2006. RES consumption has almost doubled since 1990. However, its share in the gross inland consumption (energy mix) still remains modest at 7.8 % in 2007 ([5]), 7.1 % in 2006. RES remain the fifth source of the EU gross inland consumption. In 2008, a further slight increase occurred in RES consumption (an estimated 2.3 %).

In 2007, fossil fuels continued to dominate the energy mix. They represented 78.6 % of EU-27 gross inland consumption, staying at the 2006 level. Low-carbon energy sources amounted to 21.4 % of EU gross inland consumption in 2007.

2/ The average EU citizen drives 30 km to get to work, which involves the consumption of two litres of petrol and the emission of 5.5 kg of CO_2.

2.1.3. Final energy consumption by energy sources/products, sector and end use

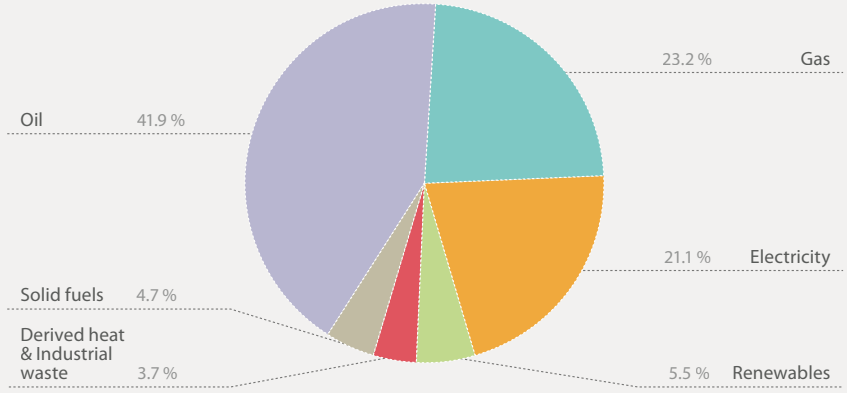
2.1.3.1. Final energy consumption by energy sources/products

Between 2006 and 2007, EU-27 final consumption of oil, gas and solid fuels fell by respectively 2.4 % (-12 Mtoe), 3.2 % (-9 Mtoe) and 2.8 % (-1.5 Mtoe). Solid fuels hit their lowest level since 1990 with 54 Mtoe while oil (485 Mtoe) and gas (269 Mtoe) consumption, decreasing for the third consecutive year, reached the level recorded in 2002. Mild weather ([6]) and high energy prices drove consumption down. However, final consumption of electricity (244 Mtoe) and of RES (63 Mtoe) continued increasing respectively by 0.6 % or 1.5 Mtoe and 3.2 Mtoe or 5.4 %. Legislation and policy initiatives to mitigate climate change effects contributed to the growth of RES consumption while the growth of electricity consumption mainly reflected the increasingly service-oriented EU economy.

Oil products remained the largest energy source used in the EU-27 in 2007 (41.9 %), followed by gas (23.2 %). However, their respective shares fell slightly by 0.3 pp for oil and by 0.6 pp for gas compared to 2006. The share of electricity and of RES rose by 0.4 pp for each while solid fuels remained stable at 4.7 %.

([5]) *Expressed in gross final energy consumption, which is the reference for the calculation of the 20 % RES target, the 2007 share is 9.17 %.*
([6]) *Heating degree days fell from 3 038.301 in 2006 to 2 943.226 in 2007 (Source: Eurostat).*

FIGURE 3



EU-27, FINAL ENERGY CONSUMPTION BY FUEL AND PRODUCT (in %) (2007)
Total = 1 157.68 Mtoe

Source: Eurostat

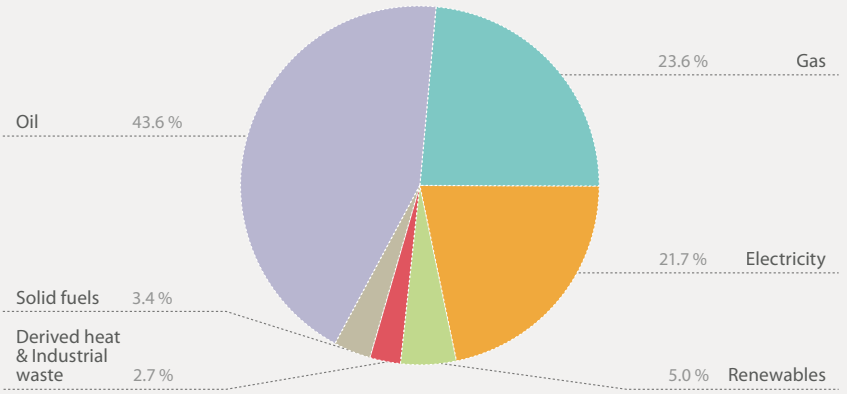
In 2007, final energy consumption fell in EU-15 (990 Mtoe versus 1 006 Mtoe) but remained stable in EU-10 (134 Mtoe versus 135 Mtoe)([7]). The main differences between EU-15 and EU-10 were with regard to oil and solid fuels although trends are converging. In 2007, the share of oil in the final energy consumption in EU-15 was 43.6 % down by 0.7 pp compared to 2006 while for EU-10 it was 31.7 %, 1.5 pp above 2006 level.

The share of solid fuels was 10 pp higher in EU-10 than in EU-15, respectively 13.4 % for EU-10 and 3.4 % for EU-15, due to higher use of solid fuels for electricity generation and heat production in EU-10. 62 % of electricity in EU-10 came from coal in 2007 while it was 24.7 % in EU-15. The differences for solid fuels have however slowly narrowed. EU-10 reduced consumption by 1 pp between 2006 and 2007 while at the same time the share of solid fuels for EU-15 stabilized.

Gas was the second largest fuel both for EU-15 and EU-10 and accounted respectively for 23.6 % and 20 % of final energy consumption. In both cases, this share decreased between 2006 and 2007, although more substantially in EU-10.

Electricity represented a bigger share of final energy consumption in 2007 in EU-15 (21.7 %) than in EU-10 (17.4 %), up in both cases by 0.5 pp compared to 2006.

FIGURE 4

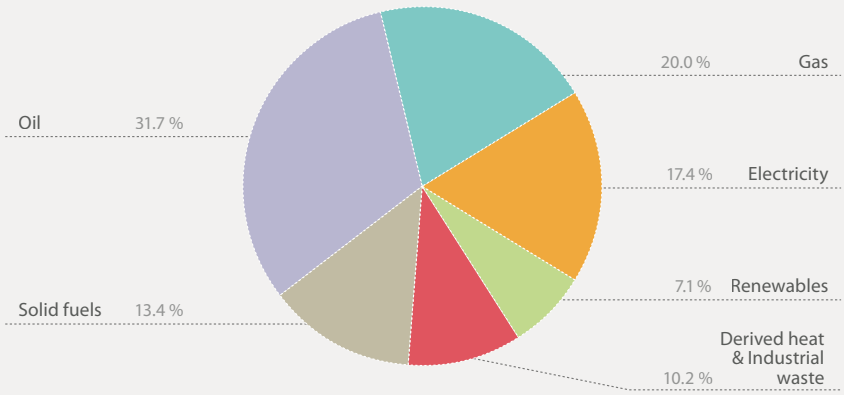


EU-15, FINAL ENERGY CONSUMPTION BY FUEL AND PRODUCT (in %) (2007)
Total = 990 Mtoe

Source: Eurostat

([7]) *At the time of writing of this report, the 'EU-12' category did not exist in the Eurostat database which contains the official data used in this report.*

FIGURE 5



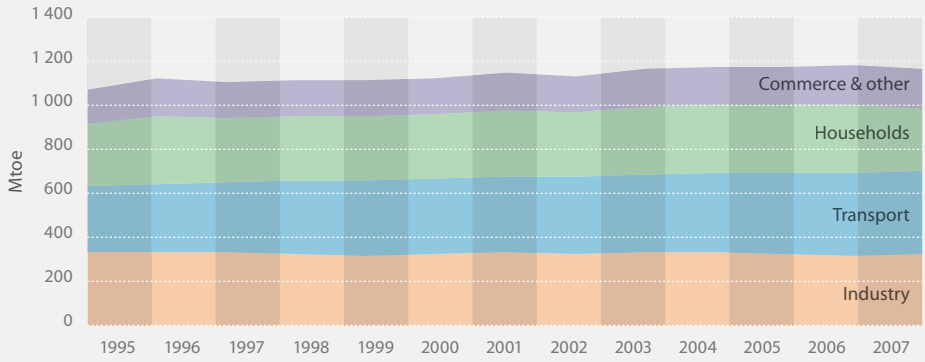
EU-10, FINAL ENERGY CONSUMPTION BY FUEL AND PRODUCT (in %) (2007)
Total = 134 Mtoe

Source: Eurostat

2.1.3.2. Final energy consumption by sector

Transport remained the biggest final energy consumer in 2007 followed by industry and households. Compared to 2006, the shares of transport and industry rose respectively by 1 and 0.7 pp. Since 1990, energy consumption in the transport sector has been steadily increasing by 1.8 % per year on average. In contrast, the shares of households and of 'commerce and other' declined in 2007. Households accounted for less than one quarter of final energy consumption, 24.6 %, down by 1.3 pp from 2006.

FIGURE 6



EU-27, TOTAL FINAL ENERGY CONSUMPTION (in Mtoe) (1995-2007)

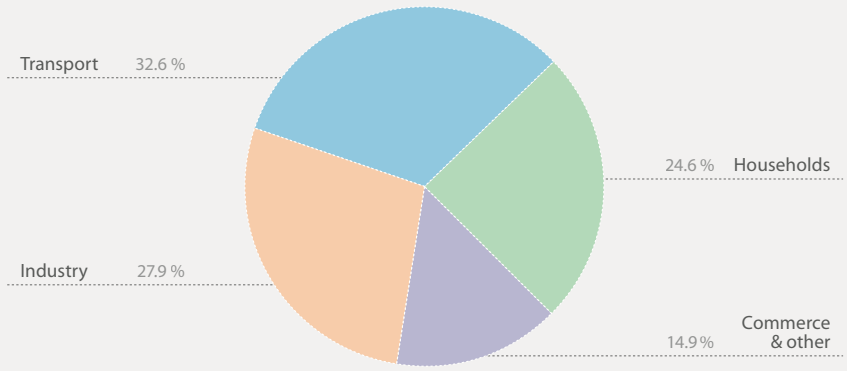
Source: Eurostat

3/ Heating represents 70 % of household energy consumption and about 14 % of EU greenhouse gas emissions. Reducing home temperature by 1°C would cut down CO_2 emissions by 300 kg a year for each household.

In 2007, the breakdown of final energy consumption by sector showed differences between EU-15 and EU-10. For EU-15, transport was the biggest consumer (33.8 %), followed by industry (27.3 %) and households (24 %). For EU-10, industry was the biggest consumer (29.7 %) followed by households (27.6 %) and transport (26.2 %).

Since 2005 however, common trends are clear. Transport has been steadily increasing its share of final energy consumption both in EU-15 and EU-10 although by more for EU-10 than EU-15: +3.1 pp for EU-10 and +1.4 pp for EU-15 over 2005-2007. Households decreased their share in both cases, in particular between 2006 and 2007 with drops of 1.3 pp for EU-15 and of 1.9 pp for EU-10.

FIGURE 7



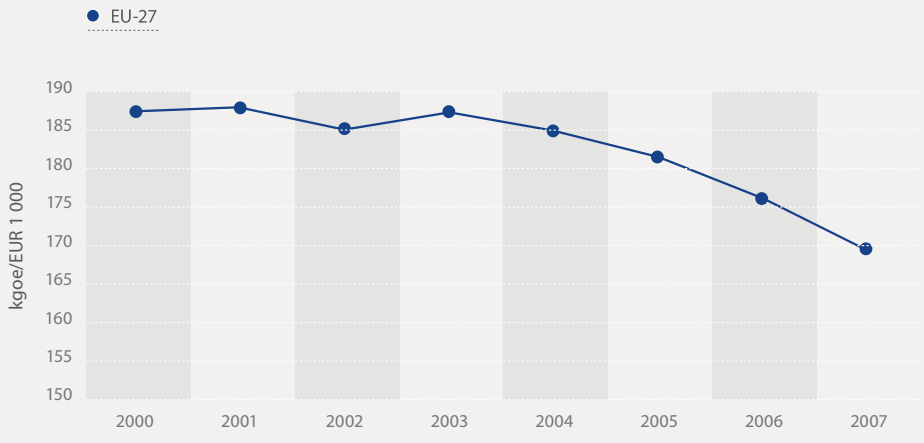
EU-27, FINAL ENERGY CONSUMPTION BY SECTOR (in %) (2007)
Total = 1 157.68 Mtoe

Source: Eurostat

2.1.4. Energy intensity

Energy intensity is a measure of how much energy is used to produce a unit of economic output. It can be measured as the ratio of gross inland energy consumption and the gross domestic product. The following charts show the evolution of this indicator:

FIGURE 8



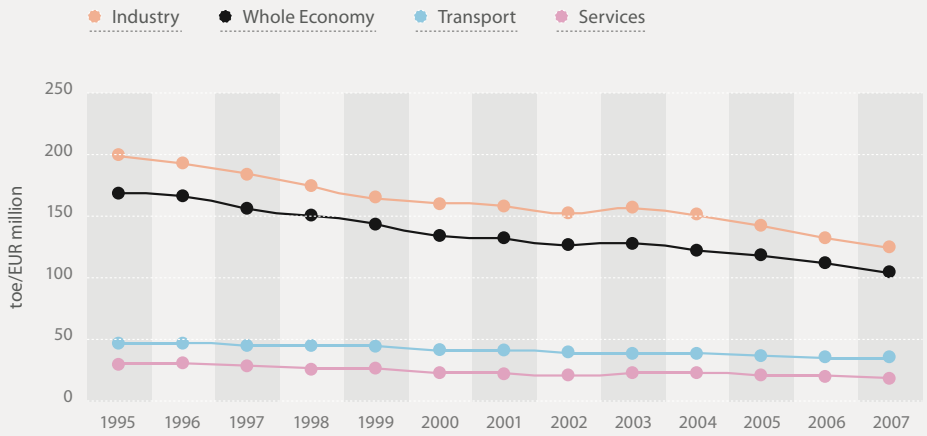
EU-27, ENERGY INTENSITY (in kgoe/EUR 1 000) (2000-2007)

Source: Eurostat

Another possibility is to measure the final energy intensity. In 2007, EU-27 final energy intensity kept improving, registering a decrease for the fifth consecutive year. Overall, final energy intensity is 105 toe/EUR million'00 in 2007 while it was 113 toe/EUR million'00 in 2006. This annual decrease was the highest registered over the 2003-2007 period.

Progress was made in all sectors between 2006 and 2007. Industry, the main locus of progress in the past, further improved its final energy intensity by more than 5 % (- 7 toe/EUR million'00). Transport and services also contributed to falling energy intensity by 5.5 % (- 2 toe/EUR million'00) and 10 % (- 2 toe/EUR million'00) respectively.

FIGURE 9



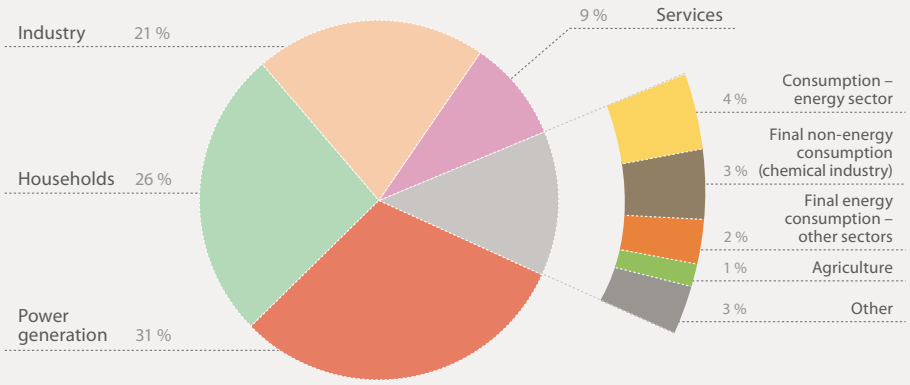
EU-27, FINAL ENERGY INTENSITY (in toe/EUR million) (1995-2007)

Source: Eurostat

2.1.5. Uses of energy sources

In 2007 in EU-27, natural gas consumption was mainly distributed between power generation (31 %), households (26 %), industry (21 %) and services (9 %). Compared to 2006, the share of households is down by 1.2 pp while the share of services declined by 0.6 pp. In contrast, the share of power generation and of industry increased respectively by 1.4 pp and 0.6 pp.

FIGURE 10

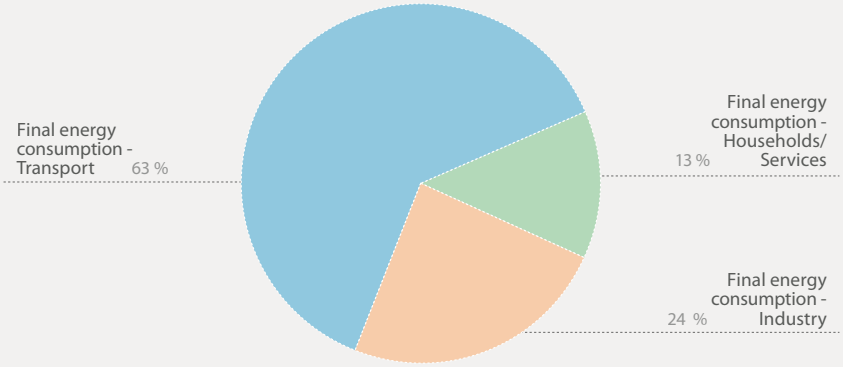


EU-27, USE OF NATURAL GAS BY SECTOR (in %) (2007)
Total = 432.41 Mtoe

Source: Eurostat

The situation is different for oil and solids fuels. Oil is mainly used by the transport sector (63 % in 2007).

FIGURE 11

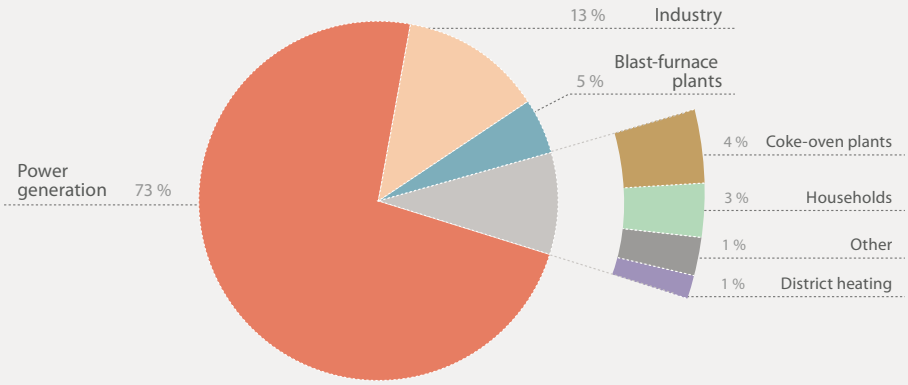


EU-27, USE OF PETROLEUM PRODUCTS BY SECTOR (in %) (2007)
Energy available for final consumption = 580 Mtoe

Source: Eurostat

Solid fuels are mainly used for power generation (73 % in 2007, up by 1 pp compared to 2006).

FIGURE 12



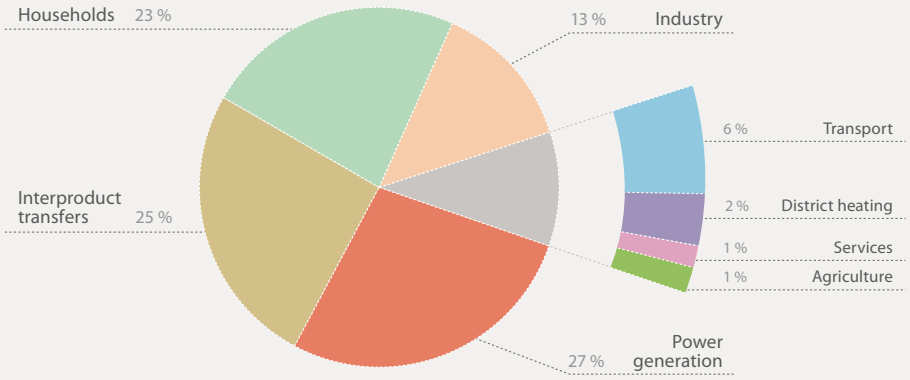
EU-27, USE OF SOLID FUELS BY SECTOR (in %) (2007)
Gross inland consumption 2007 = 331.23 Mtoe

Source: Eurostat

Electricity consumption is distributed between three main sectors. In 2007, industry was the biggest consumer of electricity with a share amounting to 40 % of electricity consumption, followed by households (28 %) and services (26.7 %). The changes registered in 2007 compared to 2006 were with regard to the share of households which was down by 0.3 pp and the share of industry which went up by 0.3 pp.

RES are mainly used by households, power generation and industry. In 2007, households accounted for 23 %, decreasing by 1.9 pp from 2006 while the share of industry (13 %) decreased by 0.7 pp between 2006 and 2007 and power generation (27 %) increased by 2.2 pp. The use of RES by transport climbed from 4.1 % in 2006 to 6 % in 2007. Conversely, in 2007, RES were less used for district heating which represented slightly more than 2 % of the gross inland consumption of RES, down by 0.3 pp from 2006. Inter-product transfers accounted for around 25 % of the gross inland consumption in 2007, down by 0.6 pp with respect the preceding year.

FIGURE 13



EU-27, USE OF RENEWABLE ENERGY SOURCES BY SECTOR (in %) (2007)
Gross inland consumption 2007 = 141.03 Mtoe

Source: Eurostat

4/ Fuel consumption decreases by 20 % when reducing driving speed from 110 km/h to 90 km/h: doing this for 10 % of our driving distance would avoid 35 kg of CO_2 emissions per person per year.

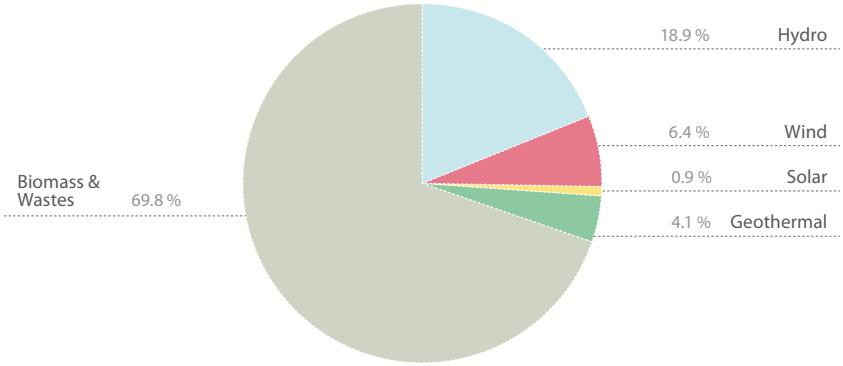
EU-27 – RES Gross inland consumption and production

Biomass including waste is by far the largest RES consumed in EU-27 and is consumed in all three sectors of power generation, heat and transport. In 2007, consumption of biomass and waste grew by 8.6 Mtoe or 9.65 % taking it to 98.3 Mtoe. Biomass and waste represented 69.8 % of the gross inland consumption of RES in the EU, up by 0.7 pp from 2006.

Hydro remained the second largest RES consumed in the EU with a consumption amounting to 26.6 Mtoe in 2007, which is slightly above the 2006 level (+0.3 %). Its share in the RES gross inland consumption fell by 1.5 pp, reaching 18.9 % in 2007. The share of geothermal energy in RES gross inland consumption fell to 4.1 %, down by 0.2 pp in 2007 in spite of an increase in consumption of nearly 3.5 % compared to 2006.

Compared to 2006, consumption of wind energy, 8.9 Mtoe in 2007, increased by 1.8 Mtoe which represents a growth of 26.6 % year-on-year. The share of wind in RES gross inland consumption gained 1 pp, reaching 6.4 %. It remained the third RES consumed in the EU.

FIGURE 14



EU-27, RENEWABLE ENERGY SOURCES: GROSS INLAND CONSUMPTION BY SOURCE (in %) (2007)
Total = 141.0 Mtoe

Source: Eurostat

In 2007, biomass and waste represented 5.4 % of gross inland energy consumption, up by 0.5 % year-on-year, while the share of hydropower amounted to 1.5 %, which was comparable to 2006. In spite of a significant increase of consumption, wind energy only accounted for 0.5 % of the gross energy consumption in 2007.

Following the same path as consumption, production of RES in EU-27 kept growing in 2007, reaching 139 Mtoe. All sources increased their share with the exception of hydro which has been steadily declining from 2001 onwards and fell by 12.3 pp over the period. The production of biofuels increased in 2007 by 42 % reaching 8.8 Mtoe. In 2006, the production had jumped by 60 %. In 2007, biofuels production accounted for 9.2 % of biomass production while it was 7 % in 2006. Bio-diesel was the most important product and accounted for more than 70 % of the production of biofuels in 2007.

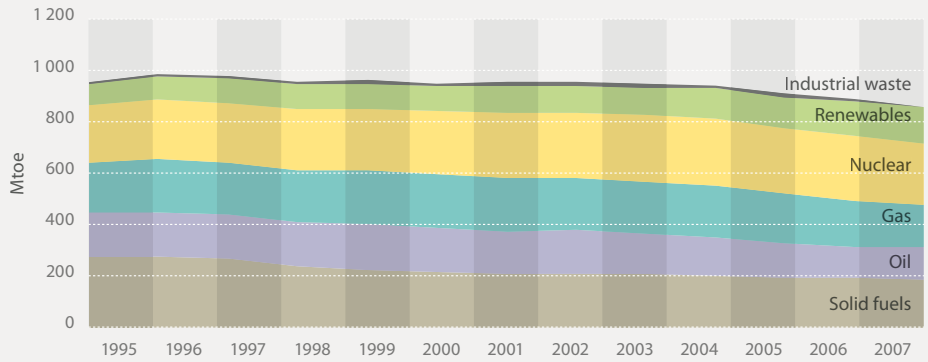
BOX 1

2.2. EU energy supply

2.2.1. EU indigenous energy production

The total EU energy production continued declining in 2007 as has been the case since 2004. In 2007, indigenous production was 860 Mtoe while it was 880 Mtoe in 2006. The fall in production reached almost 2.4 % in 2007. Monthly aggregated data suggest that in 2008 the energy production continued to decrease by 1.3 %.

FIGURE 15



EU-27, INDIGENOUS ENERGY PRODUCTION (in Mtoe) (1995-2007)

Source: Eurostat

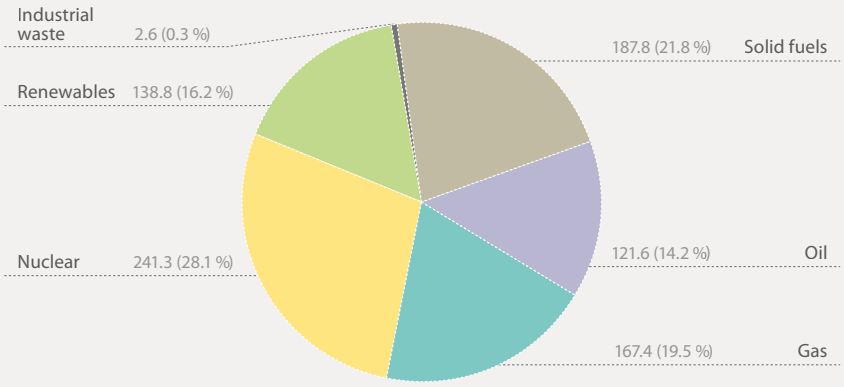
Except for the production of RES which increased by 8.3 %, the production of all other energy sources declined between 2006 and 2007. The biggest drop was for nuclear (-14 Mtoe or -5.5 %) and for gas (-12 Mtoe or -6.7 %). This fall in nuclear production for the second consecutive year was illustrative of the nuclear phase-out in some Member States and of the greater use of conventional power stations to generate power in 2007.

As for gas, the decline in production for the third consecutive year was mainly indicating that European gas fields are becoming depleted. Since 2001 when the last peak was registered, indigenous production of gas has shrunk by almost one fifth (-19.5 %). In 2007, the most significant drop in volume was experienced by the United Kingdom (-7 Mtoe, down by 10 %) while the production of gas in the Netherlands decreased slightly (-1.1 %). The drop in production came also from Germany (-1.2 Mtoe or -8.4 %) and Denmark (-1 Mtoe or – 11 %), respectively third and fifth producing countries in the EU after the UK and the Netherlands, Romania being the fourth one.

In spite of declining indigenous production, solid fuel and oil shares remained stable at around 22 % and 14 % respectively.

Conversely, renewable energy sources accounted in 2007 for 16.2 % of EU indigenous energy production, compared to 14.2 % in 2006. In 2007, EU's RES production which overtook oil production for the first time in 2006, widened the gap with oil and got closer to the levels of gas production.

FIGURE 16



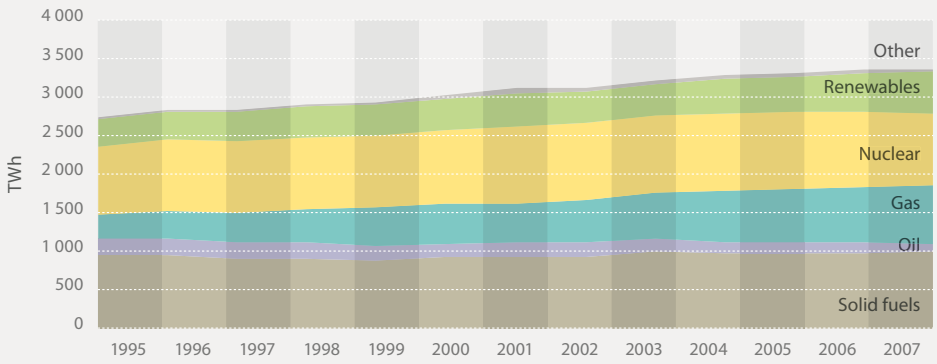
EU-27, PRIMARY ENERGY PRODUCTION AND RECOVERED PRODUCTS (in Mtoe, %) (2007)
Total = 859.45 Mtoe

Source: Eurostat

2.2.2. EU electricity generation

Total electricity generation in 2007 was 3 362 TWh which was 0.2 % higher than 2006 total generation. In 2007, a new record high was set. It confirmed upward trends experienced so far for electricity generation. However, the increase in 2007 was lower than in 2006 (1.4 %).

FIGURE 17



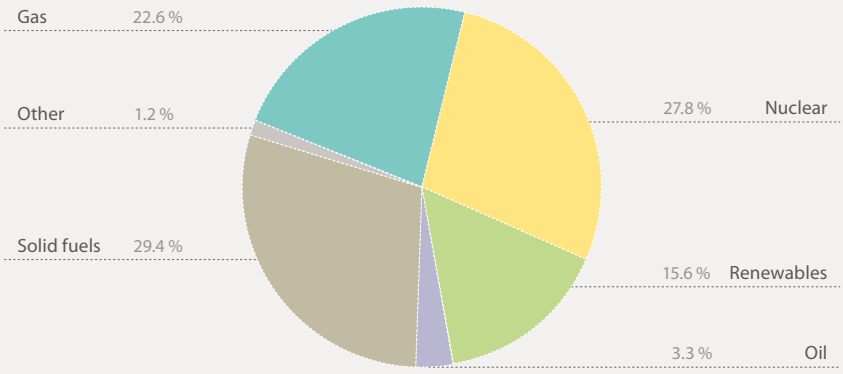
EU-27, ELECTRICITY GENERATION (in TWh) (1995-2007)

Source: Eurostat

For the first time since 2003, coal was the main source for power generation in EU-27. In 2007 as in 2006, 29.4 % of the electricity was produced from coal. However, nuclear, which used to be the first source for electricity, fell by 5.5 % from 2006 levels. This fall in generation from nuclear, which has been experienced since 2005 and amounts to – 6.3 % over that period, translates into a lower share in the EU electricity mix, 27.8 %, down by 1.7 pp from 2006.

Electricity generation from gas and from RES increased significantly in 2007, by 6.7 % or about 48 TWh for gas and by 7.4 % or 36 TWh for RES respectively. The trend towards more gas and RES for power generation was confirmed. In 2007, gas accounted for 22.6 % of the electricity produced, up by 1.4 pp with respect to 2006, while RES increased its share by 1 pp and accounted for 15.6 %.

FIGURE 18



EU-27, ELECTRICITY GENERATION BY FUEL (in %) (2007)
Total electricity generation 2007 = 3 361.69 TWh (289.11 Mtoe)

Source: Eurostat

In 2007, only 3.3 % of electricity was generated from oil. It was 3.9 % in 2006. Oil remains a marginal and declining source for power generation, subject to specific cases in Europe where some communities are still heavily dependent on oil for their electricity.

55.3 % of the electricity was generated from fossil fuels and 43.4 % from low-carbon energy sources in 2007. Fossil fuels contributed 54.6 % to the power generated in 2006.

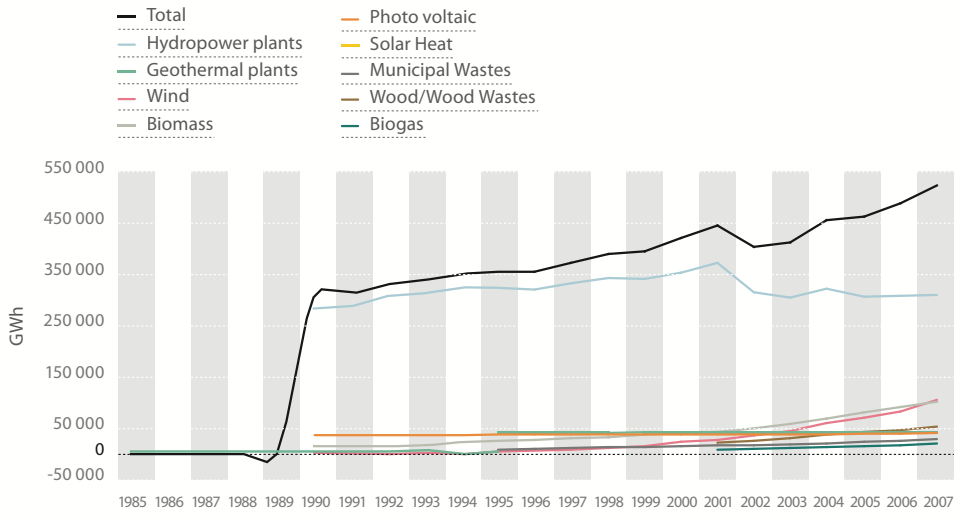
5/ The EU has 146 operational nuclear power reactors, which is more than anywhere else in the world (436 reactors). Situated in 15 Member States, they have a total capacity of 133 GW and account for around one third of the EU electricity generation.

EU-27 – Electricity from RES

In 2007, electricity generated from RES in EU-27 amounted to 525.6 TWh, up by 7.4 % compared to 2006. It accounted for 15.6 % of the electricity generated in EU-27 in 2007 which represents an increase of 1 pp compared to 2006. Additional efforts are nevertheless necessary to meet the 2010 target of 21 % of renewable electricity laid down in Directive (EC) n° 2001/77/EC ([8]).

The growth of renewable electricity comes from a limited number of Member States. Over 2006-2007, electricity generated from RES decreased or stagnated in seven Member States (BG, CZ, EL, IT, NL, RO, SI).

FIGURE 19



EU-27, ELECTRICITY FROM RES (in GWh) (1985-2007)

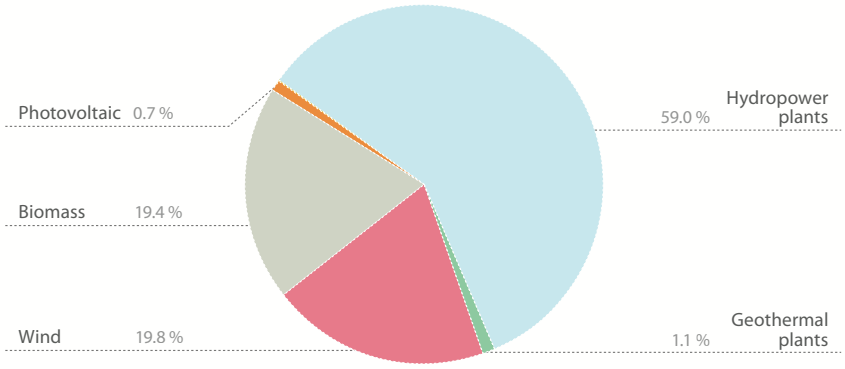
Source: Eurostat

BOX 2.1

([8]) In its Renewable Energy Progress Report, COM (2009) 192 final, adopted on 24.4.2009 and drawn up in compliance with Directive n°2001/77/EC, the Commission considers that 'whilst good progress had been made in recent years, the EU was expected to reach a renewable electricity share of 19 % by 2010 rather than the 21 % target'. Under the new Directive (Directive (EC) n°2009/28/EC of 23 April 2009), there is no target for the share of RES in electricity.

In 2007, electricity generated from wind rose by 26.7 % (22 TWh) compared to 2006 and amounted to 104.3 TWh. As for biomass, electricity generation grew by 13.3 % (12 TWh) over the same period and amounted to 101.8 TWh. Hydropower remained stable at nearly 310 TWh.

FIGURE 20



EU-27, ELECTRICITY FROM RES IN GROSS ELECTRICITY CONSUMPTION (in %) (2007)
Total = 525 578 TWh

Source: Eurostat

Hydropower remained the largest RES used for electricity generation. However, as its potential is more or less saturated in the EU, its share has been constantly decreasing since 1990 and hit a record low in 2007 of 59 % which is 4.2 pp lower than in 2006 (nearly 309 TWh). The substantial growth of electricity from wind and biomass translated into increasing shares in electricity generation from RES, of respectively 19.8 % for wind, up by 3 pp, and 19.4 % for biomass, up by 1 pp. For the first time in 2007, wind became the second largest renewable energy source for electricity in EU-27, biomass the third.

In 2007, hydropower represented 9.2 % of the total EU-27 electricity generation, which is the same level as in 2006. By contrast, wind and biomass increased their shares compared to 2006. In 2007, 3.1 % of the total electricity generation came from wind, up by 0.6 pp, and 3 % from biomass, up by 0.3 pp.

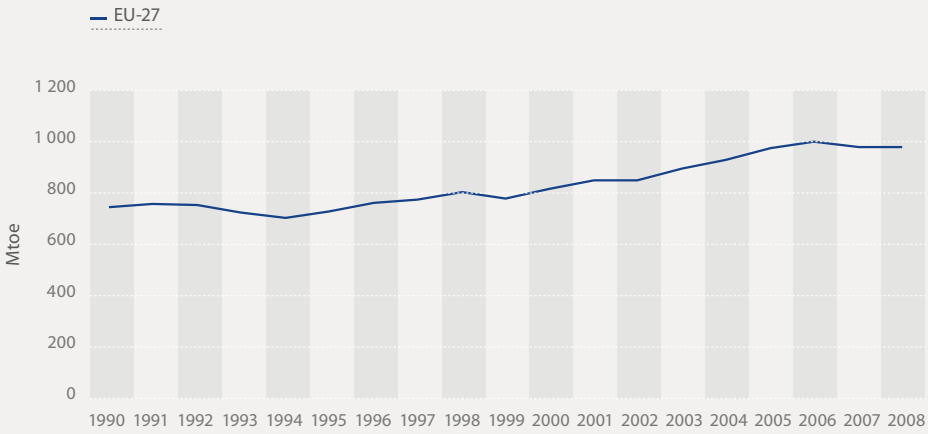
BOX 2.2

6/ CO_2 Capture and Storage (CCS) can reduce coal burning emissions by 90 %, whilst lowering coal power plant efficiency, roughly from 44 % to 33 %.

2.2.3. EU energy imports

As in the cases of energy consumption and indigenous production, EU energy imports decreased between 2006 and 2007, recording the first fall in imports since 1999. Net imports amounted to about 988 Mtoe in 2007 and were down by 2.3 % from 2006 when they reached 1 011 Mtoe. According to monthly aggregated data, in 2008 net energy imports picked up again by 1.8 % approximately.

FIGURE 21



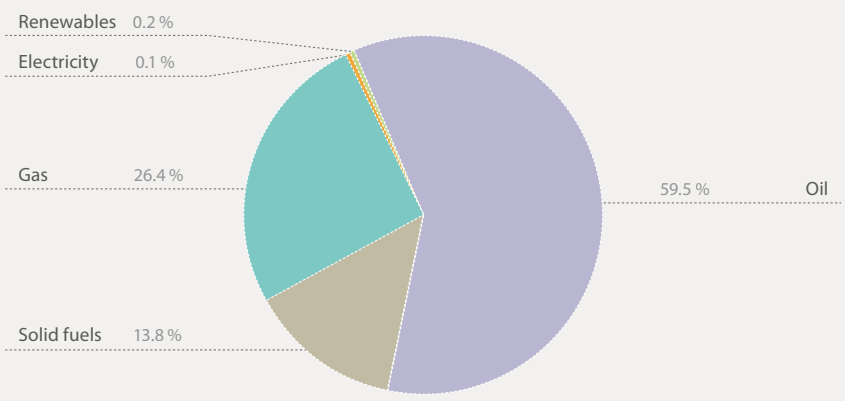
EU-27, NET IMPORTS OF ENERGY (in Mtoe) (1990-2008)

Source: Eurostat

Imports declined respectively by 3.4 % for oil and 2.2 % for gas between 2006 and 2007 as a result of a weaker demand. This was the first drop in imports since 2002 for oil and since 2001 for gas. At the same time, imports of solid fuels increased by 1.9 % from 2006 level. This increase in imports resulted from a higher consumption of solid fuels and from the need for hard coal of higher quality and energy content which the EU does not produce. In 2008, the changes in imports calculated from the aggregation of monthly data show significant changes in case of solid fuels (-3.5 %) and natural gas (+5.3 %), while crude oil import remained relatively stable (+0.5 %) resulting in an overall 1.7 % rise in energy product imports.

Crude oil still represented the biggest imported energy source corresponding to about 60 % of EU imports. The share of gas represented 26.4 % of total net imports in 2007 which was also the case in 2006.

FIGURE 22



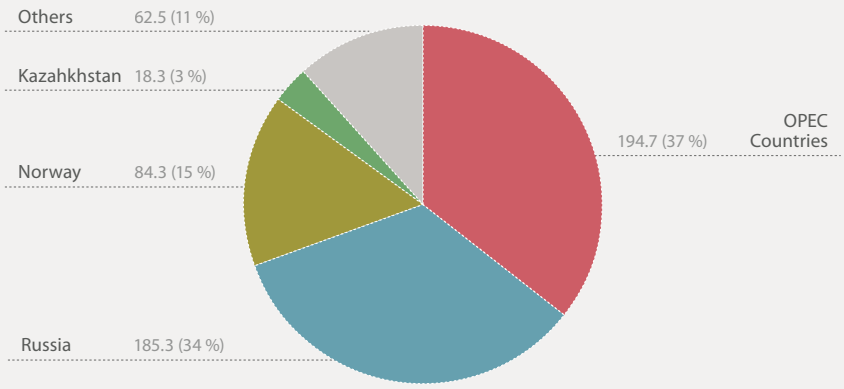
EU-27, NET IMPORTS OF ENERGY BY ENERGY SOURCE (in %) (2007)
Total = 988.35 Mtoe

Source: Eurostat

In 2007, the main external suppliers of oil to the EU were OPEC countries (37 % of imports), Russia (34 %), Norway (15 %) and Kazakhstan (3 %). While it supplied less oil to the EU in 2007 (- 19 Mtoe or – 8.8 % year-on-year), Russia increased its share in EU imports by 1 pp. Conversely, the share of the other main suppliers fell by 1 pp each for OPEC and Norway and by 2 pp for Kazakhstan. As a result, external sources of oil supply to the EU became further concentrated in 2007. The gap between the two main suppliers, OPEC and Russia, and the others has increased while the OPEC – Russia gap fell from 5 to 3 pp between 2006 and 2007. In 2008, according to monthly aggregated data, Russian imports decreased while other oil exporting countries managed to keep their shares.

The four main suppliers of gas to the EU in 2007 were Russia (41 % of imports), Norway (27 %), Algeria (17 %) and Nigeria (5 %). With higher exports and a share up by 3 pp in imports, Norway strengthened its position as a major gas supplier to the EU. Russia and Algeria exported less natural gas to the EU in 2007 and their individual shares in the EU imports were down by 1 pp. The drop in Algerian exports resulted from decreasing exports to Italy which imported more gas from Libya. Nigeria exported also less gas to the EU but its share remained at 5 %. Sources of gas remained concentrated in 2007. In 2008, this trend seemed to continue; Russia and Algeria lost nearly another 1 pp in EU-27 import share while Norway was able to raise its share by nearly 2 pp. Nigeria's share in total EU imports was down again by 1 pp.

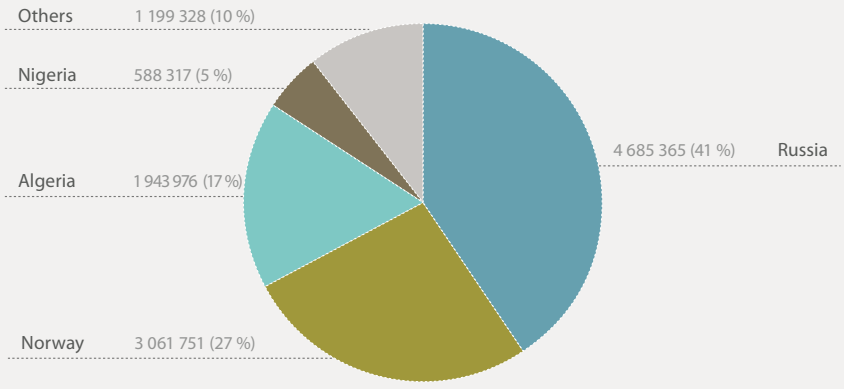
FIGURE 23



EU-27, IMPORTS OF CRUDE OIL (in Mt, %) (2007)
Total = 545.1 Mt

Source: Eurostat

FIGURE 24



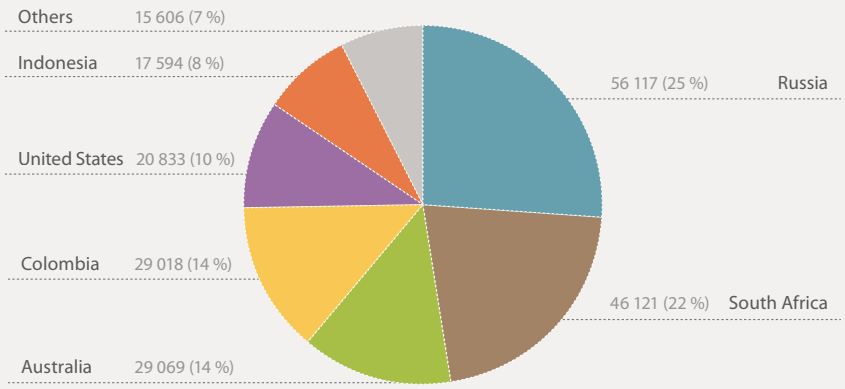
EU-27, IMPORTS OF NATURAL GAS (in TJ, %) (2007)
Total =11 478 737 TJ

Source: Eurostat

The coal market is more diversified than the oil and gas markets and external sources of supply for the EU were less concentrated. Coal imports in 2007 came mainly from six countries: Russia (25 %), South Africa (22 %), Australia (14 %), Colombia (14 %), the United States (10 %) and Indonesia (8 %). Compared to 2006, all suppliers but South Africa and Indonesia increased their exports to the EU. The shares of the two main suppliers, Russia and South Africa, were down by respectively 1 and 3 pp. As a result of higher imports from Australia and Colombia, four countries have now individual shares of 14 % or above. Only two countries were in such a position in 2006. Preliminary 2008 data show that Colombia and Australia slipped back below 13 %.

In 2007, Russia remained a significant source of imports for oil, gas and coal while Norway, supplying gas and oil to the EU, played a greater role in EU imports of gas. The Middle East was a major supplier of oil and North Africa was a substantial source of imports for gas and oil. For hard coal, Australia, Colombia and South Africa confirmed their positions as major suppliers to the EU.

FIGURE 25



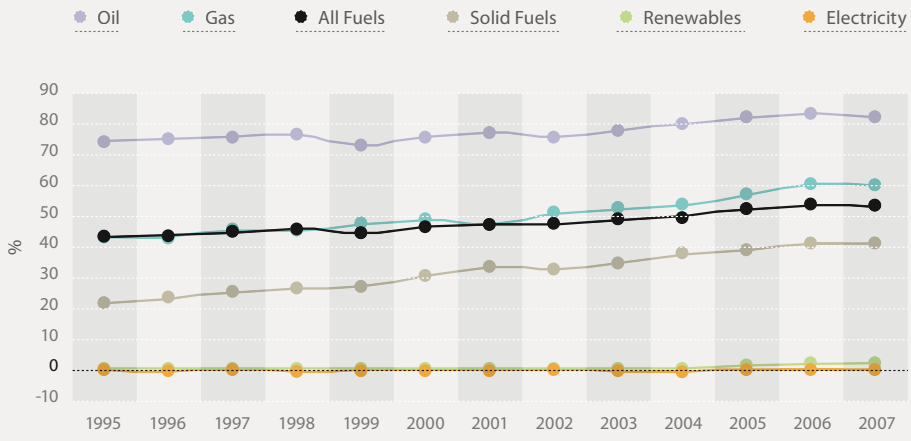
EU-27, IMPORTS OF HARD COAL (in 1 000 t, %) (2007)
Total = 455 253 000 t

Source: Eurostat

2.2.4. EU import dependency

In 2007, EU reversed the trend towards increasing import dependency for the first time since 1994. The overall EU import dependency decreased to 53.1 % down by 0.7 pp from 2006. This lower import dependency resulted from falls in the dependence on imports of oil, 82.6 % in 2007, down by 1 pp, and gas, 60.3 %, down by 0.5 pp. As in 2006, EU satisfied nearly 60 % of its needs for coal domestically. According to 2008 preliminary data, import dependency rose again and reached about 54.9 %. Within this overall value, the oil dependency rate climbed back again reaching about 84.5 %.

FIGURE 26



EU-27, IMPORT DEPENDENCY (in %) (1995-2007)

Source: Eurostat

2.3. EU energy sector's climate performance

2.3.1. GHG emissions

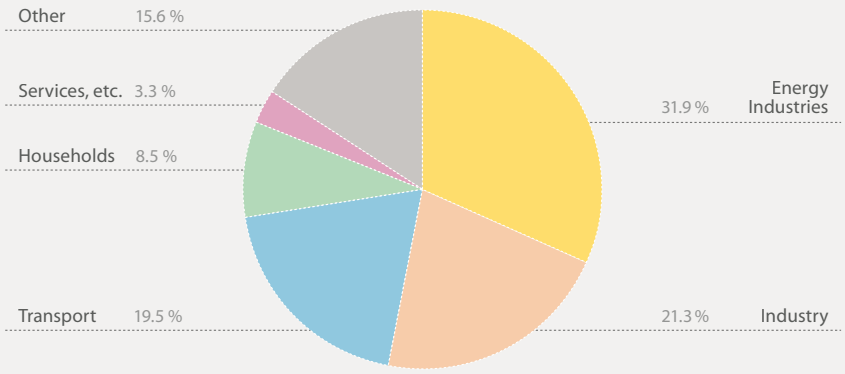
In 2007, EU-27 total greenhouse gas emissions (GHG) without LULUCF ([9]) amounted to 5 045 Mt CO_2-equivalent. Between 2006 and 2007, they decreased for the third consecutive year and fell by 1.2 % or 60 Mt CO_2-equivalent. CO_2 remains the main GHG with 83 % of GHG emissions. Declining emissions in 2007 resulted partly from warmer weather conditions, weather being one factor influencing CO_2 emissions.

In 2007 for EU-27, energy-related GHG emissions (i.e. combustion and fugitive emissions) represented 79.2 % of total GHG emissions with 3 999 Mt CO_2-equivalent which was slightly less than in 2006 (79.7 % with 4 068 Mt CO_2-equivalent in 2006).

Although the rise in energy-related GHG emissions remains modest, the shares of energy industries and transport have increased between 2006 and 2007, respectively by 0.4 pp and 0.6 pp.

By contrast, the share of households in total GHG decreased as did, to a lesser extent, that of services. Compared to 2006, the share of households was down by 0.9 pp at 8.5 % while the downward trend for services was more modest. Decreases for households and services were mainly due to an increase in energy prices and to milder weather conditions in 2007.

FIGURE 27



EU-27, GREENHOUSE GAS EMISSIONS BY SECTOR (in %) (2007)
Total = 5 045.4 Mt CO_2

Source: European Environment Agency

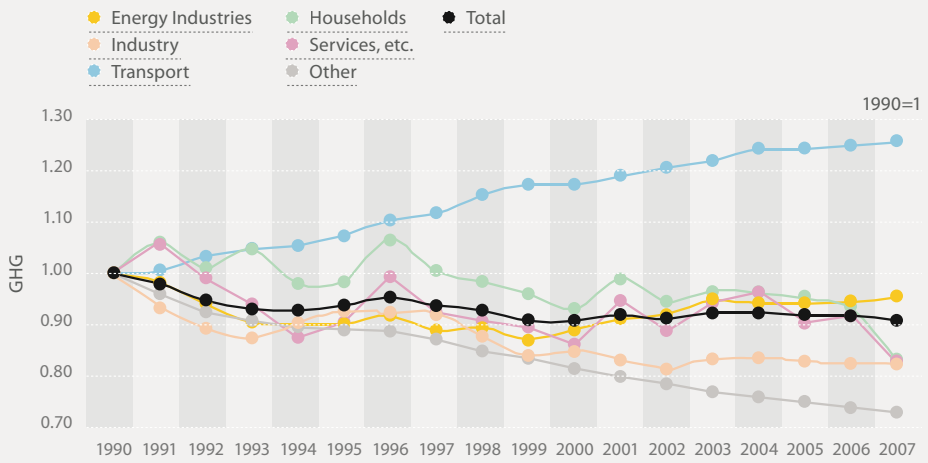
As a result of lower CO_2 emissions, it is estimated that emissions of greenhouse gases in 2008 were about 1.5 % lower than in 2007. In the verified emissions from the European Union Emission Trading Scheme (EU ETS) for 2008, total EU 27 emissions decreased by 3.9 % between 2007 and 2008 ([10]).

7/ Kg of CO_2 emitted per energy output (1 GJ)

Natural gas	50
LPG	60
Gasoline	67
Coal (lignite)	93
Coal (anthracite)	98

([9]) *Land use, land-use change and forestry (LULUCF).*
([10]) *European Environment Agency, Greenhouse gas emission trend and projections in Europe 2009, EEA report N°9/2009.*

FIGURE 28



EU-27, GREENHOUSE GAS EMISSIONS BY SECTOR (1990-2007)

Source: European Environment Agency

2.3.2. CO_2 emissions and CO_2 intensity

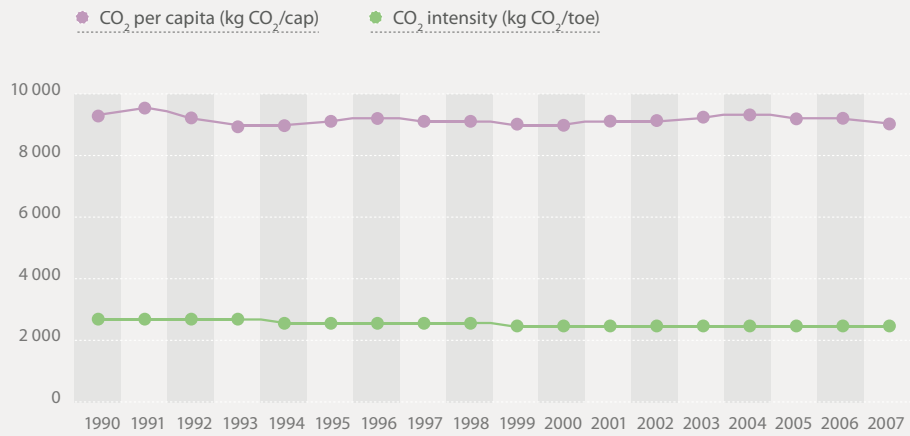
In 2007, energy-related CO_2 emissions amounted to 3 874 Mt and accounted for 92.5 % of total CO_2 emissions. Between 2006 and 2007, they decreased by 1.6 % or 65 Mt. For EU-27, declines in CO_2 emissions related to energy were recorded for households (-11.6 %) and services (-10.7 %), manufacturing industries (-1.6 %). Emission increases were due to electricity, heat generation (+15 Mt or +1.1 %), road transport (+5.3 Mt or +0.6 %), cement production and manufacture of solid fuels (respectively +4.5 Mt or 4.4 % and +3.6 Mt or 5.4 %) ([11]). Higher emissions were due to a higher electricity generation from conventional thermal power plants and due to increased traffic volumes.

CO_2 intensity, measured as ton of CO_2 per ton of oil equivalent, remains stable in 2007 with 2.49 tCO_2/toe. It has been at this level since 2004. However, CO_2 emissions per capita fell by 1.5 % with an amount of 9 066 kg per capita in 2007.

8/ In 2007, energy industries in the EU accounted for 32 % of total CO_2 emissions. Public electricity and heat production are responsible for 86 % of CO_2 emissions from the energy industries.

([11]) *European Environment Agency, http://www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009/european-community-ghg-inventory-2014-full-report*

FIGURE 29



EU-27, CO_2 INTENSITY (in kg CO_2/toe) AND CO_2 PER CAPITA (in kg CO_2/cap) (1990-2007)

Source: European Environment Agency

As in 2006, the six largest CO_2 emitters in 2007 were Germany, the United Kingdom, Italy, France, Spain and Poland. However, these Member States reduced their total emissions with the exception of Spain and, to a lesser extent Poland, which mainly stabilized their total emissions.

In terms of CO_2 intensity, which gives an indication of the CO_2 content of the fuel mix, the six Member States with the highest levels in 2006 (Malta, Greece, Cyprus, Poland, Ireland and Estonia) still had the highest levels in 2007. Levels however decreased in Greece (3.78 vs 3.88), Cyprus (3.60 vs 3.72) and Ireland (3.20 vs 3.25). They increased in Malta and Estonia and stabilized in Poland.

Overall, 18 Member States were above the EU-27 average in 2007. 17 Member States were in this situation in 2006.

9/ Each year 9.1 billion metric tons of CO_2 are globally released in the atmosphere: plants and soil absorb about 30 %, ocean surface and waters 25 % and sediment and rock less than 1 %. The rest stays airborne for a long time.

3. Energy markets developments ([12])

3.1. Oil market developments

3.1.1. Crude oil price and supply costs evolution

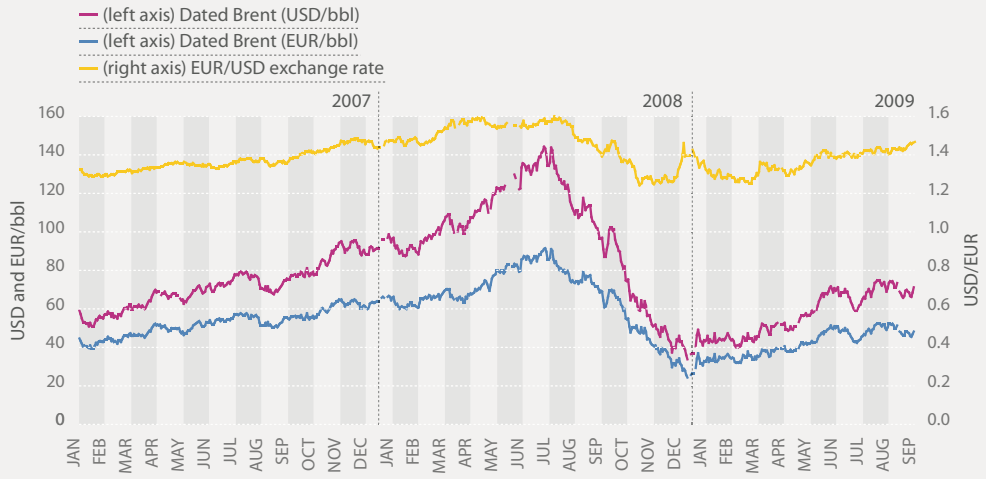
Sustained by the growth in oil demand and some speculative movements, crude oil prices increased steadily in the first half of 2008 to reach a peak of about USD 147 per barrel round mid-July, a record even on an inflation-adjusted basis. The world economy then started to slow down and in September 2008 the financial crisis triggered a sharp recession inducing a drop in oil demand and in oil prices. By the end of 2008, crude oil prices had lost more than 70 % from their peak value despite production cuts by OPEC countries. Prices continued to be depressed in the first quarter of 2009, averaging around USD 45 per barrel.

A price rise which took place since the first quarter of 2009 could mainly be attributed to positive sentiments in contrast to the weak state of fundamentals. There were indeed signs that the recession was easing as financial markets stabilised. By the end of June 2009, crude oil was trading at around USD 70 per barrel and went on during the next three months to fluctuate between USD 65 and USD 70 per barrel.

On a yearly basis, Dated Brent, the European benchmark crude, averaged USD 97.3 per barrel in 2008. This average price corresponded to an increase of 34 % over the 2007 average price of USD 72.4/bbl, which represented a near tripling of prices compared to 2002 (when prices averaged USD 25). In euro terms, the increase in price of the Dated Brent between 2007 and 2008 was less (25 %), given the appreciation of the euro against the dollar in the first part of 2008. This mitigated somewhat the impact of these increases on the EU economy.

Expressed in euro, the Dated Brent average price was EUR 66.2 per barrel in 2008 and EUR 52.8 in 2007, and it averaged EUR 38.7/bbl (51.6 USD/bbl) for the first semester of 2009, down 53 % in USD and 46 % in EUR in comparison with the first semester of 2008.

FIGURE 30



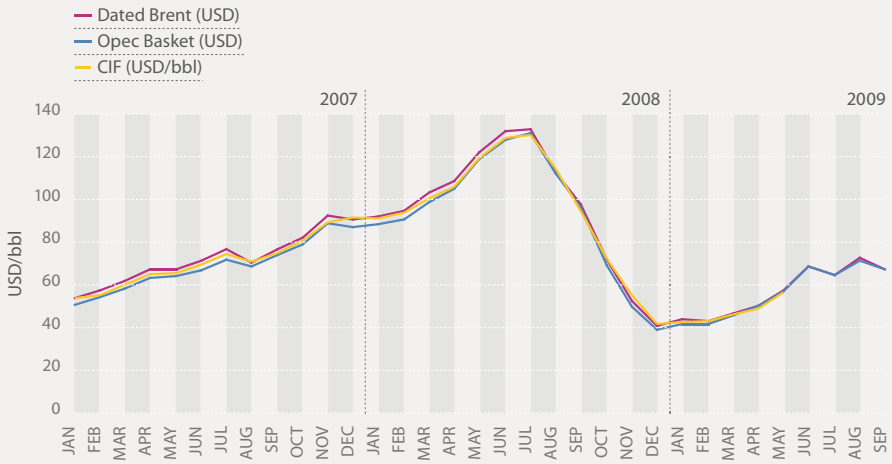
DATED BRENT (in EUR/bbl and USD/bbl) AND EUR/USD EXCHANGE RATE (1/2007-9/2009)

Sources: Platts (2009); ECB (2009)

([12]) For coal market developments, see Commission Staff Working Document, The Market for Solid Fuels in the Community in 2007 and the outlook for 2008, SEC(2009) 1500, accessible at the following address: http://ec.europa.eu/energy/observatory/coal/doc/solid_fuels/sec_2009_1500.pdf

On a monthly basis, the crude oil supply cost of the EU is following the evolution of the Dated Brent price. The EU crude oil supply cost has mostly been fluctuating in the past between the OPEC basket price – which is usually a bit below the Dated Brent price due to relatively inferior average crude quality – and the Dated Brent price. That has still been the case since January 2007. For the year 2008, the crude oil supply cost of the EU averaged USD 94.6 per barrel against USD 67.6 in 2007 (EUR 64.6 against EUR 50.0) and for the first six months of 2009, it averaged USD 50.5 per barrel (EUR 37.9).

FIGURE 31



DATED BRENT AND OPEC BASKET PRICES COMPARED TO CIF PRICES FOR EU-27 (in USD/bbl) (1/2007-9/2009)

Sources: Platts (2009); European Commission (2009)

3.1.2. Petroleum products price evolution

Spot prices and ex-tax prices

As for the crude price evolution, the spot prices and ex-tax prices of oil products have also witnessed extreme volatility over the period, reaching a peak in July 2008 and sharply falling afterwards until the end of the year. Subsequently, an upward trend could be observed during the first semester of 2009.

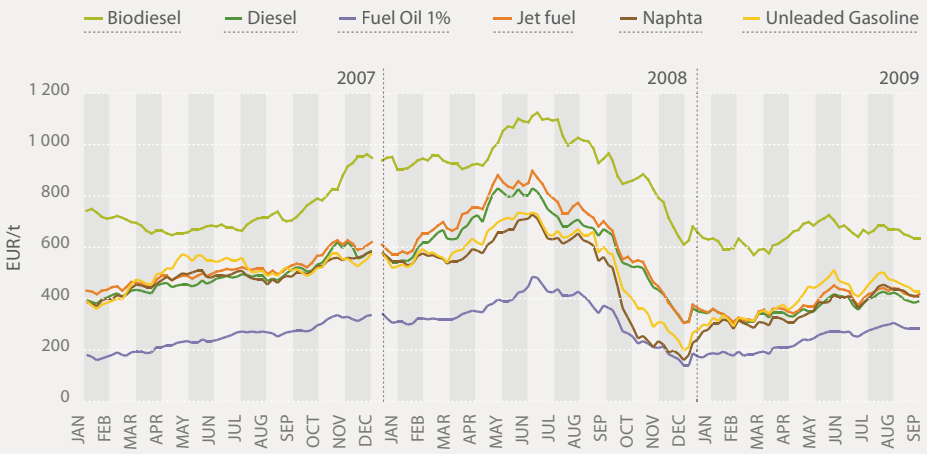
Spot prices and ex-tax prices evolved in parallel over the period, the differential, highlighted by the third graph, being the logistical storage costs and distribution margins.

Depending upon the product, these storage costs and distribution margins for Euro-super 95, diesel oil and heating gas oil have usually been fluctuating between EUR 8 and EUR 14 per 1 000 litres over the period January 2007 – September 2009 with the exception of the second semester of 2008. During the second half of 2008, it seems that the spot prices have decreased by a higher amount than the ex-tax prices, as the costs and margins for these three products have mostly been fluctuating between EUR 14 and EUR 19 per 1 000 litres.

At the Commission's initiative, a study on the competitive aspects of oil and oil product markets in the EU has recently been carried out. The aim of this study was to provide a comprehensive review of the operation of the core oil product markets (gasoline, diesel and Low Sulphur Fuel Oil) in the EU to assess whether they are well-functioning and competitive. The study concluded that there is no significant asymmetry between rising and decreasing crude and wholesale product prices but for some regional markets more data would be needed to come to conclusions. This conclusion has been recently supported by the European Central Bank in an analysis concerning the pass through of oil prices into the Euro Area liquid fuel prices in an environment of high and volatile oil prices ([13]).

([13]) Energy Economics 31/2009, p. 867-881.

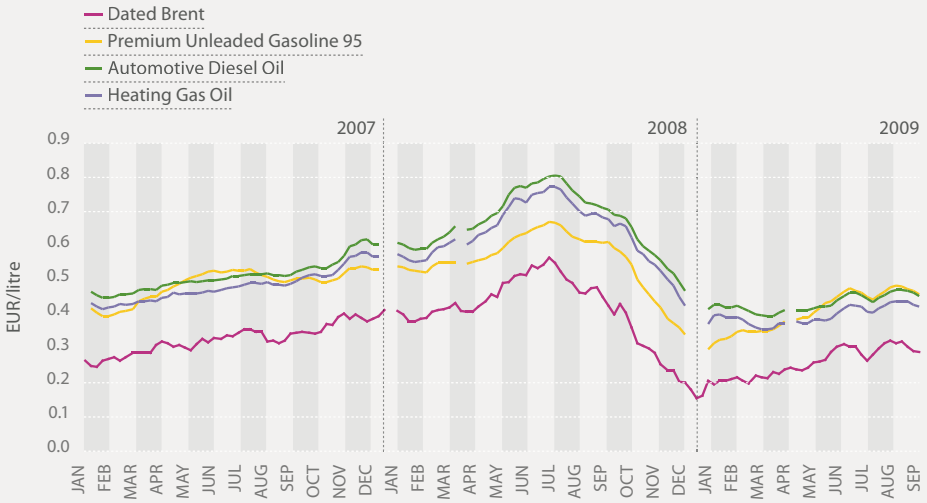
FIGURE 32



PETROLEUM PRODUCTS SPOT PRICES (in EUR/t) (1/2007-9/2009)

Source: © Platts (2009)

FIGURE 33

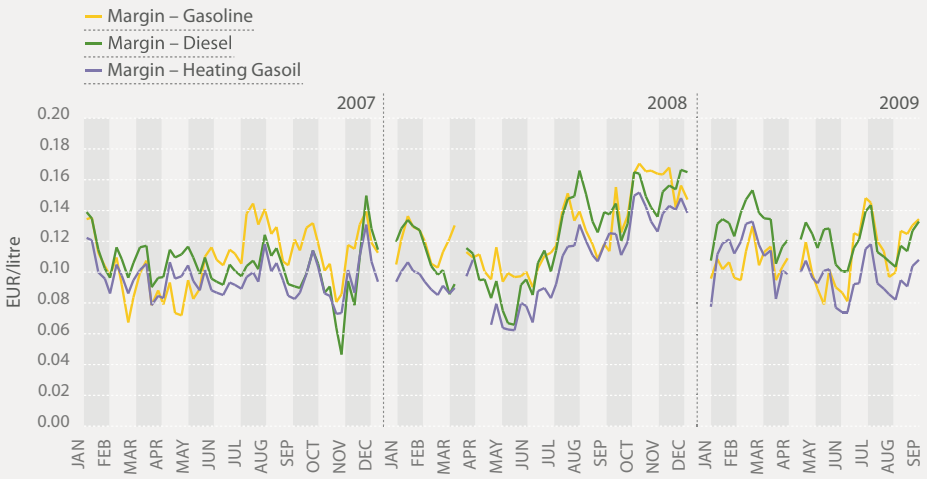


EU-27 EX-TAX PRICES AND DATED BRENT (in EUR/litre) (2007-9/2009)

Sources: European Commission (2009); Platts (2009)

10/ Over the last three years, 10.35 million Light Sweet Crude 11/2009 future contracts (1 000 barrels) were traded in the New York Mercantile Exchange. 6.30 million Brent Crude 11/2009 future contracts were traded in the International Petroleum Exchange in London.

FIGURE 34



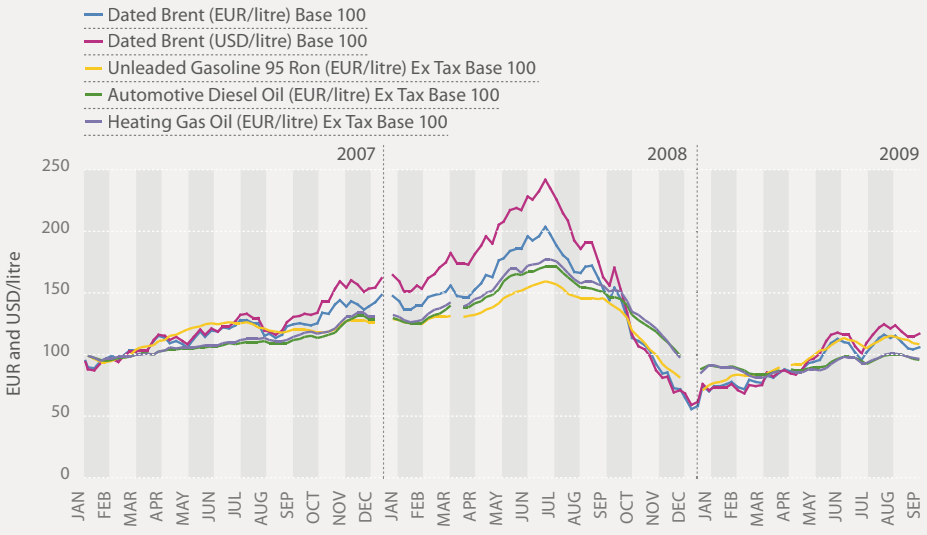
DIFFERENTIAL BETWEEN SPOT PRICES AND EX-TAX PRICES (in EUR/litre) (1/2007-9/2009)

Source: © Platts (2009)

Ex-tax prices for the main petroleum products (Euro-super 95, diesel oil and heating gas oil) have witnessed a less spectacular surge than for crude oil. This differentiated evolution between crude and products mitigated to some extent the impact on consumers of the price increase experienced in the first part of 2008 given that end-consumer prices are determined by the ex-tax prices of petroleum products.

The appreciation of the euro versus the US dollar between January and July 2008 has also played an important role. The Dated Brent price, expressed in US dollar, was multiplied by two and a half between January 2007 and July 2008 whereas, when expressed in euro, it only increased twofold over the same period.

FIGURE 35



EU-27 EX-TAX PRICES AND DATED BRENT (in EUR and USD/litre, January 2007=100) (1/2007-9/2009)

Sources: European Commission; Platts (2009)

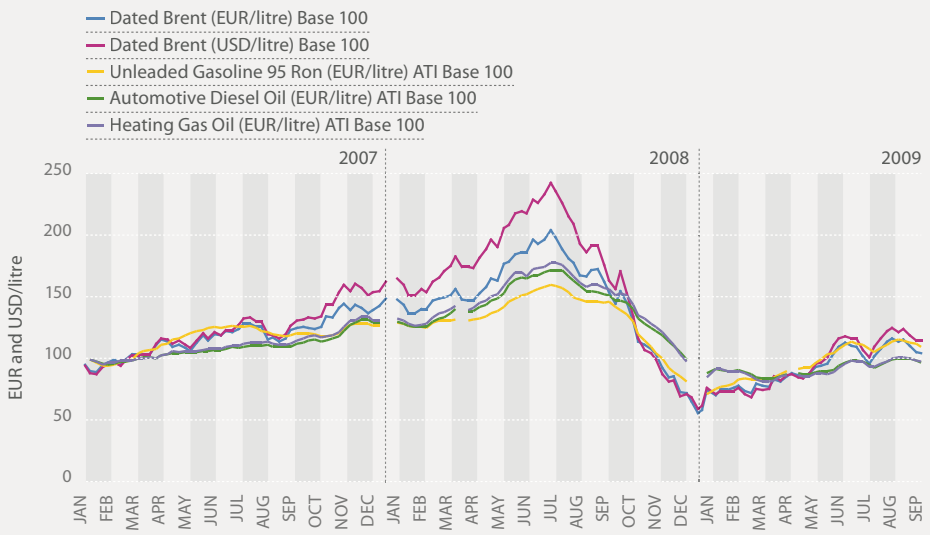
In addition, minor divergences are noticeable in the movement of the Dated Brent price and the price of the main petroleum products. These divergences could be attributed to the fluctuations of seasonal demand for a particular product, as well as a temporary surplus or deficit for a certain product on the international market.

Consumer prices

Consumer petroleum product prices (i.e. prices including taxes) have followed the same trend as crude oil and ex-tax prices over the observed period but with a smaller percentage increase and decrease due to the share of taxation.

The taxation share (mainly VAT and excise duties) in the end-consumer price has somewhat cushioned the sharp increase recorded in the ex-tax product prices in the first half of 2008. This is particularly visible on Euro-super 95, which is the product with the highest taxation level, followed by diesel oil and, finally, heating gas oil which is the least taxed product among the three considered here.

FIGURE 36



EU-27, SPOT PRICES AND CONSUMER PRICES (in EUR and USD/litre, January 2007=100) (1/2007-9/2009)

Sources: European Commission; Platts (2009)

Taxation

At constant taxation level (indirect taxes + VAT) the share of taxation in the consumer price decreases when the ex-tax product price increases. Conversely, the share of taxation increases when the ex-tax product price is decreasing. This can be explained by the fact that the excise duty is a fixed amount which is independent from the ex-tax price. In turn, VAT as an *ad valorem* tax applies on the total of ex-tax prices plus excise duties (and possibly other indirect taxes).

As an example, the average taxation share in the consumer price (average at EU level), is the following, for two different dates: 28 July 2008 (high ex-tax prices and crude oil price of about EUR 85 per barrel) and 29 June 2009 (lower ex-tax prices and crude oil price of about EUR 48 /bbl):

TABLE 1

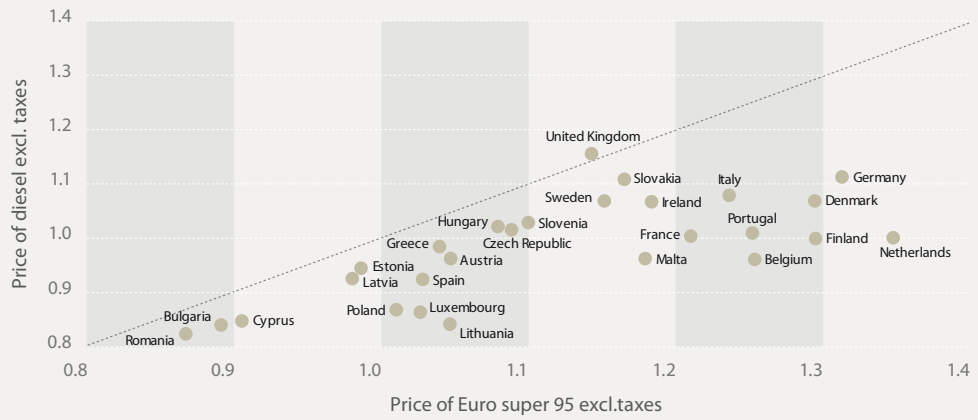
EURO SUPER 95		DIESEL OIL		HEATING GAS OIL	
28/07/2008	29/06/2009	28/07/2008	29/06/2009	28/07/2008	29/06/2009
56 %	62 %	45 %	56 %	27 %	32 %

EU-27, SHARE OF TAXATION IN TOTAL END-CONSUMER PRICE OF PETROLEUM PRODUCTS (in %) (at 28/07/2008 and 29/06/2009)

Source: European Commission

Excise duties are higher on Euro-super 95 than on diesel oil in all EU countries with the exception of the UK where the excise duty rates according to volume are identical. Consequently, at the pump, the price of Euro-super 95 is higher than the price of diesel oil in all Member States – with the exception of the UK – despite the fact that the ex-tax price is lower for Euro-super 95 than for diesel oil in most EU countries.

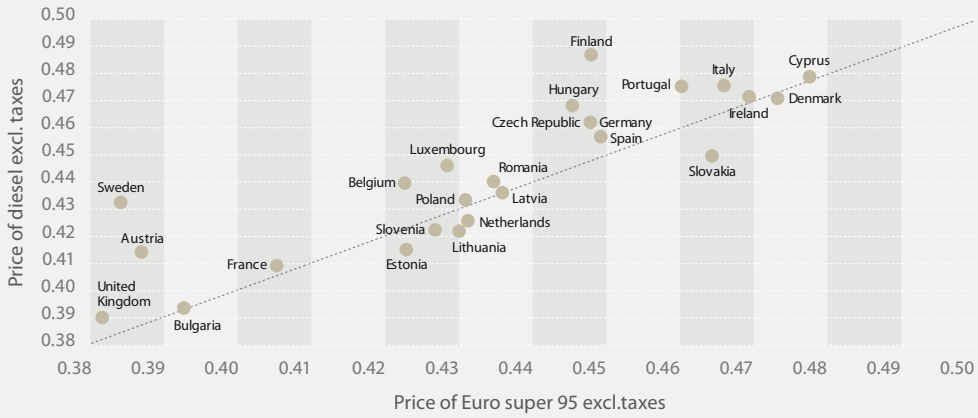
FIGURE 37



EU-27, CONSUMER PRICE OF EURO-SUPER 95 & DIESEL OIL BY MEMBER STATE (in EUR/litre) (at 5 October 2009)

Source: European Commission

FIGURE 38



EU-27, EX-TAX OF EURO-SUPER 95 & DIESEL OIL BY MEMBER STATE (in EUR/litre) (at 5 October 2009)

Source: European Commission

11/ In November 2009, excise duties for Euro-super 95 represented 35-40 % of the consumer prices in Eastern Europe, 40-50 % in Central and Western Europe and as much as 52 % in the UK.

3.1.3. Evolution of the oil supply and demand

Evolution of oil supply at world level

Despite the strong economic downturn in the course of 2008 and the consequent decrease in oil demand, world oil supply has increased slightly on average in 2008 in comparison with 2007 to reach 86.5 million barrels per day (Mb/d) as against 85.7 Mb/d in 2007 ([14]).

Evolution of the oil balance at world level and in the EU

TABLE 2

	2005	2006	2007	2008	% VARIATION '08/'07
WORLD DEMAND	**84.2**	**85.2**	**86.5**	**86.3**	**-0.2%**
OECD	**49.8**	**49.5**	**49.2**	**47.6**	**-3.3%**
NORTH AMERICA	25.6	25.4	25.5	24.2	-5.1%
EUROPE	15.7	15.7	15.3	15.3	0.0%
NON-OECD	**34.4**	**35.7**	**37.3**	**38.7**	**3.8%**
FSU	3.9	4	4.1	4.2	2.4%
CHINA	6.7	7.2	7.6	7.9	3.9%
OTHER ASIA	8.8	9	9.5	9.7	2.1%
LATIN AMERICA	5.2	5.4	5.7	5.9	3.5%
MIDDLE EAST	6.1	6.3	6.5	7.1	9.2%
AFRICA	2.9	3	3.1	3.2	3.2%
WORLD SUPPLY	**84.7**	**85.6**	**85.7**	**86.5**	**0.9%**
OECD	**20.4**	**20.1**	**19.9**	**19.3**	**-3.0%**
NORTH AMERICA	14.1	14.2	14.3	13.9	-2.8%
EUROPE	5.7	5.3	5	4.8	-4.0%
NON-OECD	**27.4**	**28**	**28.5**	**28.7**	**0.7%**
FSU	11.8	12.2	12.8	12.8	0.0%
CHINA	3.6	3.7	3.7	3.8	2.7%
OTHER ASIA	3.8	3.8	3.7	3.7	0.0%
LATIN AMERICA	3.8	3.9	3.9	4.1	5.1%
MIDDLE EAST	1.8	1.8	1.7	1.6	-5.9%
AFRICA	2.4	2.5	2.5	2.5	0.0%
OPEC	**34.9**	**35.2**	**34.9**	**35.9**	**2.9%**
CRUDE	30.6	30.7	30.3	31.2	3.0%
NGLs	4.3	4.4	4.5	4.7	4.4%

EVOLUTION OF THE OIL BALANCE AT THE WORLD LEVEL AND IN THE EU (in Mb/d, %) (2005-2008)

Source: IEA Annual Statistical Supplement (2009 Edition)

BOX 3.1

([14]) *IEA Oil Market Report of mid-September 2009.*

TABLE 3

Crude Oil Balance (kt)

	2005	2006	2007	2008	% VARIATION '08/'07
PRIMARY PRODUCTION	124 429	112 330	112 466	105 540	**-6.16 %**
TOTAL IMPORTS	648 572	646 948	638 453	641 535	**0.47 %**
TOTAL EXPORTS	75 814	69 131	67 637	66 828	**-1.20 %**
NET IMPORTS	572 755	577 817	571 819	574 607	**0.66 %**
INPUT TO REFINERIES	741 591	735 123	730 040	715 481	**-1.99 %**

Petroleum Products Balance (kt)

	2005	2006	2007	2008	% VARIATION '08/'07
TOTAL IMPORTS	283 342	299 259	262 204	278 981	**6.40 %**
TOTAL EXPORTS	271 865	277 420	250 414	270 173	**7.89 %**
NET IMPORTS	11 480	22 153	10 968	8 827	**-19.52 %**
INTERNAL DELIVERIES	613 712	614 120	591 142	597 420	**1.06 %**
MOTOR SPIRIT	107 823	105 688	103 230	97 612	**-5.44 %**
KERO JET FUEL	55 716	56 570	57 400	57 656	**0.45 %**
GAS/DIESEL OIL	276 516	282 468	278 366	285 436	**2.45 %**
incl. AUTO. DIESEL OIL	183 157	192 578	202 721	204 038	**0.65 %**
RESIDUAL FUEL OIL	47 804	45 049	38 835	34 301	**-11.68 %**
OTHERS	125 853	124 345	113 311	122 415	**8.03 %**

EU-27, EVOLUTION OF THE OIL BALANCE (in kt, %) (2005-2008)

Source: Eurostat (monthly data of November 2009)

BOX 3.2

Although OPEC began cutting production late in the year, average annual OPEC production rose by 1 Mb/d to 35.9 Mb/d. Middle Eastern OPEC members accounted for all of the net increase, with Saudi Arabian production rising by nearly 400 000 b/d and Iraqi output rising by 280 000 b/d.

Oil production outside OPEC fell by about 0.4 Mb/d in 2008, the largest decline since 1992. OECD production in particular fell by 0.6 Mb/d or 3 %, with declines recorded in both North America and Europe.

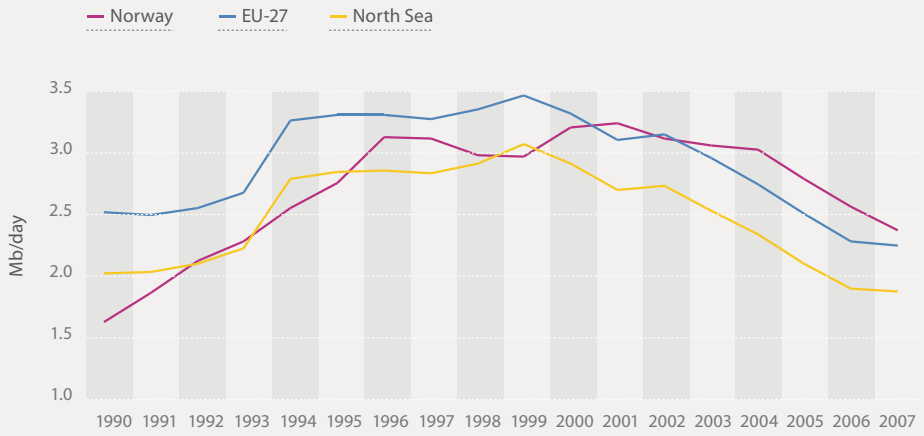
The situation has somewhat reversed in the first semester of 2009. Oil production outside OPEC has slightly increased and OPEC production dropped by 7 % or 3.6 Mb/d over the first semester of 2008. At world level, the supply was about 2.5 Mb/d or 3 % below the level of the first semester of 2008 and 2 % below the level of the second semester of 2008.

Evolution of the production in the EU

In 2008, EU crude oil production represented about 2.8 % of world production. Since 2003, EU crude oil production has been on a continuous downward trend. This decrease can mainly be attributed to the decline in North Sea production (UK, DK, NL) which represented some 80 % of the total EU production (2.1 Mb/d in 2008).

After a smaller decrease between 2006 and 2007, 2008 EU production dropped by 6.2 % driven by a 6.7 % reduction in EU North Sea production, according to Eurostat monthly data. The North Sea Norwegian oil production, one of the main EU crude oil supply sources, dropped by more than 6 % in 2008, in line with the EU North Sea production fall. The downward trend in EU total production and EU North Sea production observed in 2008 continued over the first semester of 2009.

FIGURE 39



EU-27 AND NORWAY AND NORTH SEA, CRUDE OIL PRODUCTION (in Mb/d) (1990-2007)

Source: Eurostat

TABLE 4

	DK	NL	UK	EU NORTH SEA	DE	IT	RO	EU-27
2007	15.17	3.10	72.99	91.26	5.81	6.60	5.07	112.47
2008	14.04	2.55	68.58	85.16	4.94	6.31	4.79	105.54
2009s1	6.67	1.11	34.41	42.19	2.30	2.71	2.22	51.06
2008/2007	-7.5 %	-17.9 %	-6.0 %	-6.7 %	-4.6 %	-4.5 %	-5.6 %	-6.2 %

EU-27, CRUDE OIL PRODUCTION (in Mt, %) (1/2007-6/2009)

Source: Eurostat

Evolution of oil demand at world level

The world economy is usually the key driver of energy demand and, in particular, of oil demand. This was also the case over the observed period. As for prices, the evolution of world oil demand in 2008 was mixed with the upward trend of the beginning of the year progressively replaced by a growing erosion of the oil demand propelled by the downturn in the economy. As a result and unlike the slight increase observed in the oil supply, world oil demand slightly decreased on average in 2008 in comparison with 2007 to reach 86.3 Mb/d as against 86.5 Mb/d in 2007 ([15]), the first decline since 1993.

This slight fall hides important regional disparities. In particular, 2008 demand in OECD countries fell sharply by about 1.6 Mb/d or 3.3 %, to 47.6 Mb/d, driven by a drop of nearly 1.3 Mb/d or 5.1 % in the U.S. over the preceding year. Outside the OECD, strong growth continued among several countries such as China, India and most of the Middle East and Latin America producing countries. At world level, oil demand fell back by 3 % over the first semester of 2008 and by 1.5 % over the second semester of 2008.

Erosion in oil demand accelerated in the first semester of 2009 in line with the evolution of the economy.

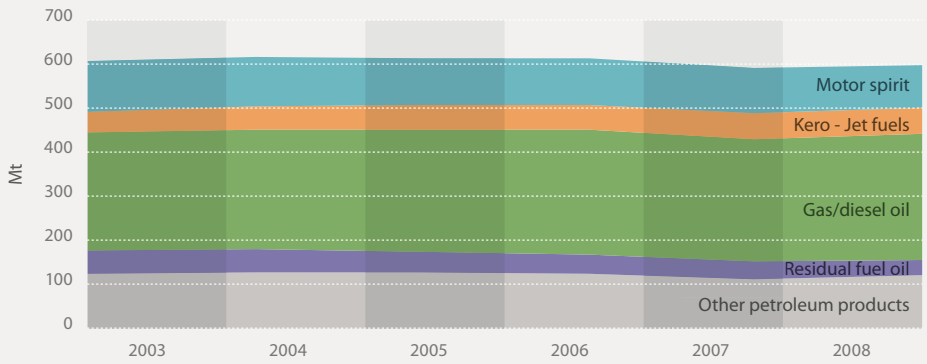
([15]) *IEA Oil Market Report of mid-September 2009.*

Evolution of oil consumption in the EU

According to Eurostat monthly data, EU gross inland oil consumption fell by 1.5 % in 2008 versus 2007 to reach a level of 647.1 Mtoe or about 13 Mb/d, equivalent to 15 % of world consumption.

EU total inland deliveries have been fluctuating within fairly narrow margins since 2003. The evolution is however very contrasted on a product by product basis. Gasoline (motor spirit) consumption was rather stable over the period while middle distillates (kerosene/jet-fuels + gas/diesel oil) consumption increased and residual fuel oil decreased partly due to the penetration of natural gas into the industrial sector.

FIGURE 40

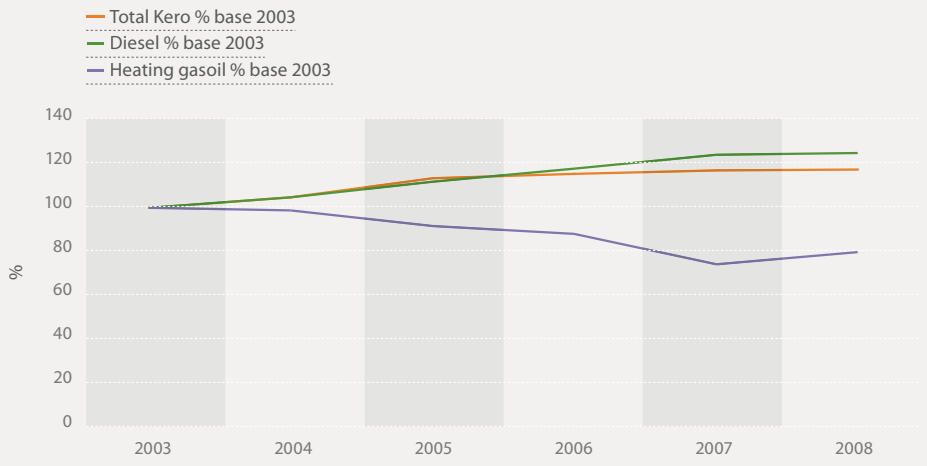


EU-27, INLAND DELIVERIES OF PETROLEUM PRODUCTS (in Mt) (2003-2008)

Source: Eurostat

The upward trend in middle distillates is the result of an on-going increase in total kerosene (mainly jet-fuel) and diesel oil consumptions. An increase of about 20 % was recorded between 2003 and 2008 for these two products. A decrease of the same scale was recorded for heating gas oil.

FIGURE 41



EU-27, INLAND DELIVERIES OF MIDDLE DISTILLATES (in %, base 2003) (2003-2008)

Source: Eurostat

3.1.4. Refining sector developments

Evolution of refining capacity, refinery intake, utilisation rate and refining margins in the EU

The EU nominal refining capacity has been very stable since 2000. At the end of 2008, it amounted to 15.5 Mb/d or 775.2 Mt per year and represented about 18 % of the world refining capacity ([16]). However, the refining capacity in service in the EU is noticeably below the nominal capacity.

Around 110 refineries processing crude oil are currently in activity in the EU. In addition, there are several small bitumen or specialist lubricant refineries.

This EU nominal refining capacity seems sufficient to cover the total EU gross consumption which amounted to about 670 Mt in 2008, i.e. 86 % of the nominal refining capacity. This overall matching at EU level does not mean that there is no imbalance on a product by product basis or on a regional level between refinery production and consumption.

On the basis of monthly Eurostat data, the quantities of crude oil and other feed-stocks processed in the EU refineries amounted to 715.5 Mt in 2008 as against 730 Mt in 2007. Logically, the decrease in oil consumption at world level and in the EU has pushed down the quantities of oil processed by refineries. This was again the case during the first quarter of 2009, with the refinery intake falling by about 5 %.

The combination of stable nominal refining capacity and lower crude runs means that the refinery utilization rate fell in 2008 to 92 %, 2 % below the 2007 level.

Refining margins have resisted well during the first half of 2008 given a strong demand despite high consumer prices for petroleum products. With the strong economic downturn in the second half of 2008, refining margins then declined sharply towards the end of the year due to the drop in oil consumption and oil prices and the increase in spare refining capacities. Refining margins for the whole of 2008 could be estimated at 5.25 USD/barrel for a typical North West Europe refinery with catalytic cracking facilities using Brent crude ([17]).

12/ The EU is the second largest producer of petroleum products in the world after the US. EU refinery capacity was 769 Mt in 2008 (18 % of total global capacity).

This is in line with the level of the three previous years. Not surprisingly, with the weaker oil demand experienced during the first semester of 2009, refining margins fell to about 2 USD/barrel on average over the first six months ([18]).

EU refinery intake by crude quality

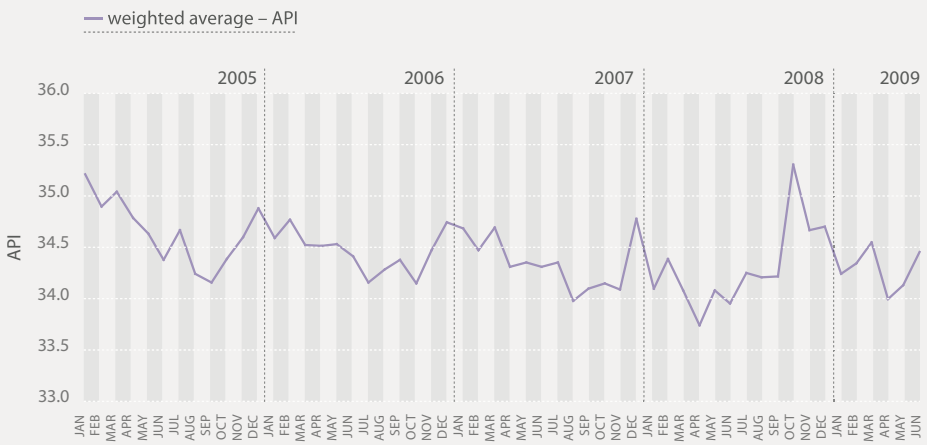
In Europe, an important decline in the North Sea production (Norway, UK and Denmark) has taken place, from 6.4 to 4.3 Mb/d between 2000 and 2008, and will continue but opinions differ on the extent. Over the same period, supplies to Europe have been growing from Africa (North and West) and Former Soviet Union (hereafter FSU) which have the potential to offset the North Sea decline.

On average, the African and FSU crudes are characterized by a lower API and higher sulphur content. At EU level, the refining industry's dependence on North Sea crudes widely varies from one Member States to another. According to Eurostat annual data, thirteen Member States have processed North Sea crudes (produced in Norway, UK, Denmark and the Netherlands) in 2007. Not surprisingly, the refining industry in North-West Europe is using more North Sea Crudes than in countries from the South or from the East of the EU. Nearly 100 % of the crude refinery intake in Ireland and Denmark is North Sea originated. For the UK, it is around 80 %, followed by Sweden (57 %), Germany (27 %), France (21 %), Finland (17 %), the Netherlands and Belgium (14 %). For the other EU Member States (including ES, PL, PT, IT), North Sea Crudes represent less than 5 % of their refinery intake.

The trend to a heavier density (lower API degree) of the crude processed by European refineries is highlighted in the following graph showing the evolution of the API level of total crude imports since January 2005 although the trend seems to have reversed in the second semester of 2008 and first semester of 2009 with the decrease in oil prices ([19]).

([16]) Source: Oil & Gas journal.
([17]) Source: IEA Annual Statistical Supplement (2009 Edition).
([18]) Source: IEA Oil Market Monthly Reports.
([19]) Source: Council Regulation 2964/95/EC.

FIGURE 42



EU-27, EVOLUTION OF REFINERY CRUDE INTAKE QUALITY (in API – weighted average) (1/2005-6/2009)

Source: European Commission

Imbalances between refinery production and gross oil consumption

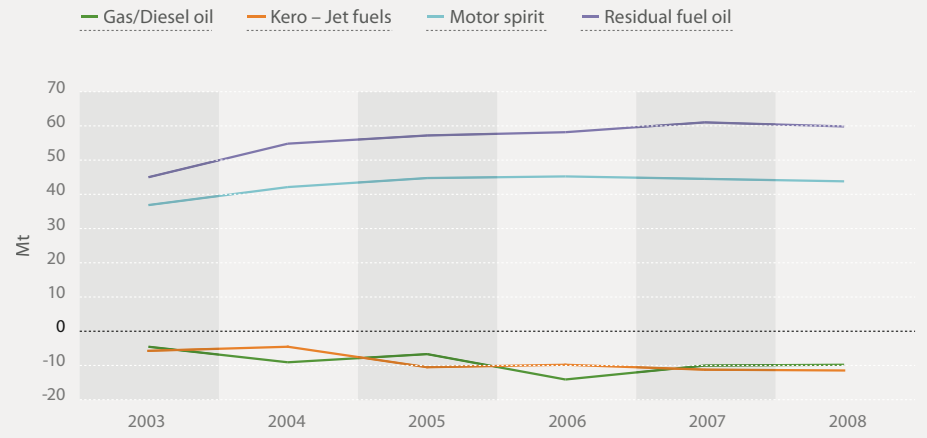
The EU refining industry has to cope with a growing production/consumption imbalance notably for middle distillates (mainly jet fuels and gas/diesel oil). Currently, the residual fuel oil surplus is mostly used as international marine bunkers. In 2008, the amount of residual fuel oil used for international marine bunkers (47.5 Mt at EU level) was higher than the amount of the same product destined for the internal market (34.3 Mt).

The ongoing shift of motor fuel demand from gasoline to diesel oil (aggravated by the taxation policy) has resulted in a gas/diesel oil deficit and gasoline surplus in Europe. The gas/diesel oil deficit is mainly covered by imports from Russia while most of the excess gasoline is exported to the USA.

The gas/diesel oil deficit is in fact more important than the level shown by Figure 43 since international marine bunkers are not taken into account. In 2008, these bunkers represented 6.3 Mt to be added to the deficit of 10 Mt recorded for internal market deliveries.

When compared to EU gross consumption (internal deliveries + bunkers), the deficit of the EU refinery production amounted to 5.6 % 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 8 % of the EU gross consumption in 2008.

FIGURE 43



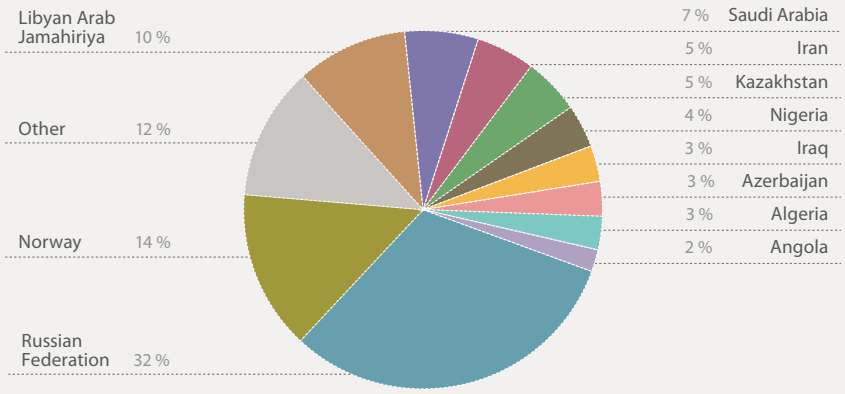
EU-27, DIFFERENCE BETWEEN EU REFINERY PRODUCTION AND MARKET DELIVERIES OF PETROLEUM PRODUCTS (in Mt) (2003-2008)

Source: Eurostat

3.1.5. Evolution of crude oil and petroleum products imports and exports

In 2008, four third-party countries to the EU represented about two thirds of the EU crude oil imports: Russia with two thirds of the EU crude oil imports, Norway (14 %), Libya (10 %) and Saudi Arabia (7 %). The last third of the EU crude oil imports is shared among a large number of countries. In 2008, OPEC countries represented 38 % of total EU crude oil imports from outside the EU.

FIGURE 44 ([20])

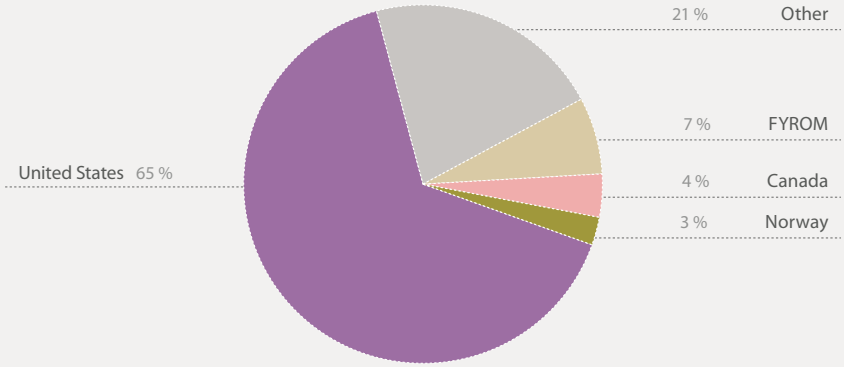


EU-27, IMPORTS OF CRUDE OIL FROM THIRD-PARTY COUNTRIES (in %) (2008)
Total = 572.5 Mt

Source: Eurostat (monthly aggregated data)

Regarding EU crude oil exports to third-party countries, the United States absorbed two thirds in 2008, nearly exclusively from the UK.

FIGURE 45



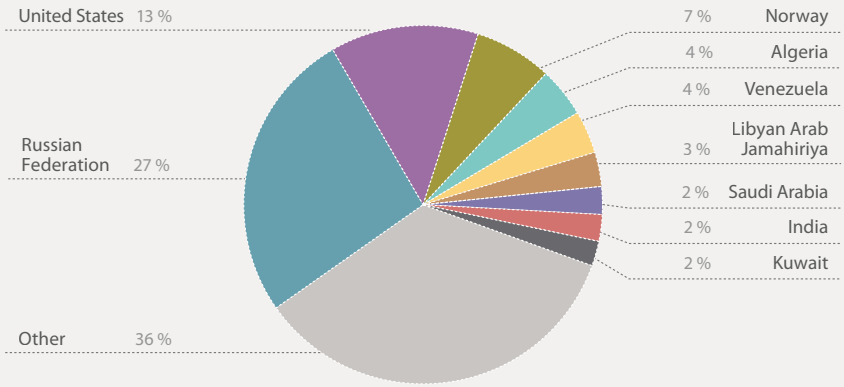
EU-27, EXPORTS OF CRUDE OIL TO THIRD-PARTY COUNTRIES (in %) (2008)
Total = 15.2 Mt

Source: Eurostat (monthly aggregated data)

([20]) Third-party countries to the EU with a share below 2 % of the total extra-EU imports or exports are grouped under the 'other' category. This is also applicable to Figures 45 and 46 and 47.

As is the case for crude oil, Russia is in 2008 the first supplier of petroleum products (mainly constituted of gas/diesel oil) to the EU with a 27 % share. The United States is second, with a 13 % share, due to its petroleum coke exports to the EU. In 2008, OPEC countries represented 19 % of the total EU petroleum products imports from third-party countries to the EU.

FIGURE 46

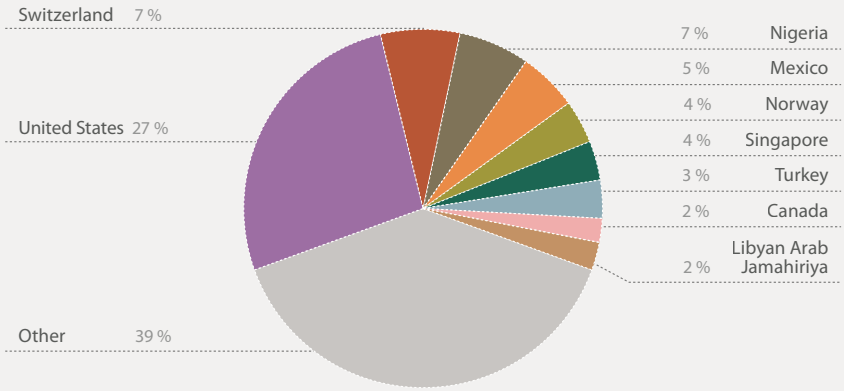


EU-27, IMPORTS OF PETROLEUM PRODUCTS FROM THIRD-PARTY COUNTRIES (in %) (2008)
Total = 122.7 Mt

Source: Eurostat (monthly aggregated data)

As is the case for crude oil, the United States is in 2008 the first destination for EU petroleum products exports with a 27 % share mainly constituted of gasoline.

FIGURE 47



EU-27, EXPORTS OF PETROLEUM PRODUCTS TO THIRD-PARTY COUNTRIES (in %) (2008)
Total = 107.1 Mt

Source: Eurostat (monthly aggregated data)

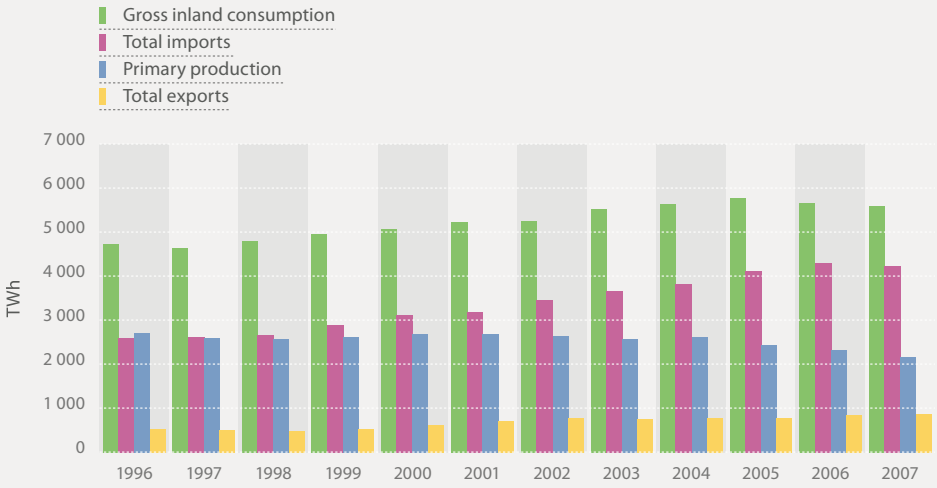
3.2. Market developments in the EU's gas sector

The period covering 2008 and the first half of 2009 was quite eventful for the gas sector in Europe. While other regions of the world and other energy commodities have been affected by huge price fluctuations resulting from a robust growth of demand being transformed by the global financial crisis into a slowdown of the real economy, none faced a disruption of supply challenge similar to what occurred in the European gas markets in January 2009.

A brief summary of the events that took place in one of the coldest winter days in 2009 can be found in the *Quarterly Reports on European Gas Markets* ([21]).

The EU's annual gas balance is slowly deteriorating, as the small reductions in consumption that started from 2006 onwards cannot compensate for the decreasing levels of domestic production.

FIGURE 48

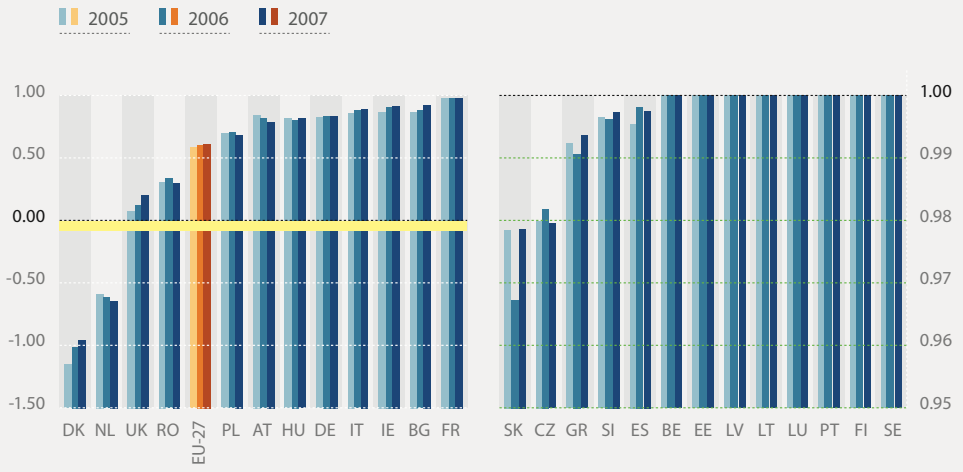


EU-27, ANNUAL BALANCE OF NATURAL GAS (in TWh) (1996-2007)

Source: Eurostat

As a result, EU's import dependency ([22]) increased from 0.43 in 1996 to 0.61 in 2007, the latest available year of official Eurostat statistics. Not surprisingly, import dependency is increasing in most of the Member States for the 2005-2007 period, the few exceptions being the Netherlands (becoming a more pronounced exporter), Romania (increase in stocks and a reduction of imports) and Austria (increase of exports and a small reduction in imports and in consumption).

FIGURE 49



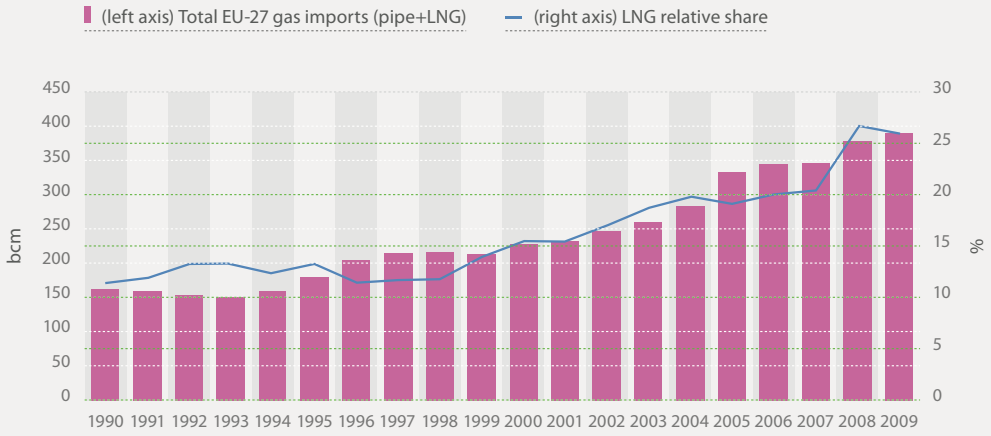
EU-27, NATURAL GAS IMPORT DEPENDENCY* BY MEMBER STATE (2005-2007)

Source: Eurostat
** 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.*

([21]) *http://ec.europa.eu/energy/observatory/gas/gas_en.htm*
([22]) *Measured as the ratio of net imports to gross inland consumption plus bunkers (storage in the case of gas).*

While the volume of imported gas into the EU is increasing, it seems that Member States are trying to diversify as much as possible the supply sources and routes. As suggested by Figure 50, the relative part of LNG deliveries is increasing with supplies coming from Norway, Algeria, Libya, Egypt, Nigeria, Equatorial Guinea, Trinidad and Tobago, Qatar, Oman and Malaysia. Also, the number of LNG entry points is increasing with new regasification plants coming on-stream in Italy and the UK.

FIGURE 50



EU-27, TOTAL IMPORTS OF NATURAL GAS AND RELATIVE SHARE OF LNG (in bcm, %) (1990-2009)

Source: Gas Strategies

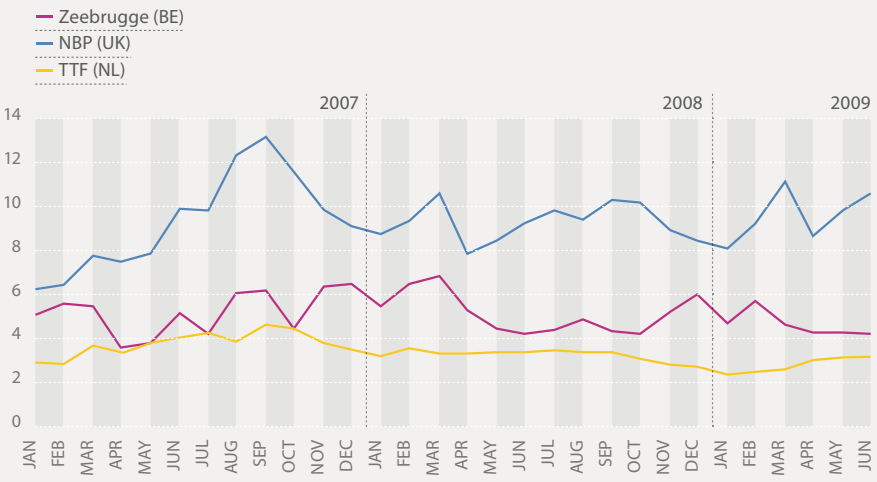
3.2.1. Wholesale markets

The traded and throughput volumes increased significantly on the active gas hubs in continental Europe. For the period covering 2007 to the first half of 2009, the monthly traded volume on the Dutch TTF almost tripled ([23]) while it grew by almost 60 % on the Belgian hub in Zeebrugge ([24]). For its part, the throughput increased by 161 % in TTF and by 95 % in Zeebrugge, reaching respectively 17 TWh and 10 TWh.

The UK NBP hub remained by far the most liquid in Europe, with trading volumes in the winter going typically above 1 100 TWh for a corresponding physical value of 100-120 TWh.

It seems that the churn rate ([25]) was not significantly affected by the reduction of gas demand resulting from the recession ([26]). This suggests that while industrial demand for gas was decreasing, market operators reduced the traded volumes correspondingly.

FIGURE 51



BE, NL, UK, MONTHLY CHURN RATE ON WHOLESALE MARKETS (1/2007-6/2009)

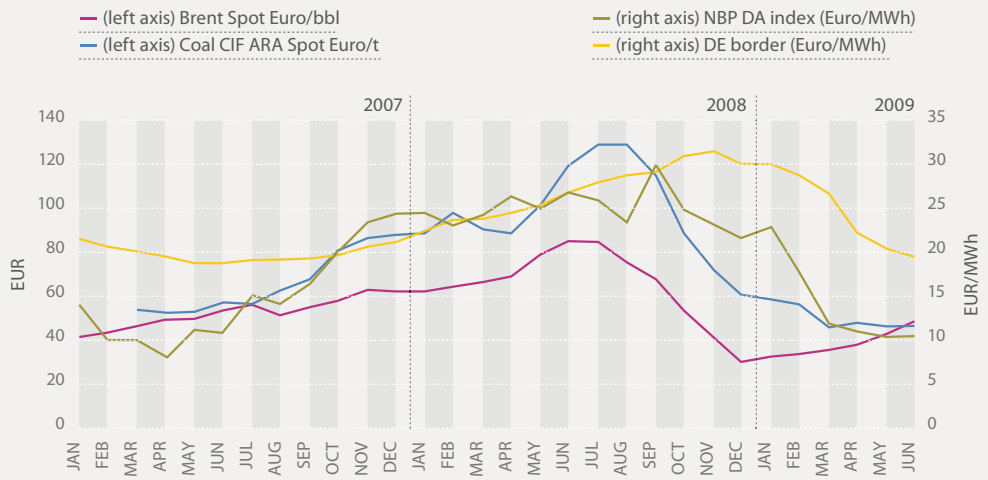
Sources: Huberator (BE); Gas Transport Services (NL); National Grid (UK); Platts (2009)

([23]) As reported by Gas Transport Services, the traded volume went from 19.30 TWh to 54.17TWh.
([24]) From 26.28 TWh to 41.95 TWh. (Source: Huberator).
([25]) The churn rate is an indicator for the liquidity of a market/hub. It measures the ratio between traded and physically delivered volumes.
([26]) Similarly, there are no indications that the January gas dispute affected the churn rate.

Spot markets

It is interesting to note that participants in the wholesale markets for gas did not seem to price in the effects of the January gas crisis ([27]). Some of the reasons for this may be that there were no disruptions observed on the grids of Central and Western Europe and that long term contracts which are used to price incoming pipe gas are indexed to a basket of oil and refined products with a lag of several months, so no immediate reaction of the price was to be expected. As can be witnessed from the next graph, the monthly average German border price ([28]) followed an evolution which was similar to the one of the reference oil benchmark, but with a lag of 5 to 7 months.

FIGURE 52



PRICES OF COMPETITIVE FUELS VS PRICE OF GAS ON SELECTED EU SPOT MARKETS (in EUR and EUR/MWh) (1/2007-6/2009)

Sources: © Platts (2009) (Brent, coal, NBP); BAFA (DE border)

On the other hand, the monthly average of the NBP spot price was following its own dynamic, reflecting the demand and supply conditions on the UK market. As a result, during the observed period the hub price was more volatile and reached the pre-crisis peak earlier than the oil indexed price.

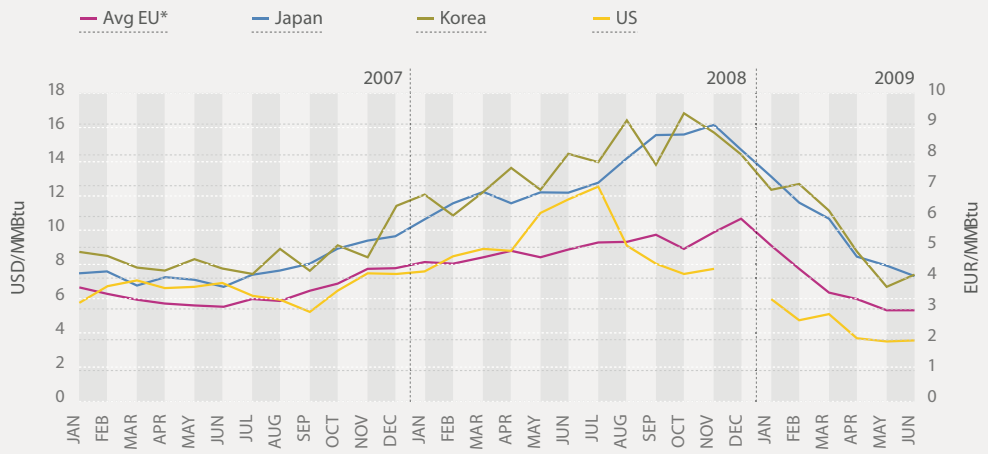
In periods of pronounced oversupply it may be expected that the pressure on the hub spot prices to further diverge from the oil market reference price will increase. During periods of buyer's market (supply being structurally higher than demand) the hub spot price tends to be below the indexed price, prompting the buyers of long term contracts to use the minimum quantity of gas, as specified by the take or pay obligations, and to cover their remaining needs with relatively cheap spot market supplies, such as LNG. This in turn increases the demand on the spot market but as additional supply comes in, hub spot prices may still fall.

The next graph indicates clearly that the global gas market was likely oversupplied in the middle of 2008. Prior to that date, strong demand from the Pacific basin was pulling the world LNG prices up, with spot cargoes going mainly in the South Asian regasification terminals. As prices were cut drastically in the space of a few months, some of the LNG deliveries to the Pacific became less attractive because the relative cost of transport was increasing. As a result, more cargoes were oriented to the Atlantic basin and mainly to Europe (since the average price was higher than the US price), keeping the market well supplied.

It is also interesting to observe that the EU average LNG prices were close to the Atlantic benchmark until the first third of 2008. Later, it seems that Atlantic prices decoupled. The US LNG price reached its peak monthly value in July 2008 (USD 12.56/MMBTU) and then fell steadily. The EU average LNG price was closer to the price of indexed gas: as the German border price it peaked in the end of 2008 and then fell continuously until June 2009.

([27]) However, a short period of increased volatility was observed in the middle of January on the spot prices for gas in some hubs.
([28]) The German border price is weighted average the pipe gas prices from 3 different suppliers defined by separate long term contractual arrangements.

FIGURE 53



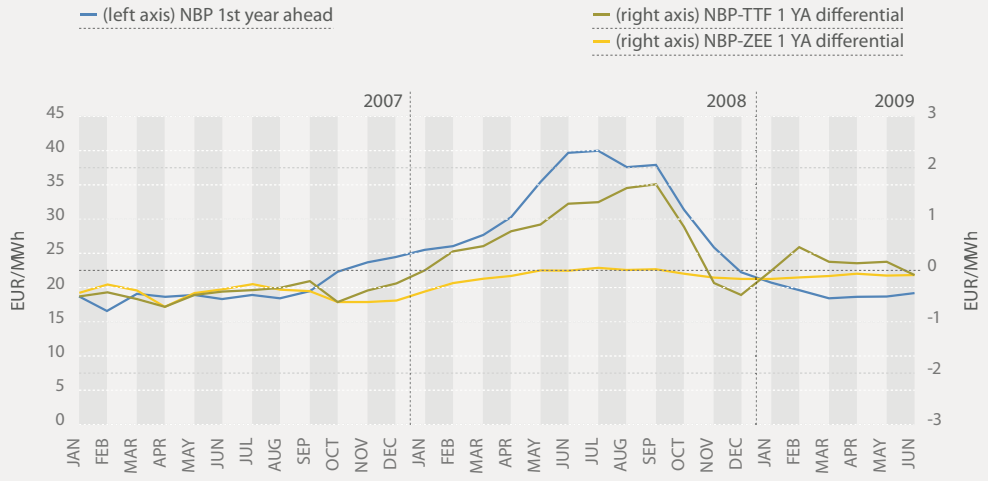
PRICES FOR LNG ON SELECTED WHOLESALE SPOT MARKETS (in EUR/MMBtu and in USD/MMBtu) (1/2007-6/2009)

Sources: Gas Strategies; Eurostat COMEXT
** 'Avg EU' is a weighted average price for monthly LNG deliveries in Belgium, Portugal, Spain and UK as reported by Eurostat.*

Forward markets

European gas prices on the forward curve were, in general less volatile than the closer to maturity contracts. For the period between 2007 and the first half of 2009 the highest to lowest price ratio was around 3 on the spot and 2 on the forward curve. The NBP contracts were mainly in contango ([29]) during this period as market operators were expecting prices in the longer term which were higher than the current level. Interestingly, the contango situation was unaffected by the strong appreciation and depreciation phases that occurred in the observed period as operators were estimating that the future market conditions would be tighter than the current ones.

FIGURE 54



EU, GAS PRICES ON EUROPEAN HUBS: FIRST YEAR FORWARDS (in EUR/MWh) (1/2007-6/2009)

Source: © Platts (2009)

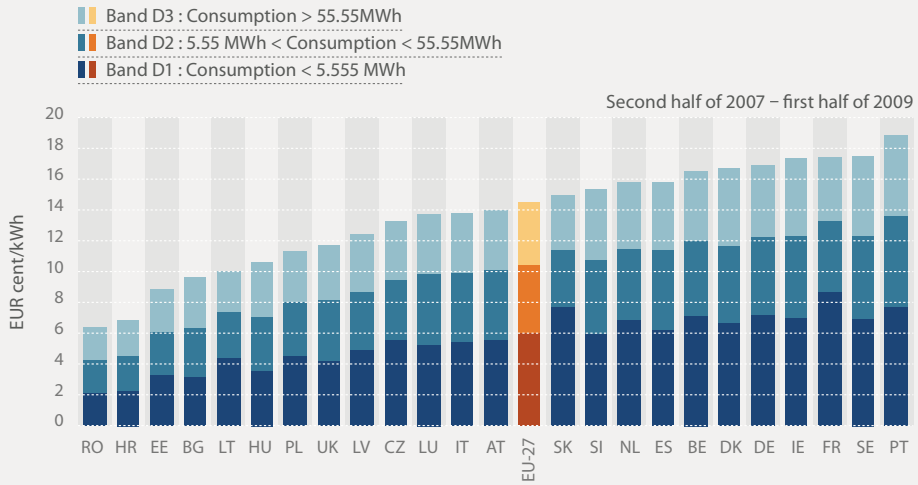
([29]) *The term* contango *describes a situation where the future price is* higher *than the spot price.*

During the appreciation phase, the price differential between the UK and the Netherlands increased to almost EUR 2/MWh. By the end of 2008 as prices started to slide, the differential turned the other way around. The Belgian year-ahead price was traded at a discount in 2007 and the beginning of 2008. As prices fell later on, it traded very close to the UK contract.

3.2.2. Retail markets

The prices of gas, net of taxes, for the three household bands were relatively close to the average EU levels in the period from the second half of 2008 to the first half of 2009. The price ratio of the Member States with the highest and cheapest price level was at 4.07 for the most modest group of consumers (band *D1*), while the corresponding values for groups *D2* and *D3* were 2.79 and 2.44 respectively.

FIGURE 55



EU-27, AVERAGE HOUSEHOLD PRICES FOR NATURAL GAS (WITHOUT TAXES) FOR SELECTED EUROSTAT ANNUAL CONSUMPTION BANDS (in EUR cent/kWh) (SECOND HALF OF 2007 – FIRST HALF OF 2009)

Source: Eurostat

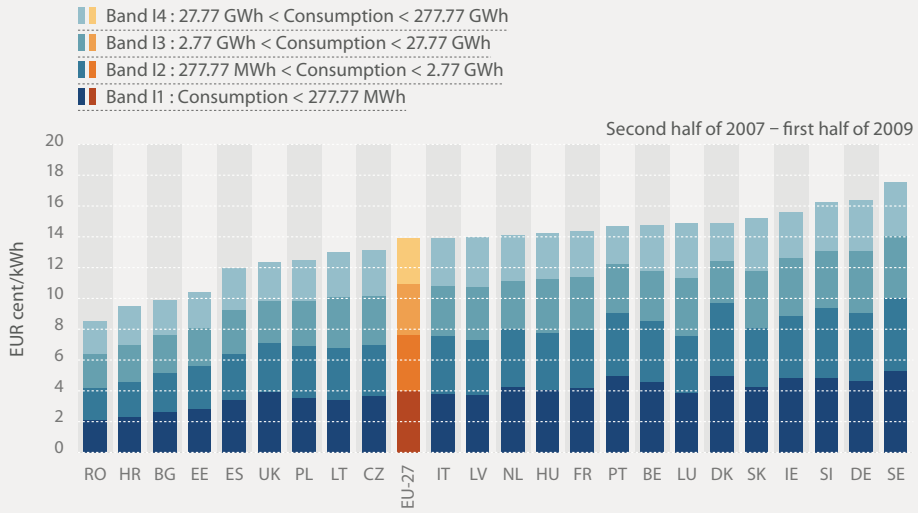
13/ The EU has eight regional gas hubs: National Balancing Point (UK), Title Transfer Facility (NL), Zeebrugge (BE), Point d'Echange de Gaz (FR), Punto di Scambio Virtuale (IT), GASPOOL and Net-Connect Germany (DE), Baumgarten (AU, CZ, HU, SK; operational in 2010).

When measured in Eurocents per kWh, 9 out of the 10 cheapest average prices are offered in the New Member States, with only Slovenia and Slovakia being above the EU average. However, these countries appear less competitive when the price is measured in purchasing standards.

While French and Slovak prices are relatively high for users in group *D1*, more intensive gas consumers in these two countries are enjoying prices which appear competitive on an EU level.

The dispersion of industrial gas prices, net of taxes, around the EU average is even less pronounced. The highest-to-cheapest price ratio is at 2.5, 2.2, 1.9 and 1.7 for the four reported bands of industrial consumers (and starting from the smaller consumers). This result may suggest that gas is considered as an important input for most of the users who are interested in prices as low as possible with respect to their competitors from other Member States. An alternative interpretation is that the majority of industrial users are paying according to an oil-indexed formula. The use of a similar pricing mechanism produces a harmonization effect across the Member States.

FIGURE 56



EU-27, AVERAGE INDUSTRIAL PRICES FOR NATURAL GAS (WITHOUT TAXES) FOR SELECTED EUROSTAT ANNUAL CONSUMPTION BANDS (in EUR cent/kWh) (SECOND HALF OF 2007 – FIRST HALF OF 2009)

Source: Eurostat

Italy and Slovakia are among the countries where modest consumers of gas fare relatively better than their compatriots using the gas more intensively. The UK, Denmark and Portugal are on the other side of the range, with big consumers of natural gas enjoying relatively more competitive prices than the modest users. As prices are really close to the EU averages for all of the observed industrial bands the differences on relative competitiveness remain minor.

3.3. Market developments in the EU's electricity sector

The Member States continued the gradual integration of their wholesale electricity markets throughout 2008 and the first half of 2009. During the observed period, a number of important developments occurred with the potential to speed up the creation of a functioning single market.

The *European Network of Transmission System Operators for Electricity* (ENTSO-E) became fully operational in July 2009, regrouping 42 TSOs from 34 states and replacing all existing European TSO associations. Proposed by the Commission in the Regulation on cross-border exchanges of electricity as part of the EU third internal energy market Package, ENTSO-E was established in order to ensure optimal management of the electricity transmission network and to allow the trade and supply of electricity across borders in the EU.

The reinforced cooperation of stakeholders in the Regional Initiatives of ERGEG, with the support of the European Commission, is also producing promising results in terms of market transparency, calculation and allocation of cross border capacity and day-ahead market coupling.

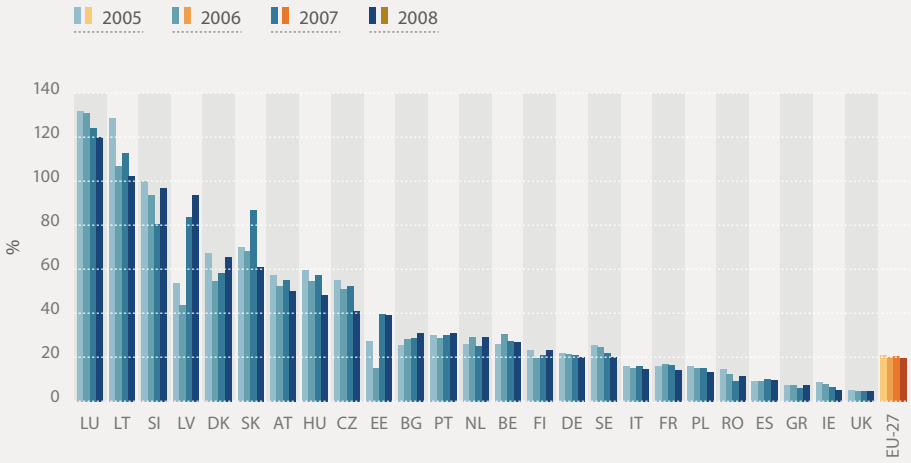
Finally, the ongoing process of regrouping ([30]) , consolidation ([31]) and cooperation ([32]) of the wholesale trading platforms across Europe is expected to further facilitate market participants in taking their economic decisions.

In 2008 and the beginning of 2009 the market participants continued to exchange actively electrical energy across the border. The total volume of exported and imported electricity of the 27 Member States reached 616.8 TWh in 2007, a value comparable to 2006 (615.9 TWh), but below the 2005 levels of 628.7 TWh. In 2008 the volume dropped by an additional 34 TWh to 582.4 TWh as it seems that the economic slowdown provoked a reduction of external trade.

Despite worsening economic prospects the EU-27 gross inland consumption of electricity grew by 0.2 % in 2008. It reached 3 272 TWh as 2008 was relatively colder than 2007 ([33]). As a result, the relative part of cross border flows to gross inland consumption of electricity remained relatively stable, dropping 1.5 points from 2005 to 2008 (from 19.4 % to 17.8 %).

Figure 57 shows that for the majority of Member States, the amount of energy exchanged with neighbouring countries compared to internal consumption remained well above 10 %.

FIGURE 57



EU-27, CROSS BORDER FLOWS OF ELECTRICITY (as % of gross consumption) (2005-2008)

Source: Eurostat
Cyprus is not exchanging electricity with other Member States; Data for Malta is missing.

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 centers at the heart of the continent.

The geographical position of a number of Member States (islands and peninsulas sharing few interconnections with the remaining parts of the continent) is still proving an obstacle for them to reach the indicative level of 10 % of cross border trade to inland consumption.

([30]) *Creation of a Baltic energy market with extension of the Nordic electricity market model to the three Baltic States following a Baltic integration roadmap (see the Communication from the Commission and the accompanying Action plan concerning the EU strategy for the Baltic sea region: http://ec.europa.eu/regional_policy/cooperation/baltic/pdf/communication/com_baltic_en.pdf http://ec.europa.eu/regional_policy/cooperation/baltic/pdf/communication/action2009.pdf).*
([31]) European Power Exchange (Epex-spot) *and* EEX Power Derivatives *replacing EEX and Powernext.*
([32]) *Common work of OMEL, Nordpool and Epex-spot on the concept of* price coupling of regions *aiming to coordinate the spot price formation of electricity across Europe. http://static.epexspot.com/document/5683/20091005_EPEX_PCR.pdf*
([33]) *According to JRC-Eurostat data, there were 2 943 and 3 008 HDDs in 2007 and 2008 respectively.*

3.3.1. Wholesale markets

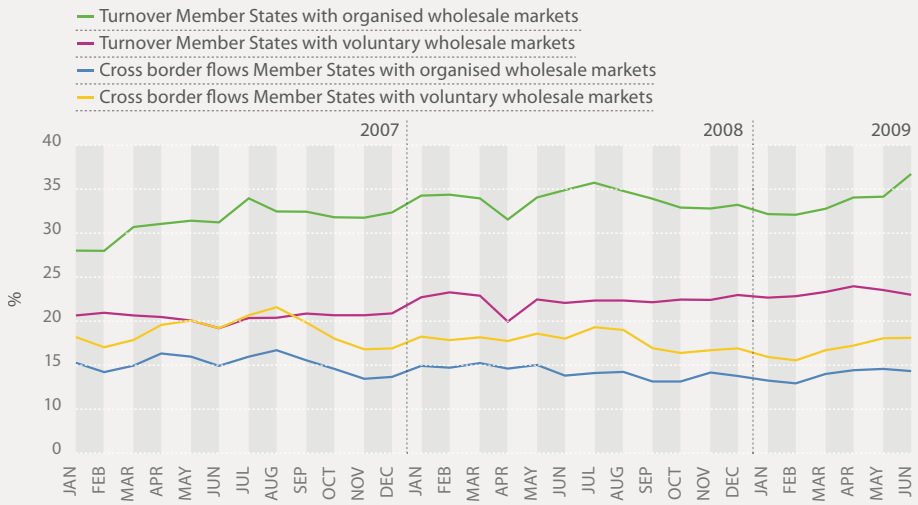
Looking into the group of selected Member States with functioning wholesale markets ([34]), it seems that the countries that developed voluntary trading venues ([35]) are relatively more open to cross border exchange of electricity than the countries with mandatory pools ([36]). For the former, the cross border ratio for 2005-2008 was between 18.8 % and 17.1 %; for the latter it was in the 17.3 % – 15.8 % range. However, the difference could also be explained by the geographical position of the respective Member States (see Figure 58).

While the relative part of external trade remained mostly stable between 2007 and the first half of 2009, (with a tendency to drop from the last third of 2008 that coincided with the start of economic recession), the turnover of the organized electricity exchanges continued to increase.

For the group of Member States with functioning wholesale markets the ratio of the total traded volume on the day-ahead segment to the inland electricity consumption, known also as the churn rate, went from 0.27 in January 2007 to 0.36 in June 2009, representing a rise of almost a third within 30 months.

While the consumption of electricity reached historical lows during the second quarter of 2009, the strong performance of the churn suggests that turnover on the exchanges was less elastic to reduction of industrial demand for electricity than the overall consumption. For example, the year-on-year change in consumption for the Member States with voluntary trading platforms was -11.9 %, -7.4 % and -7.1 % in the months of Q2 2009, while the corresponding change of the turnover on the power exchanges was +5.8 %, -2.6 and -2.6 %.

FIGURE 58



EU, DAY-AHEAD TURNOVER OF WHOLESALE ELECTRICITY MARKETS AND CROSS BORDER FLOWS OF ELECTRICITY (as % of gross consumption) (1/2007-6/2009)

Sources: Eurostat; Platts (2009); Operator trhu s elektrnou; Towarowa Gielda Energii S.A.; Operatul Pietei de Energie Electrica din Romania; Hellenic Transmission System Operator

Reported Member States with voluntary wholesale markets include: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, the Netherlands, Poland, Romania, Sweden, United Kingdom and Norway.
Reported Member States with organised wholesale markets include those with voluntary trading platforms and Greece, Italy, Portugal and Spain.

The subgroups of voluntary and mandatory exchanges recorded similar developments as it appears that the financial crisis provoked a shift in the preferences of market participants from bilateral and over-the-counter transactions to the trading on organized exchanges which is offering a centralized clearing and hence a reduction of the counterparty risk.

14/ The EU has 10 power exchanges: Nordpool (Northern Europe), APX (NE and UK), EPEX (DE, AT, FR, CH), BPX (BE), IPEX (IT), OMEL (ES and PT), PPOL PX (PL), OTE (CZ and SK), OPCOM (RO), Hellenic Pool (EL and CY). LITPZ (LT) and HUPX (HU) are planned.

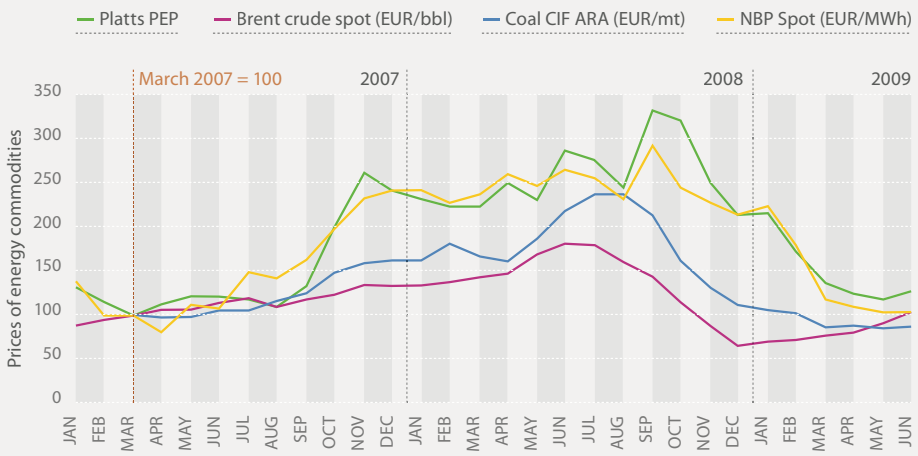
([34]) According to data availability.
([35]) Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, the Netherlands, Poland, Romania, Sweden, United Kingdom and Norway.
([36]) Greece, Italy, Portugal and Spain.

Spot markets

By the end of the first half of 2009, spot prices of energy commodities were at levels which were similar to the ones experienced at the beginning of 2007. Oil, coal, gas and electricity recorded two different phases of evolution in that period: one of a strong appreciation of the value of commodities that lasted until the beginning of the second half of 2008 and one of falling prices and stabilization that was triggered by the financial turmoil which began in September 2008.

As indicated by Figure 59, while the Brent contract was the most stable of the selected energy commodities, its monthly average spot price recorded huge fluctuations, going from EUR 41.29/bbl in January 2007, to EUR 85.17/bbl in June 2008, to EUR 30.13 in December 2008 before finishing the first half of 2009 at EUR 48.91/bbl. The Brent contract also appeared as the leading energy commodity as its spot price was among the first to fall, to stabilize and to rise again.

FIGURE 59



PRICES OF ENERGY COMMODITIES (March 2007=100) (1/2007-6/2009)

Source: © Platts (2009)

In comparison, the coal CIF ARA average monthly spot price per metric ton was multiplied by almost 2.5 between March 2007 and August 2008 (EUR 54.41 vs EUR 128.93), then lost about two thirds of its value until March 2009 where it stabilized at levels lower than those in 2007 (EUR 46.63).

It was gas, and especially electricity, that were among the most volatile energy commodities. Compared to March 2007, the monthly average spot price of the NBP gas contract almost tripled in September 2008. The monthly *Platts Pan European Power index*, was multiplied by 3.3 for the same period (from EUR 28.77/MWh to EUR 95.83/MWh respectively). As the index measures the average price on a number of trading places ([37]), it appears that some wholesale markets have experienced even higher volatilities.

Among the factors that influenced spot electricity prices in the 18-month period starting from 2007 were the usual supply ([38]) and demand ([39]) drivers as well as factors such as market sentiment (capturing uncertainty and volatility). Detailed information on price developments can be found in the *Quarterly Reports on European Electricity Markets* of the Market Observatory for energy ([40]).

Financial markets

The average monthly prices of long-term (two years ahead) electricity forwards evolved in a way similar to the spot electricity prices but remained relatively more stable. As suggested by Figure 60, the most volatile contract appears to have fluctuation levels comparable to the Brent spot price.

It seems that a trading pattern is gradually emerging where the Nordpool contract trades at an average monthly discount of EUR10/MWh with respect to the German forwards. As a rule, the forward prices in Central Western Europe evolved in a tight range of EUR 2-3/MWh around the German prices and the UK contract trades at a small premium with respect to CWE.

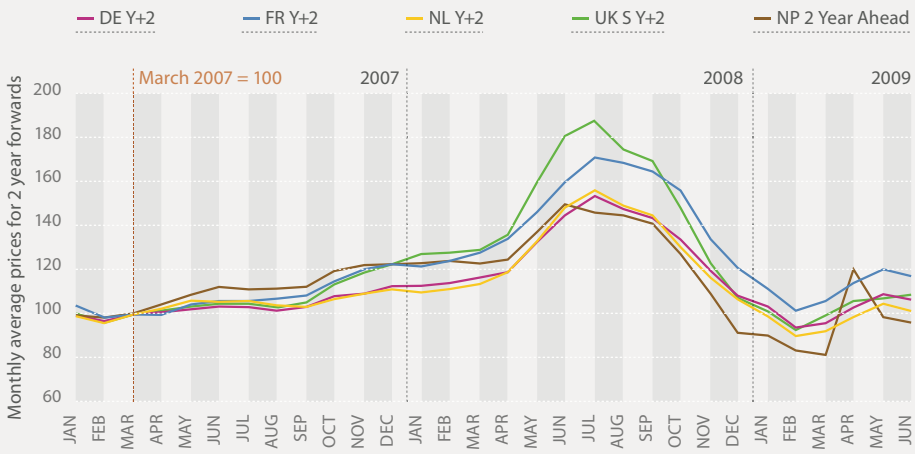
([37]) The index measures the weighted day-ahead assessments on a number of European wholesale markets including Belgium, France, Germany, the Netherlands, Spain, UK and Switzerland.

([38]) Some of the drivers include the relative price of inputs from competing fuels and emissions as indicated by the spark and dark spreads, plant availability, short term forecasts on wind conditions, hydro reserves, the state of the high voltage grid, the interconnector availability and so on.

([39]) Such as industrial production, temperature, the state of the load, etc.

([40]) http://ec.europa.eu/energy/observatory/electricity/electricity_en.htm

FIGURE 60



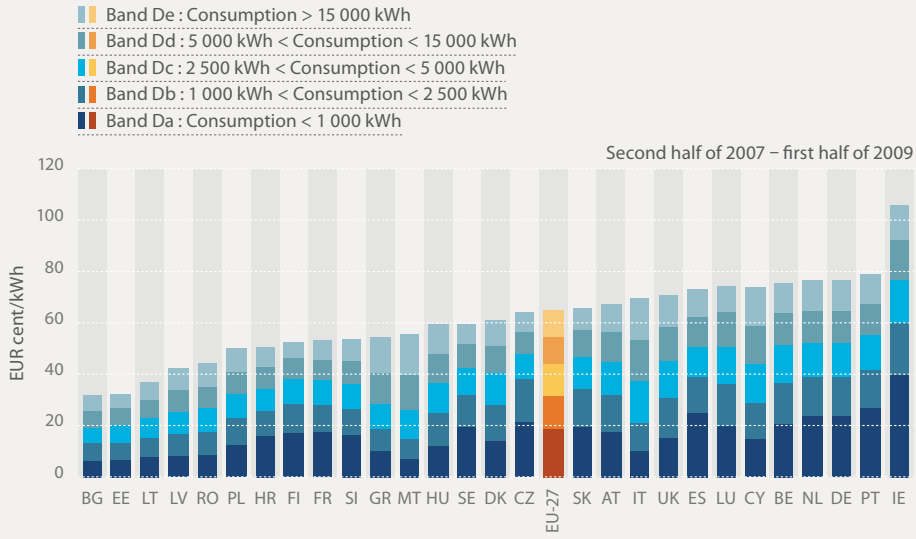
EU, MONTHLY AVERAGE PRICES OF TWO-YEAR AHEAD ELECTRICITY FORWARD (March 2007=100) (1/2007-6/2009)

Source: © Platts (2009)

3.3.2. Retail markets

Household electricity prices, net of taxes, for the 5 reported consumption categories of Eurostat differ substantially from one Member State to the other. For example, an average consumer from the most modest band *Da* can expect a biannual average price for the period covering the second half of 2007 until the first half of 2009 in the range of EUR 0.06/kWh – EUR 0.40/kWh depending on his or her country of residence, indicating a price difference of 1 to more than 6. For the higher consumption band the ratio of most expensive to cheapest price decreases, going from 3.09 and 2.66 for bands *Db* and *Dc* to 2.44 and 2.46 for bands *Dd* and *De*.

FIGURE 61



EU-27, AVERAGE HOUSEHOLD PRICES FOR ELECTRICITY (WITHOUT TAXES) FOR SELECTED EUROSTAT ANNUAL CONSUMPTION BANDS (in EUR cent/kWh) (SECOND HALF OF 2007 – FIRST HALF OF 2009)

Source: Eurostat

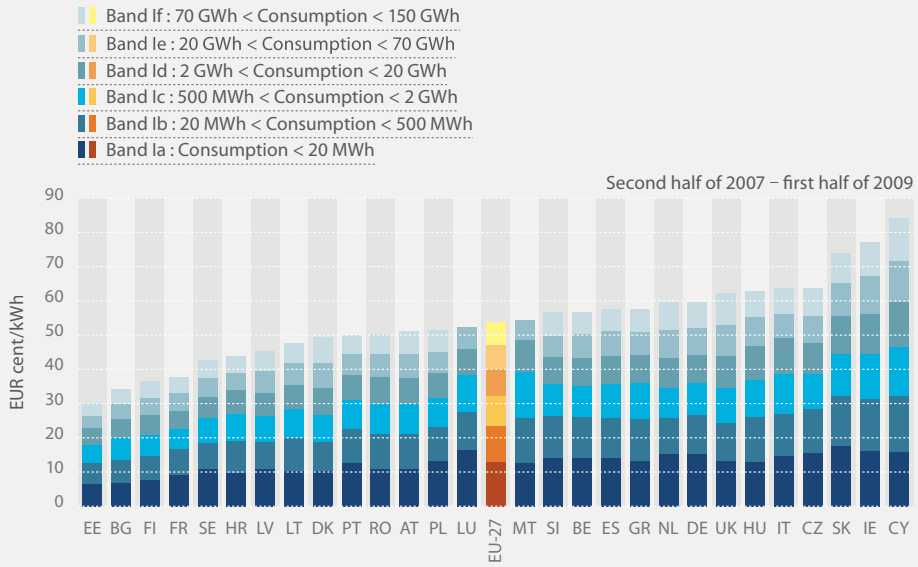
In general, New Member States are offering one of the cheapest prices of the kWh for all 5 categories. However, once the prices are measured in purchasing power standards instead of euro, the ranking of the Member States changes significantly, with New Members States moving to the right of the list where more expensive countries are displayed.

While prices for modest consumers in Malta and Italy appear very competitive, this is not the case for the more intensive users of electricity. Households in bands *Dc*, *Dd* and *De* in these two countries are paying one of the most expensive prices of the kWh.

In a similar manner, big consumers of electricity in France and Finland enjoy competitive prices while the more modest users in these countries are paying the kWh above the corresponding EU average.

The spread between cheap and expensive price area for industrial electricity prices, net of taxes and covering the period from second half of 2007 until the first half of 2009, is in general smaller than the one of household prices.

FIGURE 62



EU-27, AVERAGE INDUSTRIAL PRICES FOR ELECTRICITY (WITHOUT TAXES) FOR SELECTED EUROSTAT ANNUAL CONSUMPTION BANDS (in EUR cent/kWh) (SECOND HALF OF 2007 – FIRST HALF OF 2009)

Source: Eurostat

It seems that industrial consumers from the lower consumption bands ([41]) are more closely distributed around the EU average than the big industrial users of electricity. For example, the price range for consumers in band *Ia* and *Ib* is respectively EUR 0.07/kWh – EUR 0.18/kWh and EUR 0.06/kWh – EUR 0.16/kWh, so the ratios are 2.56 and 2.76. When it comes to bands *Ie* and *If* prices vary from EUR 0.04/kWh to EUR 0.12/kWh, with corresponding ratios of 3.20 and 4.57.

7 out of the 10 Member States with the most competitive electricity prices (net of taxes) are from the Nordic and the Baltic region, while 4 of the 6 less competitive countries are New Member States.

As a rule, end consumer industrial and household prices increased during the observed period, reflecting with some lag the increase of wholesale prices. Some of the exceptions to that rule were the countries from the Nordic region, France and some new Member States such as Poland and Romania with lower domestic and industrial prices in the first half of 2009 than in the second half of 2008.

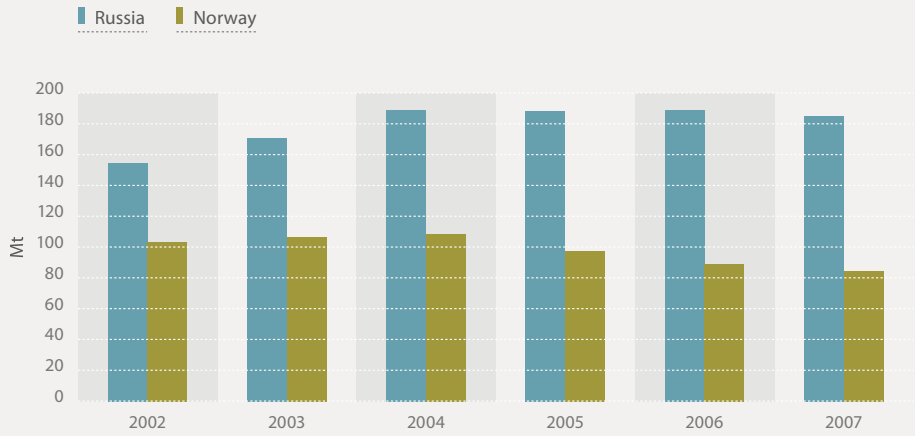
([41]) *As defined in the Eurostat Energy Statistics database.*

4. Oil and gas: key data on selected supplier and transit countries

4.1. Focus on key EU suppliers

In this chapter, key energy facts and figures on Russia, Norway and Algeria are presented. They are the main suppliers of oil and gas for the EU.

FIGURE 63



EU-27, CRUDE OIL IMPORTS FROM RUSSIA AND NORWAY (in Mt) (2002-2007)

Source: Eurostat

TABLE 5

Crude oil imports into EU-27 (% of total imports)

	2002	2003	2004	2005	2006	2007
RUSSIA	30	31	33	33	34	34
NORWAY	20	20	19	17	16	15

EU-27, SHARE OF RUSSIA AND NORWAY IN TOTAL CRUDE OIL IMPORTS (in %) (2002-2007)

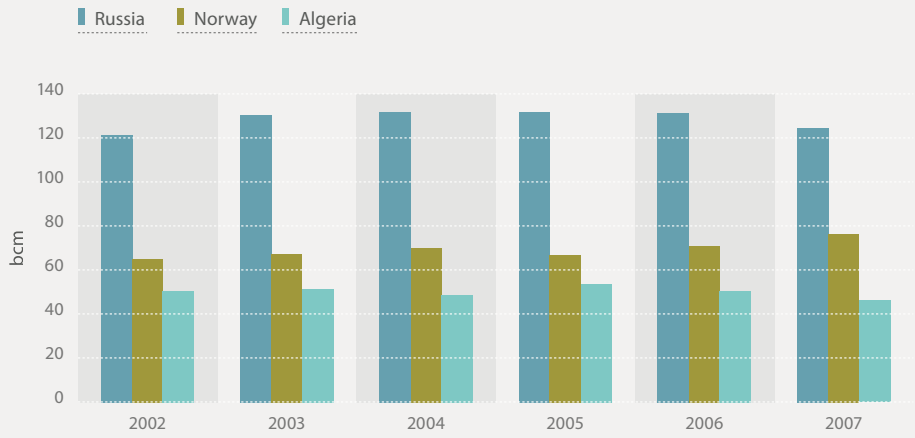
Source: Eurostat

Russia and Norway are the most important crude oil suppliers to the EU. The share of Russian crude oil imports has increased since 2002, while the share of Norwegian crude oil has declined. This is in line with the declining production in the North Sea.

As far as natural gas is concerned, Russia has throughout the observed period remained by far the most important exporting country to the EU, even though its share in the EU imports has somewhat decreased. On the other hand, Norway has in the same period increased the exported volumes of natural gas to the EU, as well as its share in the EU imports.

Algeria steeply increased its gas production since the 1980s and became the third most important gas exporter to the EU.

FIGURE 64



EU-27, NATURAL GAS IMPORTS FROM RUSSIA AND NORWAY AND ALGERIA (in bcm) (2002-2007)

Source: Eurostat

TABLE 6

Natural gas imports into the EU-27 (% of total imports)

	2002	2003	2004	2005	2006	2007
RUSSIA	47	48	46	44	42	41
NORWAY	27	26	26	24	24	27
ALGERIA	22	21	19	20	18	17

EU-27, SHARE OF RUSSIA, NORWAY, ALGERIA IN TOTAL NATURAL GAS IMPORTS (in %) (2002-2007)

Source: Eurostat

4.1.1. Russian Federation

The Russian Federation is the EU's single most important supplier of energy products, accounting for over 25 % of EU consumption of oil and gas. Europe is the most important destination for Russia's energy exports.

Disagreements on the terms of sale and transit of Russian gas through Ukraine have led to gas supply interruptions in January 2006, March 2008 and January 2009. While the interruption in 2008 was entirely absorbed by Ukraine, the interruptions in 2006 and 2009 affected EU Member States to varying degrees, with the interruption in 2009 becoming the most serious to date.

The deliveries of oil have been interrupted as well. In 2003 oil ceased flowing through the Druzhba pipeline to the Latvian port of Ventspils and in 2006 also to the Lithuanian port of Butinge. Additionally, in 2007, oil deliveries through Belarus were affected for a few days as a consequence of the dispute on oil transit.

Nevertheless, the share of Russian hydrocarbons on the EU market is projected to remain high in the future, considering not only the geographical proximity of Russia and the EU but also the large Russian reserves of hydrocarbons and falling domestic production from the EU's North Sea oil and gas fields.

TABLE 7

Oil

	2005	2006	2007
ANNUAL PRODUCTION (Mbbl)	3 400	3 500	3 600
PRODUCTION TO DATE (Mbbl)	132 400	135 900	139 500
RESERVES (PROVEN AND PROBABLE) (Mbbl)	134 000	131 000	127 000

Gas

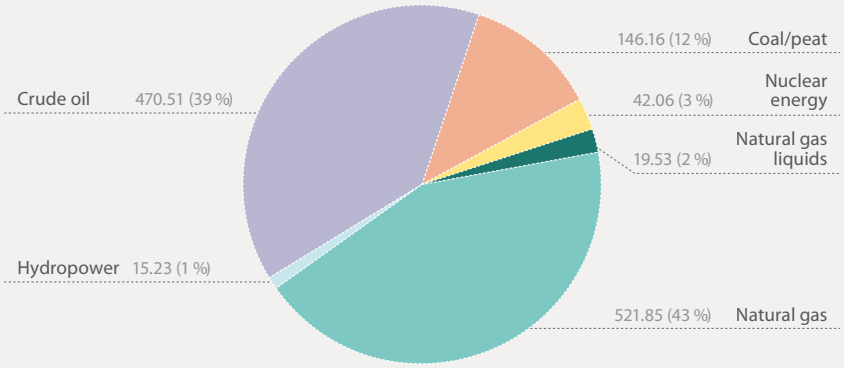
	2005	2006	2007
ANNUAL PRODUCTION (bcm)	622	636	631
PRODUCTION TO DATE (bcm)	15 600	16 300	16 900
RESERVES (PROVEN AND PROBABLE) (bcm)	49 000	48 800	48 800

RUSSIA, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2005-2007)

Source: © Petroconsultants SA (2009) (rounded values)

The hydrocarbon reserves create a very solid basis for high primary energy production. It amounted to 1 230.6 Mtoe in 2007 (compared to 1 220.0 Mtoe in 2006), with crude oil and natural gas representing more than 80 %.

FIGURE 65 ([42])



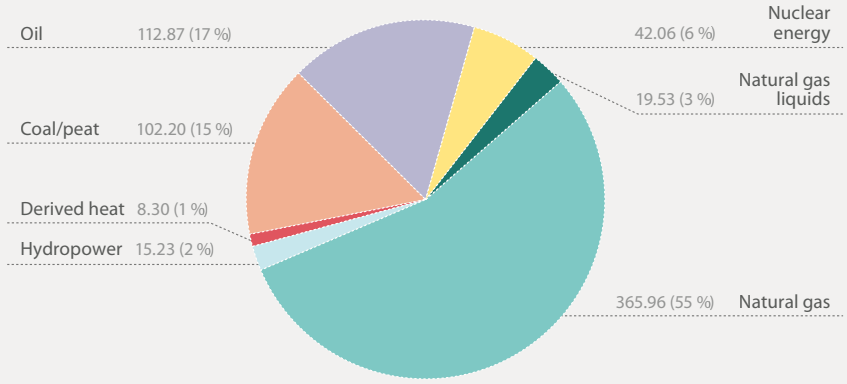
RUSSIA, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe, %) (2007)
Total = 1 215.34 Mtoe

Source: © OECD/IEA (2009)

In 2007, gross inland consumption reached 672.1 Mtoe and 670.7 Mtoe in 2006. Almost half of the gross inland consumption is secured through natural gas. Judging by volumes only, leaving transport and export considerations apart, it can be said that the vast majority of the gross inland consumption is sourced from domestic gas fields (imports are only 1 % of primary gas production).

([42]) Values under 1 % are not presented. The same is applicable to Figure 66.

FIGURE 66

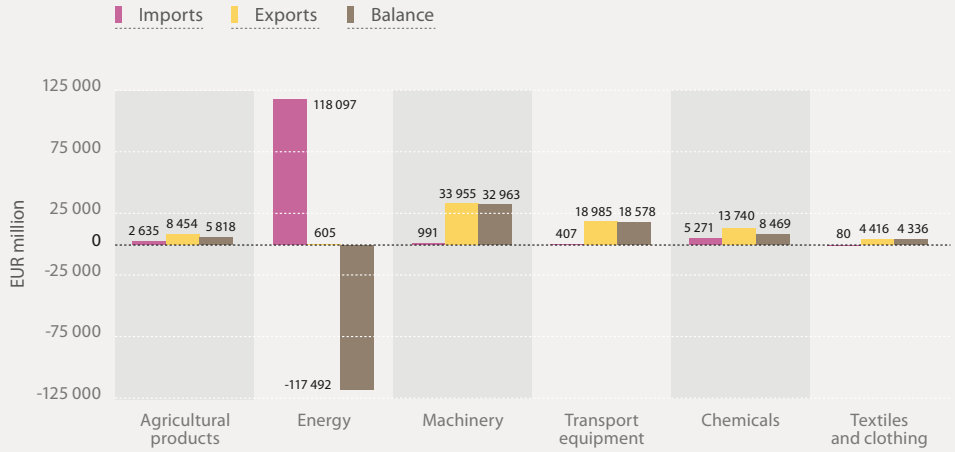


RUSSIA, GROSS INLAND CONSUMPTION (ENERGY MIX) (in Mtoe, %) (2007)
Total = 666.15 Mtoe

Source: © OECD/IEA (2009)

Gross inland consumption represents only around 50 % of the total primary energy production, which makes a large quantity of hydrocarbons available for export. The exact figures are difficult to obtain, however in 2005 the share of EU-25 in Russian exports was approximately 50 % for both natural gas and crude oil ([43]).

FIGURE 67



EU-27, MERCHANDISE TRADE WITH RUSSIA (in EUR million) (2008)

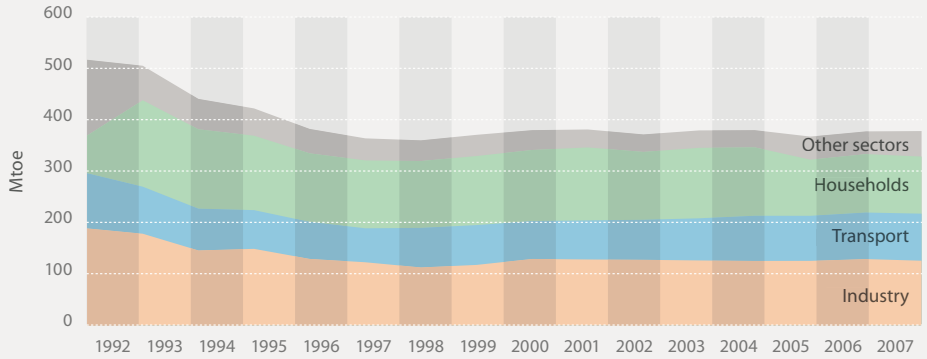
Source: European Commission

Energy is by far the most important product in the bilateral merchandise trade between EU and Russia. The EU has a positive trade balance with Russia in many product categories. However, imports of energy from Russia are so large that the whole EU trade balance is negative (in year 2008 the deficit amounted to EUR 68 billion).

As far as Russian domestic energy use is concerned, final energy consumption in 2006 and 2007 was 381.9 Mtoe and 382.5 Mtoe respectively. The steep decrease in the previous decade reflects the transformation depression and restructuring of the post-Soviet economy. The level of consumption after 2000 remained fairly stable around 380 Mtoe.

([43]) *Source: The European Union and Russia – Statistical Comparison, Eurostat, 2007.*

FIGURE 68

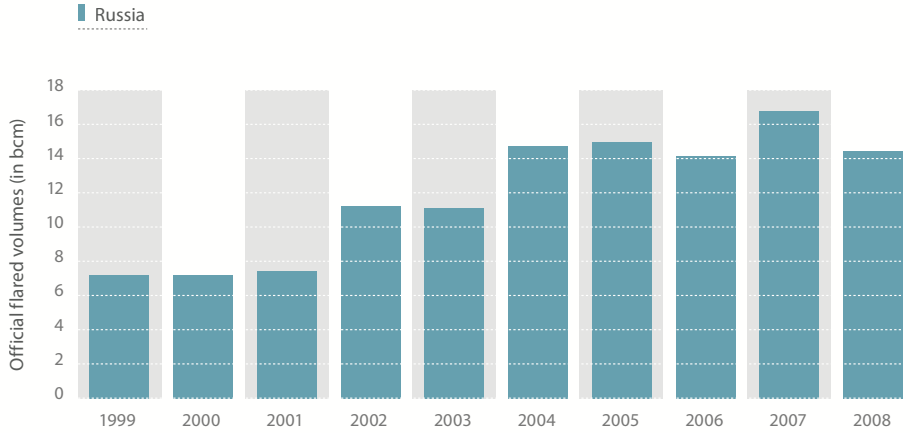


RUSSIA, FINAL ENERGY CONSUMPTION (in Mtoe) (1992-2007)

Source: © OECD/IEA (2009)

Flaring of gas in Russia

FIGURE 69



RUSSIA, FLARED VOLUME OF GAS (in bcm) (1999-2008)

Source: Government of Russia

The officially reported data shows that flaring of associated gas (i.e. gas in connection with oil production) in Russia reached around 14 bcm in 2008. However, other data indicate higher levels. According to the satellite estimates by GGFR (Global Gas Flaring Reduction Partnership), the volumes were 58.6 bcm in 2005, 50.3 bcm in 2006, 51.6 bcm in 2007 and 40.3 bcm in 2008, making Russia the biggest gas flaring country in the world. (According to the same sources, Nigeria is in second place with 14.9 bcm of flared gas in 2008). The reasons behind these large volumes are lack of regulation and adequate national policy, but also long distances to markets and limited local markets, which makes it difficult to sell excess gas. In 2007, President Putin instructed the Russian government to implement appropriate measures. In 2008 the government set a target to utilise 95 % of associated gas by 2012.

BOX 4

4.1.2. Norway

Norway is the EU's second most important supplier of oil and gas after Russia. Energy issues between EU and Norway are addressed through Norway's membership in the European Economic Area and through the Energy Dialogue which was established in 2002. It aims principally at the coordination of energy policies including research and technological development in the energy sector and relations with other energy producing countries.

Through the EEA Agreement, Norway is an integral part of the EU internal energy market. However, it has not fully implemented the EU legislation related to gas as it exports almost all its gas (domestic consumption accounts for only 6 % of the primary gas production).

The annual production of gas has been increasing. Estimates from the Norwegian Petroleum Directorate indicate that by 2020, gas production can reach a volume of between 115-140 billion cubic meters per year. On the other hand, and as the table shows, the production of oil has been decreasing.

TABLE 8

Oil

	2005	2006	2007
ANNUAL PRODUCTION (Mbbl)	1 070	1 010	930
PRODUCTION TO DATE (Mbbl)	20 300	21 300	22 200
RESERVES (PROVEN AND PROBABLE) (Mbbl)	10 500	9 500	9 000

Gas

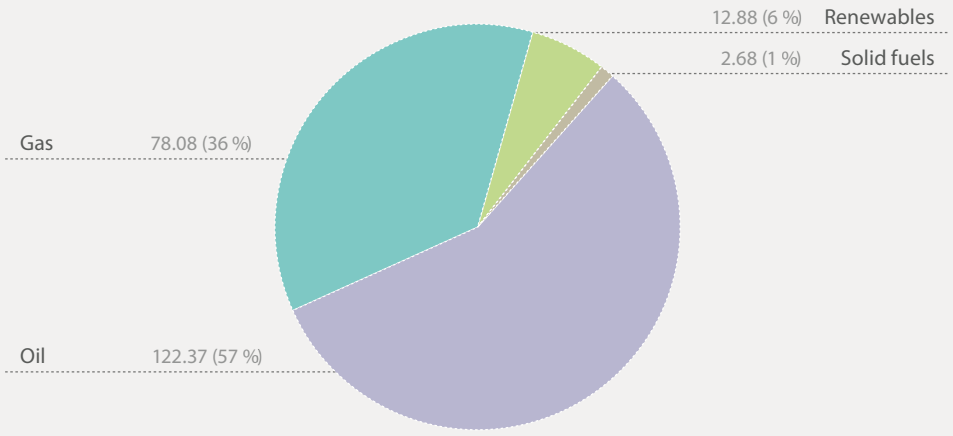
	2005	2006	2007
ANNUAL PRODUCTION (bcm)	85	94	97
PRODUCTION TO DATE (bcm)	1 080	1 200	1 300
RESERVES (PROVEN AND PROBABLE) (bcm)	3 200	3 150	3 100

NORWAY, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2005-2007)

Source: © Petroconsultants SA (2009) (rounded values)

On the whole, hydrocarbons make up more than 90 % of Norwegian total primary energy production and almost 40 % of the hydrocarbons are gas.

FIGURE 70

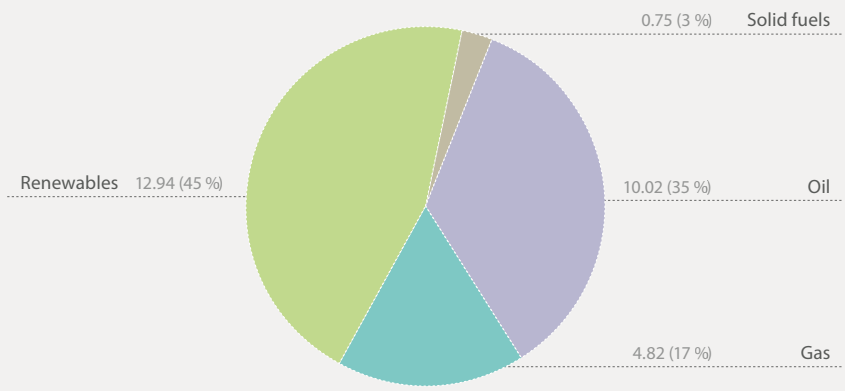


NORWAY, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe, %) (2007)
Total = 216.01 Mtoe

Source: Eurostat

The gross inland consumption in 2007 was 27.7 Mtoe and 25.0 Mtoe in 2006. Compared to the total primary energy production, this is 12.8 % and 11.2 % respectively.

FIGURE 71



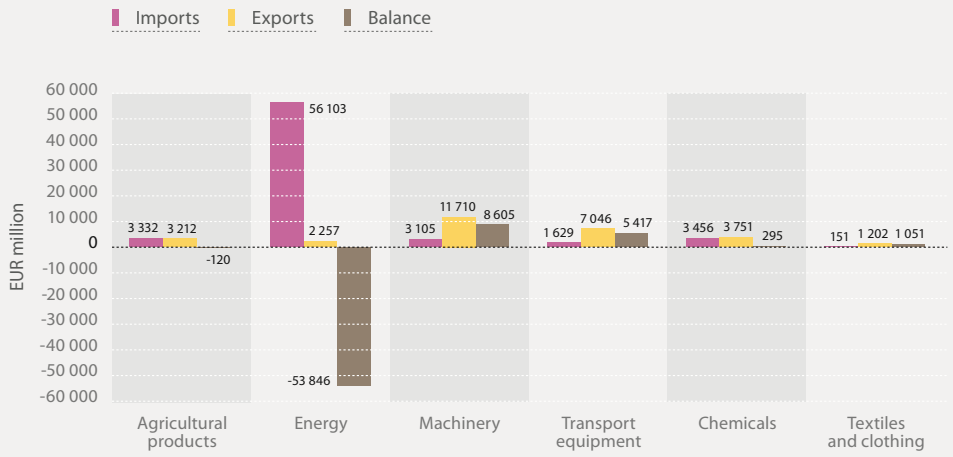
NORWAY, GROSS INLAND CONSUMPTION (ENERGY MIX) (in Mtoe, %) (2007)
Total = 28.53 Mtoe

Source: Eurostat

Looking at total primary energy production, it is clear that renewable energy sources (most notably hydropower) play the major role in the domestic energy supply (although they account only for 12.88 % of the primary production). In 2007, only 6 % of gas was consumed in Norway, while the rest was exported.

Almost all of Norwegian gas and oil is exported to the EU. As the EU imports also Norwegian electricity, energy constitutes the most important group in the merchandise trade. As in the case of Russia, energy trade creates such a deficit that the whole EU trade balance with Norway is negative (in 2008 the deficit amounted to EUR 48 bn).

FIGURE 72



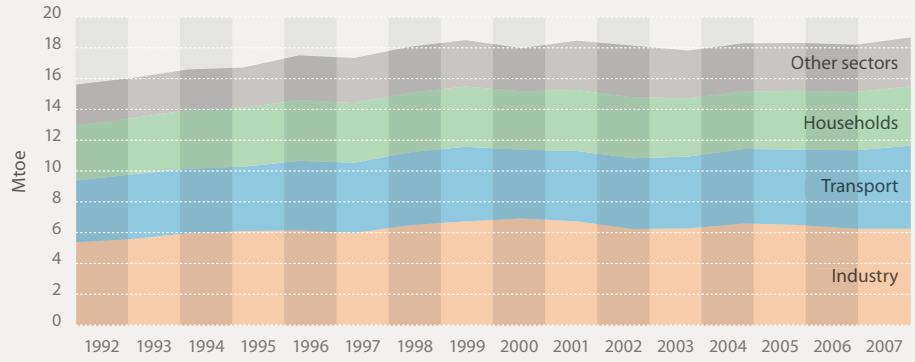
EU-27, MERCHANDISE TRADE WITH NORWAY (in EUR million) (2008)

Source: European Commission

In the last decade, Norwegian final energy consumption remained stable at around 18 Mtoe, more precisely 18.62 Mtoe in 2001, 18.36 Mtoe in 2006 and 18.84 in 2007. The average growth in consumption in the period from 2001 to 2007 was 0.55 %, while the average real GDP growth in the same period was 2.35 %, indicating a decoupling between economic growth and energy consumption.

15/ In 2007 Norway was Europe's main oil producing country, the tenth in the world. The EU's main oil producing country was the UK (607 Mbbl), followed by Denmark (113 Mbbl). Saudi Arabia produced 3 665 Mbbl of oil.

FIGURE 73

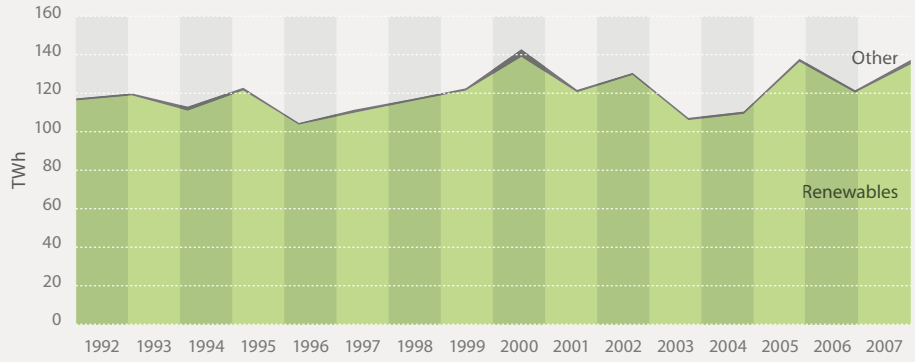


NORWAY, FINAL ENERGY CONSUMPTION BY SECTOR (in Mtoe) (1992-2007)

Source: Eurostat

The relatively small importance of gas for domestic energy supply is again confirmed in the electricity generation sector where renewable energy sources (hydropower) are by far the most important source.

FIGURE 74



NORWAY, ELECTRICITY GENERATION (in TWh) (1992-2007)

Source: Eurostat

Out of 22 500 MW of installed generation capacity, 21 500 MW are hydropower plants, reflecting abundant hydro resources. Consequently Norwegian final electricity consumption per capita was in year 2007 approximately 23 500 kWh per capita. This is more than the consumption in the neighbouring Scandinavian countries (14 500 kWh per capita in Sweden and 16 000 kWh per capita in Finland), and considerably above EU-27 consumption (5 700 kWh per capita).

Large hydro energy potential makes Norway an attractive partner for electricity trade. In 2007, EU-27 imported 14.4 TWh of electricity from Norway.

16/ In 2007 Norway was Europe's main gas producing country, the sixth in the world. The EU's main gas producing country was the UK (75 987 Mcm), followed by the Netherlands (68 293 Mcm).

4.1.3. Algeria

With the current stable political situation and very favourable hydrocarbon production which lasted from the beginning of this decade up till the present economic crisis, Algeria managed to rapidly increase its fiscal revenue and to accumulate exchange reserves.

With increased hydrocarbons revenues, Algeria embarked on a massive public investment programme, the so-called second Economic Recovery Programme in the period from 2005 to 2009. The programme has been allocated a substantial budget, estimated at EUR 45 billion, the largest share of which is going to the housing sector, followed by infrastructure, public services and agriculture.

Looking at the reserves, it is likely that hydrocarbons and especially natural gas can continue to play an important role in Algerian revenues in the future. Nevertheless, it can be noted that the ratio between reserves and production has fallen in the last three years. However, this is a conservative estimate of the reserves.

TABLE 9

Oil

	2005	2006	2007
ANNUAL PRODUCTION (Mbbl)	705	708	720
PRODUCTION TO DATE (Mbbl)	18 800	19 500	20 300
RESERVES (PROVEN AND PROBABLE) (Mbbl)	13 000	12 500	11 800

Gas

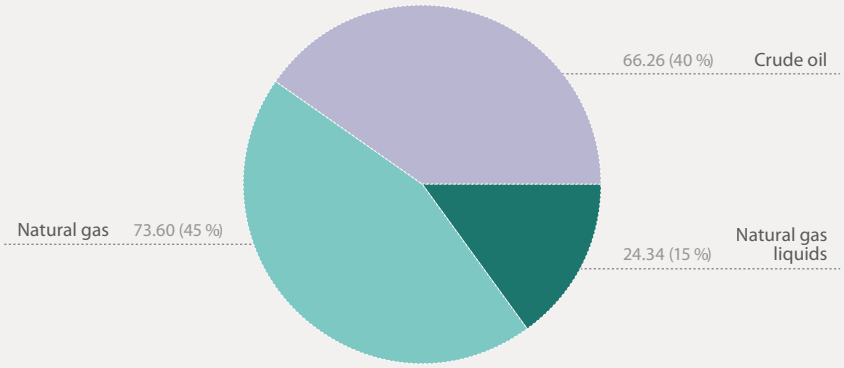
	2005	2006	2007
ANNUAL PRODUCTION (bcm)	104	102	105
PRODUCTION TO DATE (bcm)	2 000	2 100	2 200
RESERVES (PROVEN AND PROBABLE) (bcm)	3 600	3 500	3 500

ALGERIA, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2005-2007)

Source: © Petroconsultants SA (2009) (rounded values)

Hydrocarbons are extremely important for Algeria's domestic supply. In 2007, total primary production reached 164.3 Mtoe, consisting almost completely of hydrocarbons.

FIGURE 75 ([44])



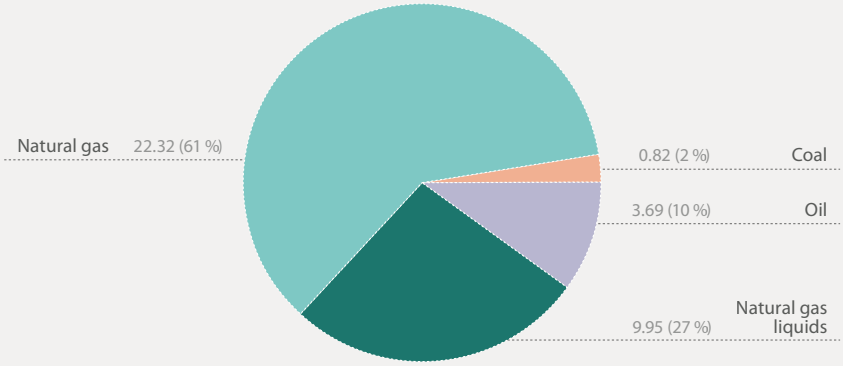
ALGERIA, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe, %) (2007)
Total = 164.20 Mtoe

Source: © OECD/IEA (2009)

([44]) Values under 1 % are not presented.

In the same year, the gross inland consumption reached 36.9 Mtoe, less than a quarter of primary production. Consequently energy exports were 129.2 Mtoe and imports only 1.7 Mtoe (mainly coal).

FIGURE 76 ([45])



ALGERIA, GROSS INLAND CONSUMPTION (ENERGY MIX) (in Mtoe, %) (2007)
Total = 36.78 Mtoe

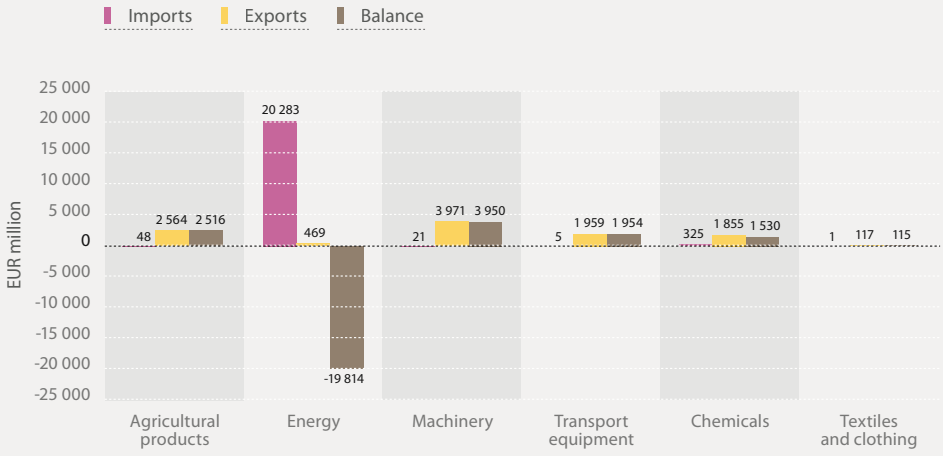
Source: © OECD/IEA (2009)

According to the IEA, two-thirds of Algeria's gas exports are destined for Europe through gas pipelines. This makes Algeria the EU's third most important gas supplier.

The share of the EU in Algerian oil exports is very high as well, representing around one third of the exports. However, when compared to Russia or Norway, Algeria is a relatively small oil exporter to the EU with a share of just above 2.4 % in total EU oil imports.

Figure 77 shows that energy clearly dominates EU trade with Algeria. In 2008, energy represented 71 % of all EU imports from the country.

FIGURE 77



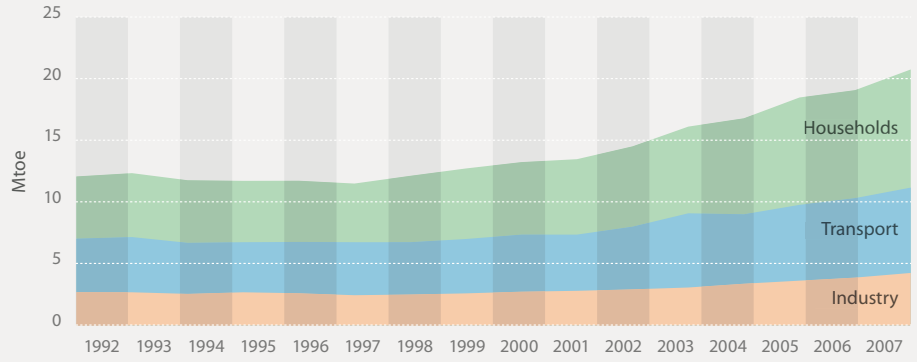
EU-27, MERCHANDISE TRADE WITH ALGERIA (in EUR million) (2008)

Source: European Commission

Energy consumed in the country has increased considerably due to steep economic growth. In the period from 2000 to 2007, final energy consumption increased by 63 % in the residential sector, 55 % in industry and 50 % in transport.

([45]) *Values under 1 % are not presented.*

FIGURE 78



ALGERIA, FINAL ENERGY CONSUMPTION (in Mtoe) (1992-2007)

Source: © OECD/IEA (2009)

4.2. Emerging supply and transit countries

The Caspian basin is becoming increasingly important for European energy supply. In monetary terms, the value of energy imported increased from EUR 19.0 billion in 2007 to EUR 26.5 billion in 2008 (compared to total imports increasing from EUR 22.5 billion to EUR 30.5 billion in the same period). In the transportation of these products, Turkey plays an important role due to its geographic position and is already an important transit country for energy supplies to the EU.

On the other side of the globe, Brazil has become the most important exporter of ethanol. In 2008, Brazil exported more than 5 000 million litres of ethanol. Compared to 2007, this represents an increase of 45 %. More than 75 % of the ethanol imported to the EU originates from Brazil. Moreover, Brazil has been increasing its oil production and is becoming an important actor in the field.

In this chapter, the key data for the countries of the Caspian Region and Central Asia, Turkey and Brazil are presented.

4.2.1. The Caspian Region and Central Asia

The Caspian region and Central Asia are rich in energy resources, mostly still untapped, and primarily located in Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan. The region is already a source of oil and gas supply to European markets and is emerging as an important source of growth in global oil and gas supply. According to the IEA's medium term projection for global oil supply, the Caspian Region and Central Asia is projected to increase its oil production by over 800 kb/d by 2013, representing some 70 % of the net increase in non-OPEC oil supply growth during this period.

TABLE 10

Oil

	AZERBAIJAN	KAZAKHSTAN	TURKMENISTAN	UZBEKISTAN
ANNUAL PRODUCTION (Mbbl)	307	495	72	37
PRODUCTION TO DATE (Mbbl)	7 400	8 500	3 300	1 300
RESERVES (PROVEN AND PROBABLE) (Mbbl)	14 500	33 100	2 000	1 500

Gas

	AZERBAIJAN	KAZAKHSTAN	TURKMENISTAN	UZBEKISTAN
ANNUAL PRODUCTION (bcm)	11	29	70	63
PRODUCTION TO DATE (bcm)	350	290	2 100	1 700
RESERVES (PROVEN AND PROBABLE) (bcm)	1 600	3 200	2 800	1 700

CASPIAN REGION AND CENTRAL ASIA, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2005-2007)

Source: © Petroconsultants SA (2009) (rounded values)

Table 10 shows that the region also has the potential to make a significant contribution to the global gas balance with Azerbaijan and Kazakhstan joining established producers like Turkmenistan and Uzbekistan as net gas exporters.

In the structure of their total primary energy production, all four countries rely on the production of hydrocarbons (only Kazakhstan has significant coal reserves). However, oil represents a bigger share in Azerbaijan and Kazakhstan (80 % and 41 % respectively), whereas natural gas is more important in Turkmenistan (85 %) and Uzbekistan (88 %).

TABLE 11

Total primary energy production in Mtoe (2007)

	AZERBAIJAN	KAZAKHSTAN	TURKMENISTAN	UZBEKISTAN
COAL	0	43.01	0	1.15
OIL	41.55	55.54	9.30	3.21
NATURAL GAS	9.08	24.79	56.08	52.94
NATURAL GAS LIQUIDS	1.26	11.87	0.71	2.20
HYDRO	0.20	0.71	0.0003	0.55
BIOMASS & WASTES	0.001	0.07	0	0.0002
TOTAL	**52.09**	**135.99**	**66.09**	**60.05**

CASPIAN REGION AND CENTRAL ASIA, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe) (2007)

Source: © OECD/IEA (2009)

In gross inland consumption, however, natural gas is the most important fuel in all of these countries. This makes especially Azerbaijan and Kazakhstan heavy net exporters of oil (35 Mtoe and 54 Mtoe of net exports in 2007). On the other hand, Turkmenistan is a major net exporter of natural gas (43 Mtoe in 2007). Uzbekistan is also a net exporter of gas, but on a somewhat smaller level (12 Mtoe in 2007).

TABLE 12

Gross inland consumption (energy mix in Mtoe, 2007)

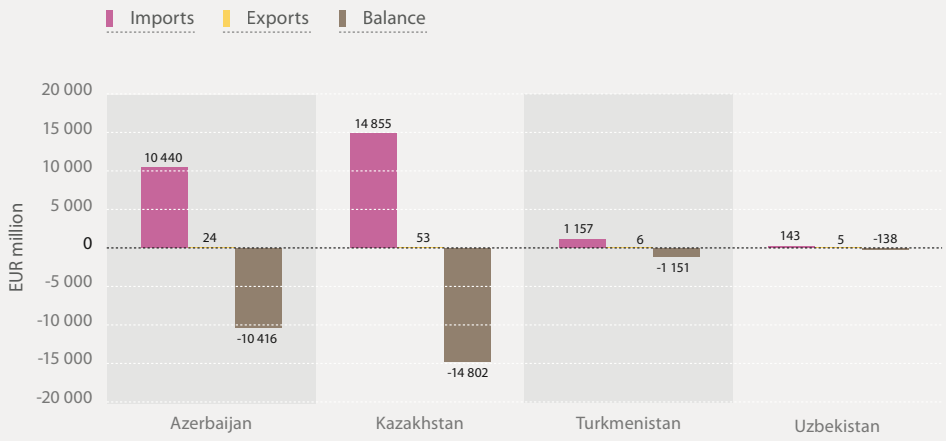
	AZERBAIJAN	KAZAKHSTAN	TURKMENISTAN	UZBEKISTAN
COAL	0	30.90	0	1.12
OIL	2.76	10.32	4.09	2.92
NATURAL GAS	7.71	23.63	13.40	41.90
NATURAL GAS LIQUIDS	1.26	0.88	0.71	2.20
HYDRO	0.20	0.70	0.0003	0.55
BIOMASS & WASTES	0.004	0.07	0	0.0002
ELECTRICITY	-0.02	-0.03	-0.13	-0.007
TOTAL	**11.91**	**66.46**	**18.07**	**48.68**

CASPIAN REGION AND CENTRAL ASIA, GROSS INLAND CONSUMPTION (in Mtoe) (2007)

Source: © OECD/IEA (2009)

The observation can be confirmed when looking at the EU-27 energy trade with the four countries.

FIGURE 79



EU-27, ENERGY TRADE WITH THE CASPIAN REGION AND CENTRAL ASIA (in EUR million) (2008)

Source: European Commission

Among these countries, Kazakhstan and Azerbaijan were in 2008 the most important energy trade partners of the EU, with oil as almost entirely dominating product.

When looking at the final energy consumption of these countries, the following differences can be noted. In case of Azerbaijan and Uzbekistan, the residential sector is the largest consumer (49 % and 44 % respectively). In Kazakhstan, industry has the largest share of the three specified sectors (39 %) but most of the available data is not attributed to a specified sector. This is even more the case for Turkmenistan.

TABLE 13

Final energy consumption in Mtoe (2007)

	AZERBAIJAN	KAZAKHSTAN	TURKMENISTAN	UZBEKISTAN
INDUSTRY	1.50	16.79	0.27	7.97
TRANSPORT	1.31	4.40	0.91	3.30
HOUSEHOLDS	3.20	2.71	0.16	15.06
OTHER	0.58	19.5	9.40	8.01
TOTAL	**6.59**	**43.40**	**10.74**	**34.34**

CASPIAN REGION AND CENTRAL ASIA, FINAL ENERGY CONSUMPTION (in Mtoe, 2007)

Source: © OECD/IEA (2009)

4.2.2. Turkey

Turkey has limited indigenous energy resources, mainly solid fuels and hydropower. It is almost totally dependent on imports to meet its rapidly growing energy needs. It is in a geographically important position as a transit country for both oil and gas from the Caspian region and Middle East.

The reserves of oil and gas are very small and do not offer the country any possibility to decrease its import dependence in the future.

TABLE 14

Oil

	2005	2006	2007
ANNUAL PRODUCTION (Mbbl)	16	15	15
PRODUCTION TO DATE (Mbbl)	880	890	910
RESERVES (PROVEN AND PROBABLE) (Mbbl)	260	250	230

Gas

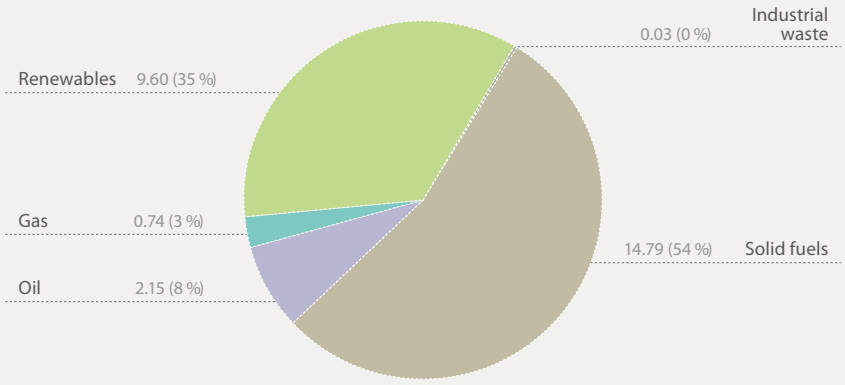
	2005	2006	2007
ANNUAL PRODUCTION (bcm)	1	1	1
PRODUCTION TO DATE (bcm)	8	8	9
RESERVES (PROVEN AND PROBABLE) (bcm)	24	25	26

TURKEY, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2007)

Source: © Petroconsultants SA (2009) (rounded values)

Consequently the hydrocarbons represent basically the smallest share in the structure of the primary energy production.

FIGURE 80

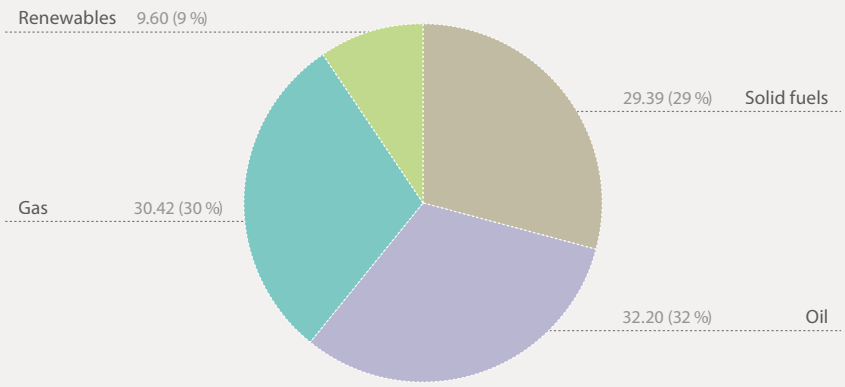


TURKEY, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe, %) (2007)
Total = 27.31 Mtoe

Source: Eurostat

Solid fuels are the most important primary energy product. However, also in this case, Turkey is a growing net importer (13.6 Mtoe in 2006, 14.6 Mtoe in 2007).

FIGURE 81

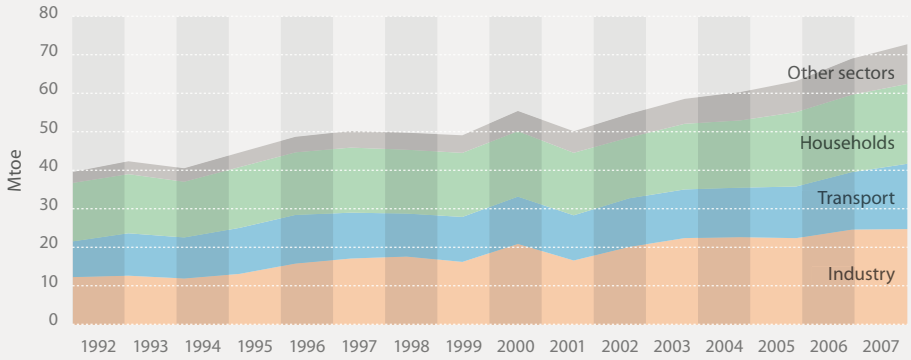


TURKEY, GROSS INLAND CONSUMPTION (ENERGY MIX) (in Mtoe, %) (2007)
Total = 101.61 Mtoe

Source: Eurostat

Unlike primary production, hydrocarbons constitute the biggest part of Turkish gross inland consumption. In 2007, 63 % (22.8 bcm) of natural gas was imported from Russia, 17 % (6 bcm) from Iran and 12 % (4.2 bcm) from Algeria. In the same year, crude oil was imported from Russia (38 %, 8.9 Mt), Iran (37 %, 8.8 Mt) and Saudi Arabia (15 %, 3.6 Mt) ([46]).

FIGURE 82



TURKEY, FINAL ENERGY CONSUMPTION (in Mtoe) (1992-2007)

Source: Eurostat

Turkish final energy consumption reached 73 Mtoe in 2007, compared to 69 Mtoe in 2006. Since 2000, the share of industry in final energy consumption has been above the share of households. In the recent years the share of services has also been increasing (from 2 % in 1992 to almost 9 % in 2007).

([46]) The figures on natural gas originate from IEA and the figures on oil from Eurostat.

4.2.3. Brazil

Brazil has a very dynamic energy sector. It is the tenth largest energy consumer in the world and the largest in Latin America (i.e. South and Central America), accounting for over 40 % of the region's consumption. It also has the second largest oil reserves in Latin America, after Venezuela. Exploiting the country's oil potential is one of the key priorities of the Brazilian government.

TABLE 15

Oil

	2005	2006	2007
ANNUAL PRODUCTION (Mbbl)	625	660	669
PRODUCTION TO DATE (Mbbl)	8 800	9 500	10 100
RESERVES (PROVEN AND PROBABLE) (Mbbl)	24 600	30 000	30 300

Gas

	2005	2006	2007
ANNUAL PRODUCTION (bcm)	14	14	14
PRODUCTION TO DATE (bcm)	210	230	240
RESERVES (PROVEN AND PROBABLE) (bcm)	860	1 000	1 000

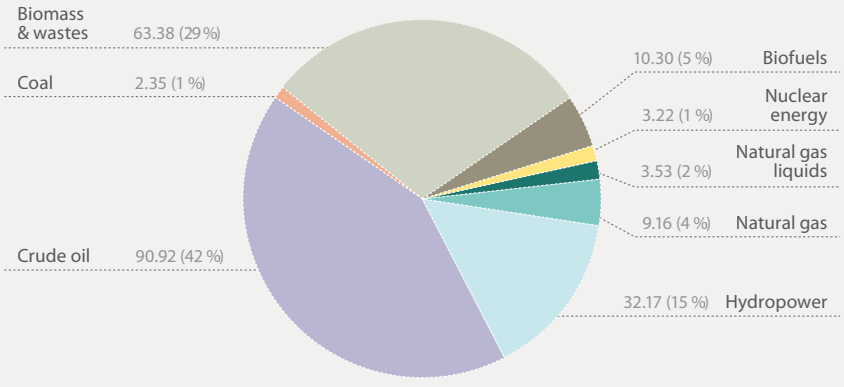
BRAZIL, PRODUCTION AND RESERVES OF OIL AND GAS (in Mbbl, bcm) (2005-2007)

Source: © Petroconsultants SA (2009) (rounded values)

Oil production has been growing considerably in the past years. The production of gas has also risen, but to a smaller extent. In both cases, proven and probable reserves have increased, and consequently the reserve to production ratio has increased for both products. For oil, the ratio increased from 39.4 in 2005 to 45.3 in 2007, while for gas the increase was from 60.2 to 72.8.

Total primary energy consumption has been increasing significantly over the past years. In 2000, it stood at 148 Mtoe. In 2007 it had already increased to 216 Mtoe. In this period, the production of oil increased by 42 %. The production of biofuels increased even more – by 115 %.

FIGURE 83 ([47])



BRAZIL, TOTAL PRIMARY ENERGY PRODUCTION (in Mtoe, %) (2007)
Total = 215.03 Mtoe

Source: © OECD/IEA (2009)

([47]) *Values under 1 % are not presented. This is also applicable to Figure 84.*

The production of biofuels is basically the production of ethanol. It is divided into two main groups:

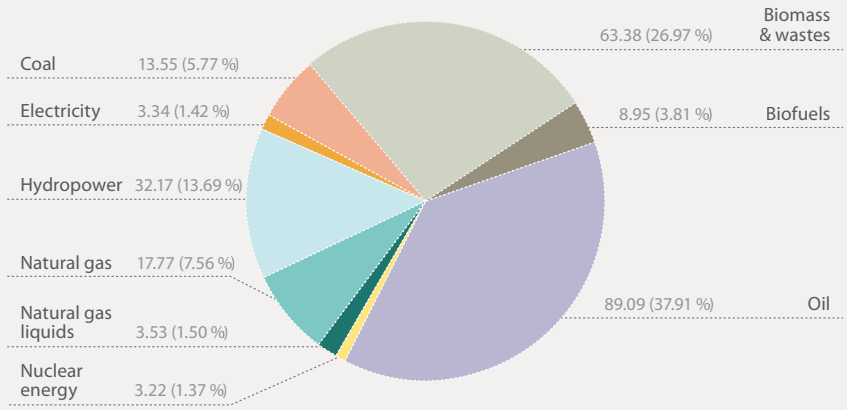
- Anhydrous ethanol, which is almost pure ethanol and is blended with motor spirit (the blend finally contains 25 % of ethanol).
- Hydrous ethanol contains around 5 % water and is used in flex fuel vehicles in a blend with up to 85 % of ethanol.

In 2007, anhydrous ethanol represented 39 % of primary biofuels production, hydrous ethanol 58 % and bio-diesel the rest.

Total gross inland consumption reached 234.9 Mtoe in 2007, meaning that Brazil is still a net energy importer. However, it has the potential to turn into a net exporter. The oil production for example has been growing considerably in the past years, leading Brazil to achieve net oil self-sufficiency in 2006 and to export small quantities of oil thereafter. Oil from the recently discovered Tupi and Carioca fields should turn it into a significant oil exporter.

As far as ethanol is concerned, it is the leading exporter in the world. The figures from Ethanol World Trade show that Brazil exported 3 533 million litres of ethanol in 2007 and 5 124 million litres in 2008 (an increase of 45 %). The USA, which has become the largest ethanol producer, exported in 2008 only 600 million litres.

FIGURE 84

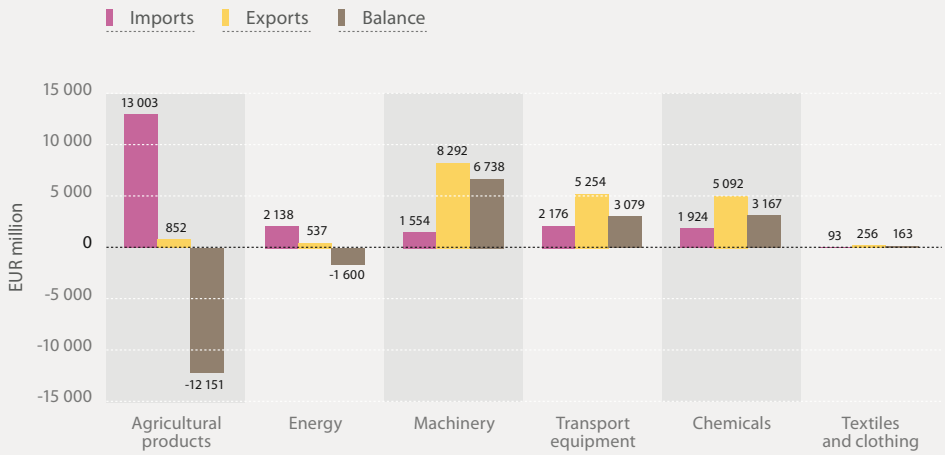


BRAZIL, GROSS INLAND CONSUMPTION (ENERGY MIX) (in Mtoe, %) (2007)
Total = 235.0 Mtoe

Source: © OECD/IEA (2009)

In 2008, 14.2 % of the Brazilian oil exports were to Europe. Nevertheless, in EU oil imports, the share of Brazilian oil is still very marginal (less than 1 %). Brazilian ethanol, on the other hand, constitutes a much larger share of EU imports. According to the European Bioethanol Fuel Association, over 75 % of EU ethanol imports come from Brazil (out of 1.9 billion litres imported in 2008).

FIGURE 85

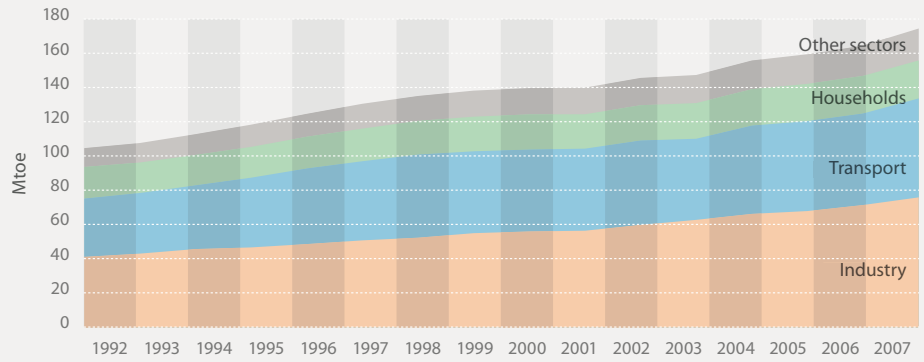


EU-27, ENERGY TRADE WITH BRAZIL (in EUR million) (2008)

Source: European Commission

Final energy consumption reached 176.2 Mtoe in 2007, compared to 166.1 Mtoe in 2006.

FIGURE 86



BRAZIL, FINAL ENERGY CONSUMPTION (in Mtoe) (1992-2007)

Source: © OECD/IEA (2009)

In the period from 1992 to 2007, final energy consumption in the industry sector increased by 84 %, in transport by 70 % and in the residential sector by 20 %. The dominance of the industry sector as the fastest growing consumer is even more obvious when looking at the period from 2000 to 2007, where the growth was 35 % in industry, 21 % in transport and 8 % in households. This confirms the classification of Brazil as an emerging economy.

5. Investment in renewable energy capacity in the EU

The EU has confirmed its commitment to remain at the forefront of the promotion of renewable energy sources (RES) ([48]) it has been fostering since 1997 with the adoption of Directive 2009/28/EC of 23 April 2009: The European Parliament and the Council agreed that by 2020, the EU shall reach a target of 20 % of RES in its gross final energy consumption. This requires more than doubling the current share of RES ([49]). In order to reach this target and transform its energy system which is still heavily dependent on fossil fuels, the EU must exploit its RES potential for power generation, heat and transport.

By reaching the target in 2020, the EU can save between 600 and 900 million tonnes of CO_2 per year and it can reduce its annual fossil fuel demand by over 250 Mtoe. RES is supposed to harness indigenous energy resources and further trigger technological and industrial development. According to a recent study commissioned by the European Commission, the gross value added generated by the renewable energy industry reached EUR 58 billion in 2005 and the industry employed roughly 1.4 million people. The study also estimated that achieving the target would provide a net effect of about 410 000 additional jobs and a net increase in gross domestic product of about 0.24 % ([50]).

5.1. Achievements and prospects for investment in RES capacity under current EU policies

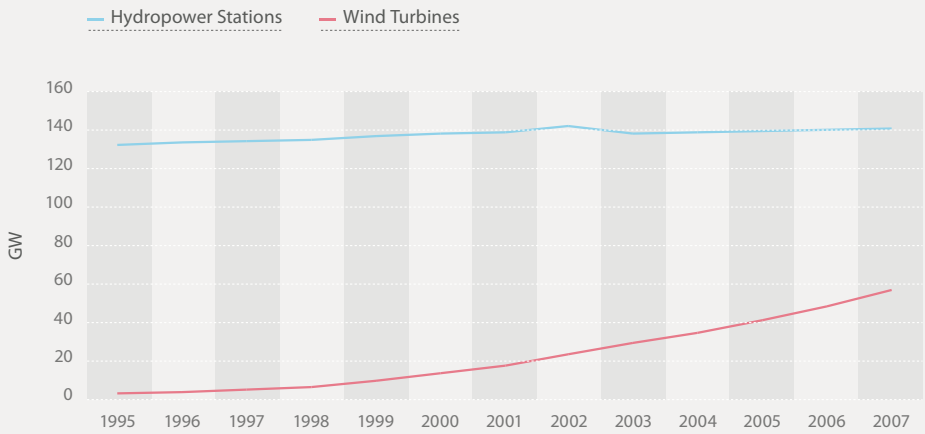
In 1997 the European Commission's White Paper on renewable energy sources set the goal of doubling the share of renewable energy sources in the gross inland consumption from 6 to 12 % by 2010 ([51]). At EU level, as indicated in the recent Commission Progress Report ([52]), overall 2010 RES targets are likely not to be met. The EU could reach a 19 % share in electricity consumption rather than 21 % and 4 % instead of 5.75 % in the transport sector. However, as a result of investment, EU RES sectors have expanded and RES have been deployed in the EU energy infrastructure.

5.1.1. Developments of the RES sector in the EU

A dynamic expansion of the sector

Wind energy has attracted considerable investment and developed quickly since the late 1990s. Between 2000 and 2007 the installed wind energy capacity in the EU quadrupled, jumping from around 13 GW to 57 GW and growing at an annual rate over 20 %.

FIGURE 87



EU-27, NET INSTALLED PRODUCTION CAPACITY OF HYDROPOWER STATIONS AND WIND TURBINES (in GW) (1995-2007)

Source: Eurostat (2009)

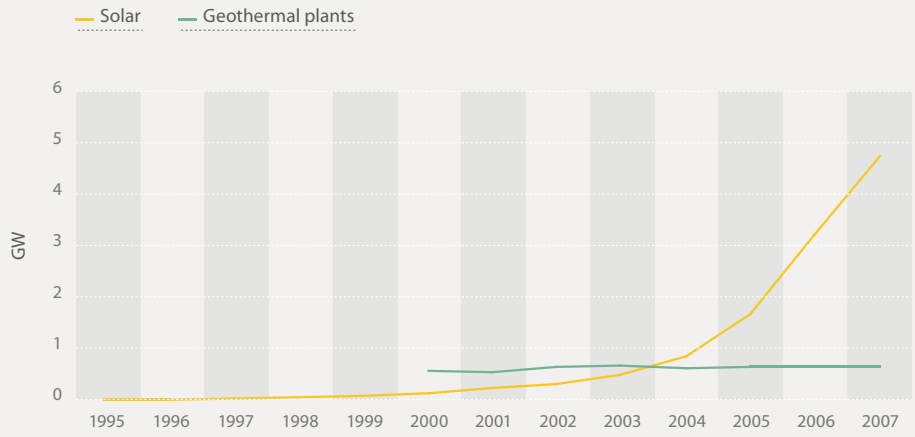
([48]) Wind power, solar power (thermal, photovoltaic and concentrating), hydro-electric power, tidal power, geothermal energy and biomass.
([49]) The share (measured in terms of gross final energy consumption) was 8.5 % in 2005 and 9.2 % in 2006. See the latest Renewable Energy Progress Report, COM (2009) 192 final, 24.04.09.
([50]) Employ-RES – The impact of renewable energy policy on economic growth and employment in the European Union – Available at the following address: http://ec.europa.eu/energy/renewables/studies/renewables_en.htm
([51]) Directive (EC) n° 2001/77/EC indicated that 21 % of EU final electricity demand that had to be covered by RES by 2010 while Directive (EC) n° 2003/30/EC set the share of RES in the transport sector at 5.75 % by the same date. No target was set for heat.
([52]) COM (2009) 192 final, op cit.

The White paper target of 40 GW of installed capacities by 2010 was already achieved by 2005. In 2007, 8.2 GW of new capacities were built. Initial estimations for 2008 show a slight fall in the additional capacities installed in the EU ([53]).

Although modest compared to wind, the EU photovoltaic sector has boomed over the last few years with impressive annual growth rates. The White paper target – 3 000 MW to be installed in 2010 – was already exceeded in 2006. Installed capacity grew by 55.6 % in 2007 and, according to first estimations, by 92.9 % in 2008 ([54]). Investments in PV have resulted in an increase of installed capacities amounting to 1 731 MWc in 2007 and is estimated at around 4 592 MWc in 2008. Over 2000-2007, the annual growth rate of the PV sector was of the order of 40 % on average ([55]) and has been limited by the shortages for certain components.

The solar thermal sector in the EU has also been experiencing a significant growth with an annual growth rate of 17.5 % since 2000. Over 2000-2007, the installed surfaces in the EU amounted to around 15.5 millions m^2 and in 2008 it is estimated that over 4.6 million m^2 have been installed, representing an annual growth of more than 51 % year-on year ([56]).

FIGURE 88



EU-27, NET INSTALLED PRODUCTION CAPACITY OF SOLAR AND GEOTHERMAL PLANTS (in GW) (1995-2007)

Source: Eurostat

While increasing their capacities, small hydropower and geothermal for electricity grew slowly by over 2 % each in 2007. In 2007, 277 MW hydropower capacities have been installed and 857 MWe geothermal.

As a result of investments in biofuels production capacities over the last ten years, the installed biofuels production capacity in the EU grew by 12 Mt (while it was 0.6 Mt) in 1999. A major breakthrough was recorded in 2006 with a surge of 157 % of installed capacity. Due to investment committed earlier, EU bio-diesel production capacities have increased significantly over recent years. These capacities are estimated by Industry to reach around 21 Mt in 2008. This is by far more than the growth in consumption in the EU. Bio-ethanol production capacities have steadily increased although they remain modest ([57]).

In spite of impressive growth rates, this development of RES capacities has been constrained by various barriers. Among them, administrative procedures and grid access are regularly identified as obstacles. Investing in RES is also still costlier than investing in conventional fossil fuel energy, in particular in case of low fossil fuel prices. This makes RES development still very much dependent on policy and support schemes. Competitiveness of RES has however increased significantly over the last ten years ([58]). As for wind energy, improvements in turbine efficiency combined with higher fossil fuel prices have increased its competitiveness against conventional power production ([59]). The cost of manufacturing and installing a photovoltaic solar-power system has decreased by about 20 % with every doubling of installed capacities over the last two decades ([60]). Solar photovoltaic systems today are more than 60 % cheaper than in the 1990's. Despite the downward pressure on prices for installed capacities, the price of solar electricity is still not on a par with conventional energy.

([53, 54]) EurObserv'ER, Wind energy barometer, 2009.
([55]) European Commission, Technology descriptions of the 2009 Update of the technology Map for the European Strategic Energy Technology Plan (SETIS).
([56]) EurObserv'ER, Solar barometer, 2009.
([57]) See under 5.1.2.
([58]) For an overview of the competitiveness of the renewable energy sector/industry in the EU, see the recent Study on the competitiveness of the EU eco-industry, prepared for the European Commission, available at the following address: http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=3769&tpa_id=203&lang=en
([59]) EWEA – Wind Energy – The facts (A guide to the technology, economics and future of wind power).
([60]) According to ESTIF.

An increasingly mature and diversified sector

In comparison to the world context, the EU, also thanks to various support schemes, has been very attractive for investment in RES for the power and for the transport sector. Developments in the heat sector have somewhat been limited: 2 % of annual growth over 1997-2005 ([61]).

The EU on-shore wind sector is witnessing an increased competition for market shares after a consolidation phase in 2003-2004. The EU wind capacities have also become more geographically diversified and balanced. While Germany, Spain and Denmark accounted for more than 80 % of the sector in 2003, their share represented around 60 % in 2007, and is estimated at less than 40 % in 2008. With the development of offshore wind the picture will become even more diversified. Markets endowed with a huge potential for wind power will emerge: for example, in 2008, more offshore capacities than in any other Member State were installed in the UK.

The PV sector in the EU has not grown as fast as industrial capacities for the production of PV equipment. This created overcapacities and difficulties for some producers.

Solar thermal in the EU is pulled by Germany where 39 % of the cumulated capacities of thermal collectors in the EU are installed. A few Member States (DE, ES, IT, FR, GR) account for 84 % of all solar thermal installations in the EU ([62]). Individual houses have so far pulled the sector. The collective market covering housing companies or even heating and cooling systems is also increasing significantly ([63]).

Impact of the financial and economic crisis

Preliminary data show that RES investments in the world and in the EU have been affected by the financial turmoil and the economic crisis, experienced in 2008 and 2009 ([64]). At European level, however, investment in clean energy is estimated to have risen by 2 % in 2008 ([65]). It is expected that investment will not be too severely affected in 2009 although the conditions in which energy markets have developed so far have considerably been altered. The support schemes in place in the EU and the political will demonstrated in the recovery plans have cushioned the impact of the financial crisis on the RES sector. Some Member States have also increased investment in green technologies.

Renewable energy in Member States recovery plans

Nineteen national recovery plans ([66]) included measures related to the development of RES. Member States plan to increase energy generation from wind power plants (EE, FI, HU, IE, LT, MT, NL, PT, UK) and solar power (FR, HU, IT, MT, PT, SK). IE plans to increase investment in ocean energy technologies. PL supports investments in the field of renewable sources of energy and environmental investments for cities and communal enterprises. EE plans to invest in alternative energy sources in transport. CZ, HU, LV and NL are to promote production and use of biomass.

The budget foreseen for these measures varies from EUR 8 million (EUR 1.48/capita) (SK) to GBP 2.8 billion (EUR 3.3 billion; EUR 53.93/capita) (UK).

EU recovery plan and Renewable energy

The European Recovery Action Plan includes financial support for the connection and integration of renewable energy resource and offshore wind. EUR 565 million are specifically dedicated to off-shore wind projects and EUR 910 million for electricity grid development.

BOX 5

Short term outlook for investment

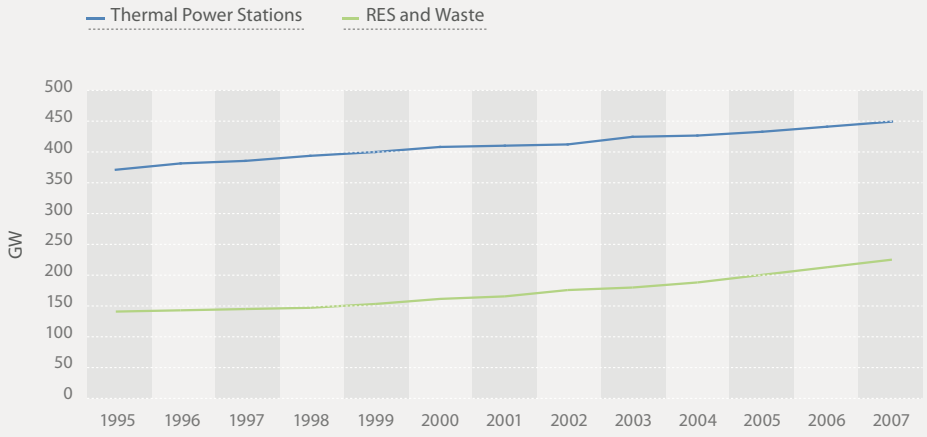
The short term outlook on investment varies depending on the technology/energy sources or on the Member States concerned. The European wind sector is expected to grow by over 9 GW installed annually through to 2010, which would translate into annual investment of nearly EUR 16 billion ([67]). Off-shore wind, supported by the EU in the context of the European Recovery Plan and by Member States in their recovery packages, will probably take off. Investment in biofuels production capacities has decreased recently. Lower diesel prices and financing problems have altered the attractiveness of investment. According to first estimates, investment in solar energy has dropped at EU level in 2008 and in the beginning of 2009, mainly as result of the change in the support scheme for solar investment in Spain.

([61]) PROGRESS report – promotion and growth of renewable energy sources and systems, p. 32, available at http://ec.europa.eu/energy/renewables/studies/doc/renewables/2008_03_progress.pdf
([62]) ESTIF – Solar thermal markets in Europe – Trends and Market Statistics in 2008, May 2009.
([63]) EurObserver – Solar Thermal barometer, 2008.
([64]) IEA, World Energy Outlook, 2009.
([65]) New Energy Finance.
([66]) CZ, CY, DK, EE, ES, FI, FR, HU, IE, IT, LT, LU, LV, MT, NL, PL, PT, SK, UK.
([67]) EWEA – Wind energy – The Facts, op cit.

5.1.2. Deployment of RES in energy infrastructure

According to the latest official data, the RES and waste power generation park was the second largest in the EU in 2007 reaching 225.5 GW and almost 29 % of the total EU net installed generation capacity. It grew by around 95 GW over 1990-2007 and by around 80 GW over 1997-2007. As a result of this substantial investment, the RES and waste additionally installed capacity amounted to 64.4 GW over 2000-2007 while it was only 41.9 GW for thermal power plants.

FIGURE 89

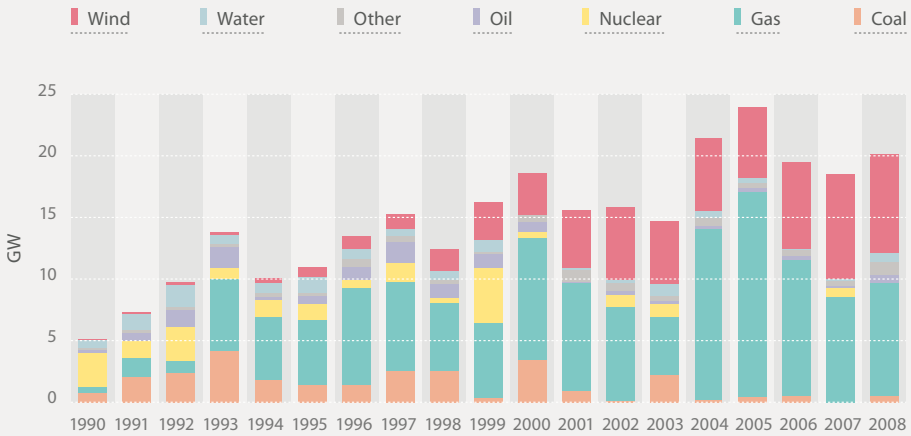


EU-27, NET INSTALLED PRODUCTION CAPACITY OF HYDROPOWER STATIONS AND WIND TURBINES (in GW) (1995-2007)

Source: Eurostat (2009)

With respect to 2006, the additional net RES installed capacity amounted to 11.4 GW in 2007, + 5.35 % from 2006 – which was slightly less than the previous years ([68]). For thermal power plants, the additional net installed capacities amounted to around 9 GW in 2007, representing an increase of 2 %.

FIGURE 90



EU-27, ADDITIONAL OPERATIONAL ELECTRICITY CAPACITY (in GW) (1990-2008)

Source: © Platts (2009)

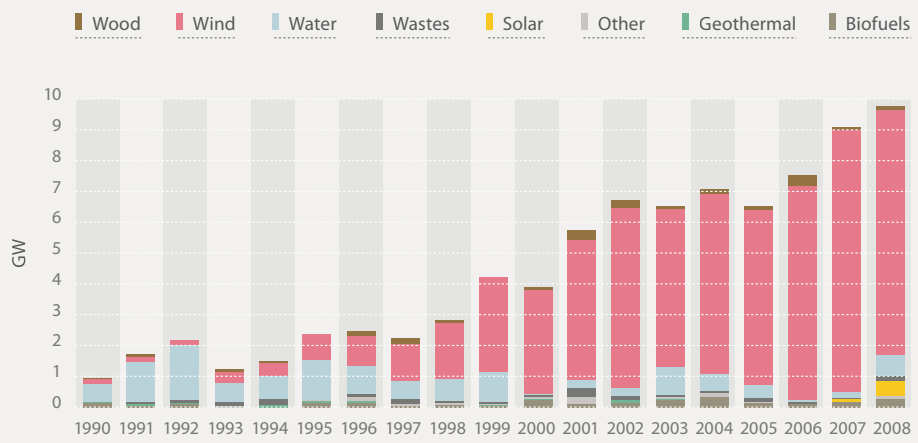
([68]) *+13.3 GW or 6.6 % in 2006 and +11.7 GW or 6.2 % in 2005.*

The RES power generation park remained however far behind the thermal power generation park which accounted for 449.1 GW or 57.6 % of the total net installed capacity in 2007. For the first time in 2007, however, the RES and waste park represented 50 % of the thermal conventional net installed capacities, up by 12 percentage points from 1990.

Investment in RES power generation infrastructure has contributed to diversifying the EU generation mix. Wind energy and waste capacities have strongly increased while hydropower stations still remain the building block, with net installed capacities of 140.2 GW or 62 % of the RES net installed capacities in 2007.

In 2007, wind accounted for 25 % of the net RES installed capacities and for 7.2 % of the total installed capacities with 56.2 GW out of which around 1.5 GW offshore. Net installed capacity for electricity produced from waste accounted for 23.5 GW in 2007, around 3 times higher than in 1997. Wood/Wood wastes, biogas and municipal solid wastes have steadily increased their share but at a slower pace than wind. Photovoltaic systems and geothermal installed capacities remained marginal in the EU generation park in 2007. As showed by the graph below, the operational RES electricity generation capacity is progressively being diversified with however a massive amount of wind.

FIGURE 91

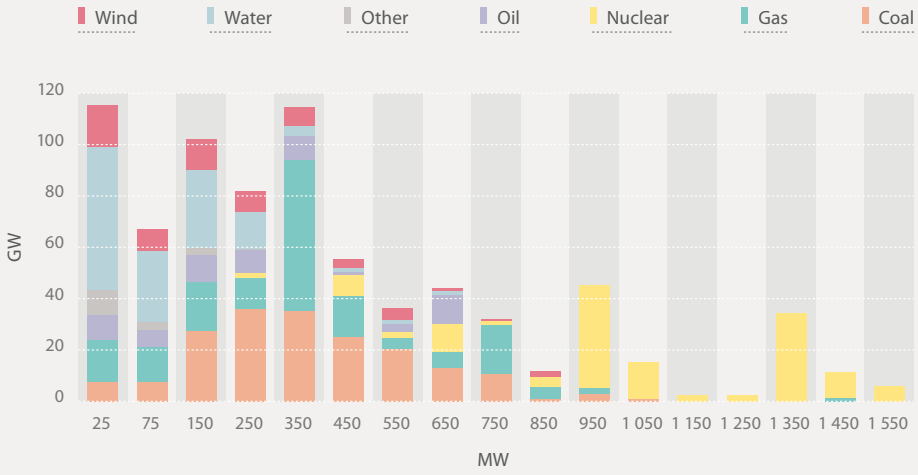


EU-27, ADDITIONAL OPERATIONAL RES ELECTRICITY GENERATION CAPACITY (in GW) (1990-2008)

Source: © Platts (2009)

The new RES power generation park remained dominated by medium or relatively small installations with some exceptions for hydropower and offshore wind generation capacities. The following chart illustrates generation total operating generation capacity according to the size of the power plants. On an individual basis, most of the RES capacity is less than 100 MW.

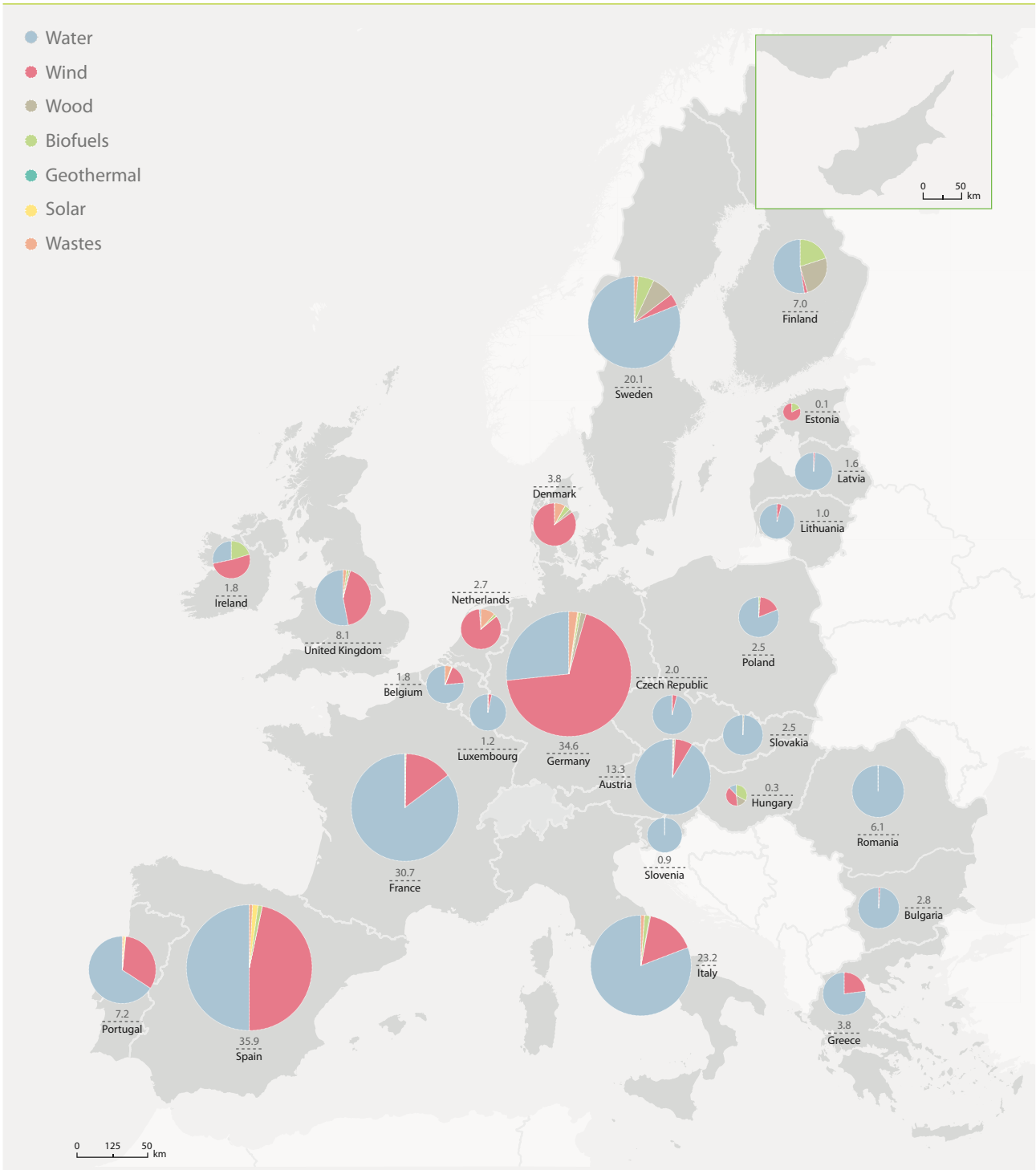
FIGURE 92



EU-27, TOTAL OPERATING GENERATION CAPACITY (in GW) BY SIZE OF POWER PLANT (in MW)

Source: © Platts (2009)

MAP



ELECTRICITY PRODUCTION CAPACITY BY RES IN THE EU IN 2009 (in GW)

Sources: © Platts (2009); © EuroGeographics, 2006 (for the administrative boundaries); European Commission (September 2008)

According to Industry, bio-diesel production capacities reached 21 Mt in 2008. As of July 2009, the number of bio-diesel plants stands at 276 ([69]). The EU has large capacities for biofuels production, in particular given EU consumption. In 2007, consumption amounted to 8.1 Mtoe. In 2008, bio-ethanol production capacities were estimated at 6 M liters, distributed in 19 Member States.

In the EU in 2007, landfill gas accounted for half of EU production of biogas while biogas from sewage plants represented 14 % of the production. Over the last years, however, the increase of the biogas production was mainly driven by the development of small methanisation units on farms in particular in Germany which has become the largest producing country in the EU ([70]).

([69]) See European Biodiesel Board.
([70]) EurObservER, Biogas barometer, 2008.

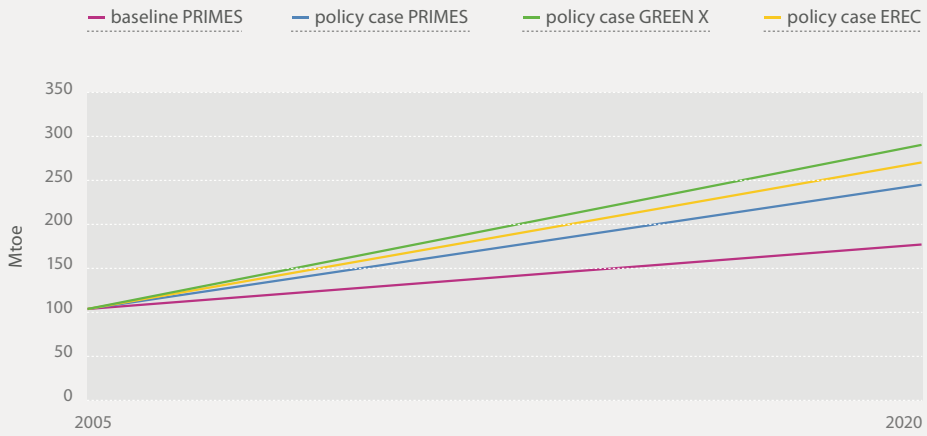
5.2. Potential and challenges for investment in RES capacity under new EU policies

The objective of 20 % of RES in final energy consumption by 2020 will require significant investments. Whilst Member States are expected to set out their individual pathways in 2010, a synoptic view on possible pathways at EU level can provide some initial insights in the investment potential and challenges ahead.

5.2.1. Possible pathways up to 2020

In 2007, according to Eurostat data, RES contributed 141 Mtoe to the EU gross inland consumption and approximately 116 Mtoe to the EU final energy consumption ([71]). By 2020, this contribution should have significantly increased as illustrated by a range of scenarios, based on various assumptions produced for the European Commission ([72]) and for Industry ([73]).

FIGURE 93

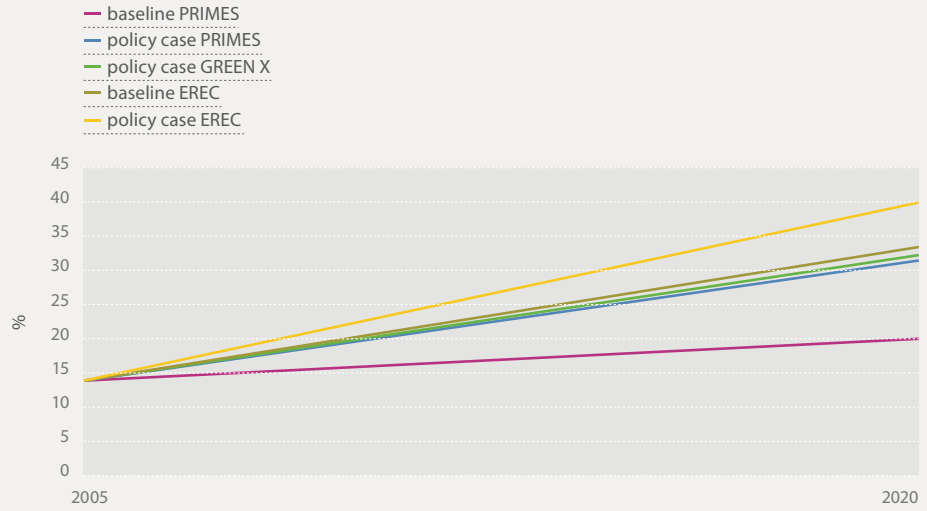


EU-27, FINAL ENERGY CONSUMPTION OF RES IN 2020 (in Mtoe)

Source (data compilation): European Commission

At EU level RES are expected to grow in the power, heat and transport sector under the various scenarios:

FIGURE 94



EU-27, RENEWABLE ENERGY SOURCES IN POWER GENERATION IN 2020 (in %)

Source (data compilation): European Commission

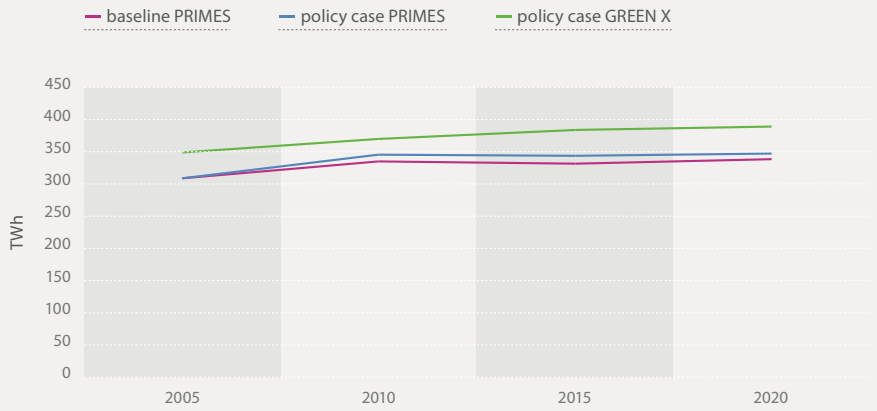
([71]) The figure of 116 Mtoe does not take into account the contribution of heat pump nor the distinction between sustainable and unsustainable biofuels. Direct consumption of RES by households, industry and transport account for 63 Mtoe while derived heat from RES and electricity produced from RES respectively account for 7.7 Mtoe and 45 Mtoe.

([72]) Primes Baseline (2007), Primes New Energy Policy scenario (2008), Green X.

([73]) EREC scenario.

For the power sector, hydro will continue to play a big role but strong growth of wind and biomass, including CHP installations using biomass is also expected. New RES-E options such as solar will also play their role.

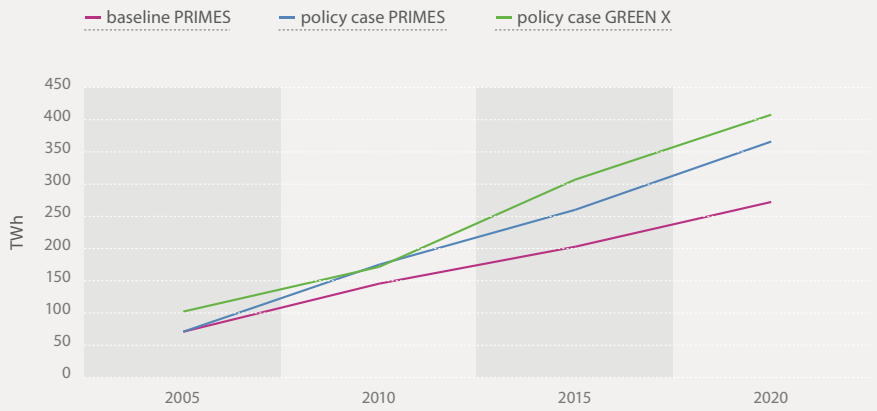
FIGURE 95



EU-27, CONTRIBUTION OF HYDROPOWER TO POWER GENERATION (in TWh) (2005-2020)

Source (data compilation): European Commission

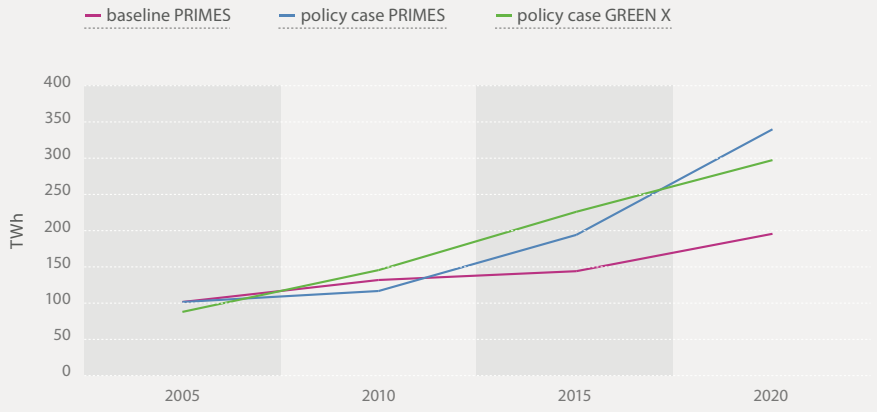
FIGURE 96



EU-27, CONTRIBUTION OF WIND ENERGY TO POWER GENERATION (in TWh) (2005-2020)

Source (data compilation): European Commission

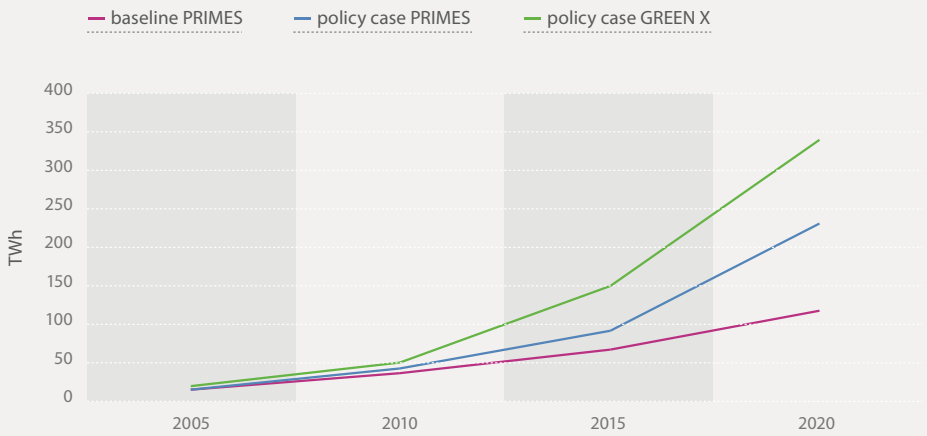
FIGURE 97



EU-27, CONTRIBUTION OF BIOMASS TO POWER GENERATION (in TWh) (2005-2020)

Source (data compilation): European Commission

FIGURE 98

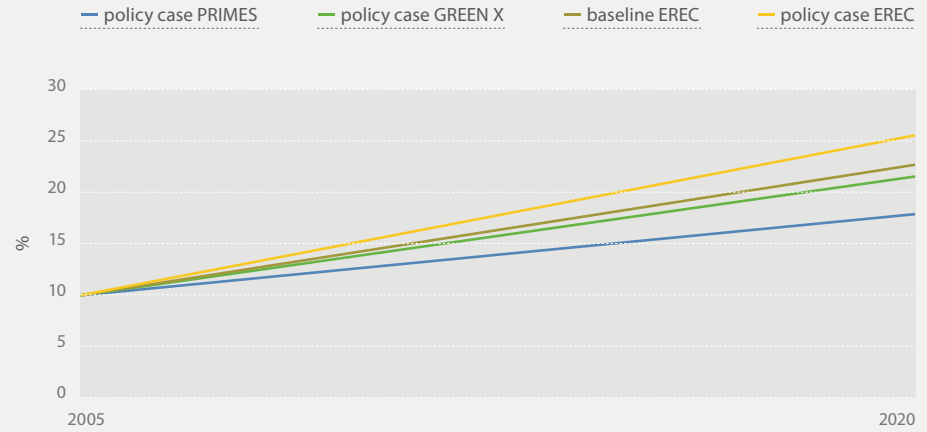


EU-27, CONTRIBUTION OF SOLAR TO POWER GENERATION (in TWh) (2005-2020)

Source (data compilation): European Commission

RES in the heating sector will significantly increase its share using more biomass, efficient CHP and household heating. Solar thermal heat and heat pumps should achieve a strong deployment by 2020. They could finally account for up to one quarter of RES-H generation.

FIGURE 99



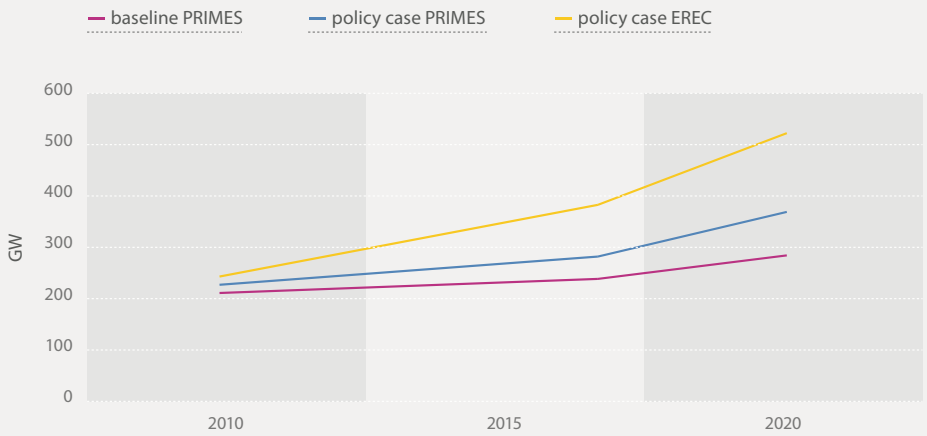
EU-27, RENEWABLE ENERGY SOURCE IN HEAT GENERATION IN 2020 (in %)

Source (data compilation): European Commission

The increase of RES in the final energy consumption will have major consequences for energy infrastructure in the EU.

17/ The largest EU hydroelectric power plant is in France (Rhône-Alpes), with a capacity of 1 884 MW. The second and third largest can be found in the UK and Romania (1 728 and 1 167 MW). The largest one in the world is the Chinese Three Gorges Dam (18 200 MW).

FIGURE 100

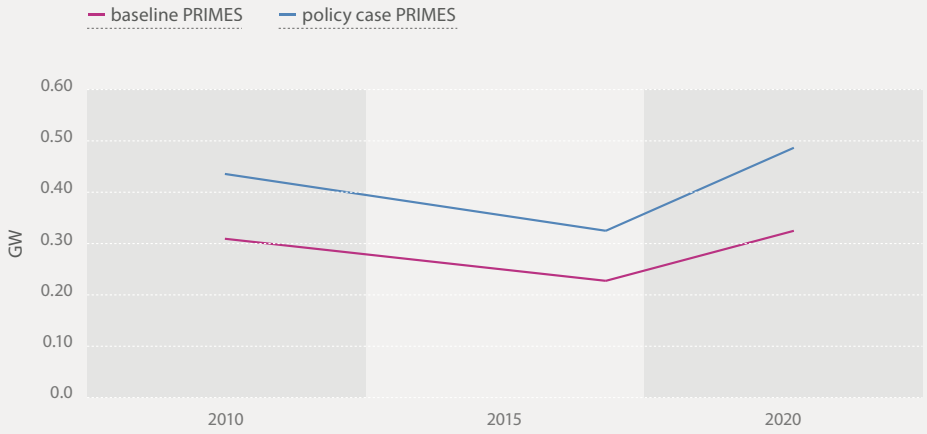


EU-27, NET INSTALLED POWER CAPACITY FOR RENEWABLE ENERGY (in GW) (2010-2020)

Source (data compilation): European Commission

By 2020, according to the PRIMES scenarios prepared for the Commission in 2008, renewable energy should represent 33% to 58% of the total new power generation capacity necessary to meet the future demand and to replace ageing facilities. Wind should attract most of investment in new power generation capacities. It should be followed by biomass and to a lesser extent by solar.

FIGURE 101



EU-27, INVESTMENT IN WIND NET POWER CAPACITY (in GW) (2010-2020)

Source (data compilation): European Commission

By 2020, electricity networks will need to accommodate at large scale energy sources which will be distributed and often variable such as wind and solar. However, the networks currently in place have been built for flows from centralised sources. Necessary infrastructure developments will include monitoring and control to manage the system with variable sources. Deployment of smart grids will also be required to facilitate the integration of decentralised sources.

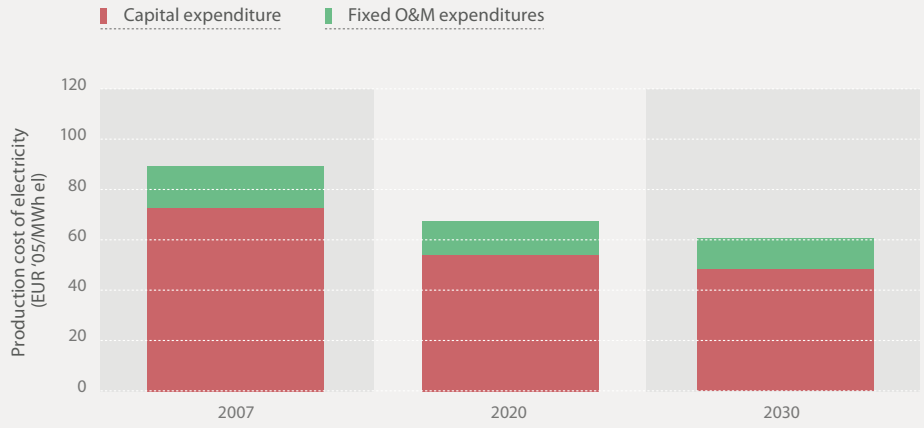
5.2.2. Market issues related to RES expansion

Given the large gap between actual RES deployment and the 20 % target, a fast-growing European market for renewable energy is to be expected. The long-term fundamentals for RES development, such as climate change, are strong and should attract investment. As already experienced, the large roll-out of RES in energy infrastructure in the EU has not been left to the market alone. The further deployment of RES in the EU will most likely depend on a combination of market forces and support policies.

The carbon price could be a fundamental driver for investment in RES. The EU Emissions Trading Scheme (ETS) which allows for the exchanges of CO_2 allowances and is designed to reduce greenhouse gas emissions in a cost-effective manner, resulted in a single price for carbon within Europe. However, due to shrinking economic activities in the aftermath of the financial and economic crisis, the cost of the environmental objective to be achieved through the EU ETS has become cheaper. While this helps economic recovery, the positive side effects of the EU ETS, such as stimulating investment in RES capacities, appear temporarily diminished ([74]). New momentum is expected to result from the revised ETS, to come into force by 2013 and from an OECD-wide market for carbon that is hoped to be achieved by 2015 followed by a global carbon market by 2020.

It is expected that costs reductions can be achieved due to technical learning, manufacturing improvements and large scale production. From the graphs below, presenting a European average of the cost of production of electricity, it appears that RES technologies have a significant innovation potential. Over time, this can result in cost reduction for capital investment (and operation and maintenance) in particular for wind energy and solar PV and CSP. For PV, the costs of solar energy are even expected to decline by approximately 50 % by 2020.

FIGURE 102



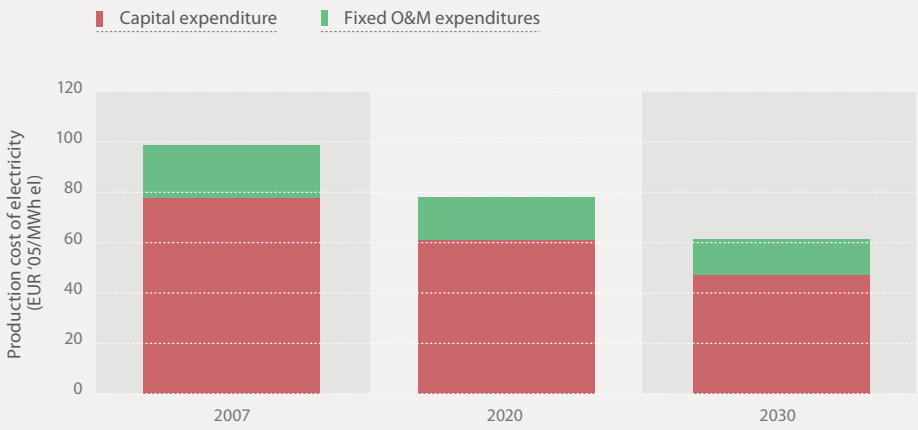
EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM WIND ON-SHORE (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

18/ The region with the highest EU on-shore wind profile is Niedersachsen in Germany, with a capacity of 6 028 MW. The second region is again in Germany, Brandenburg (3 766 MW), whereas the third is in Spain, Castilla-La Mancha (3 404 MW).

([74]) The carbon dioxide price is currently at around EUR 13-16/ton.

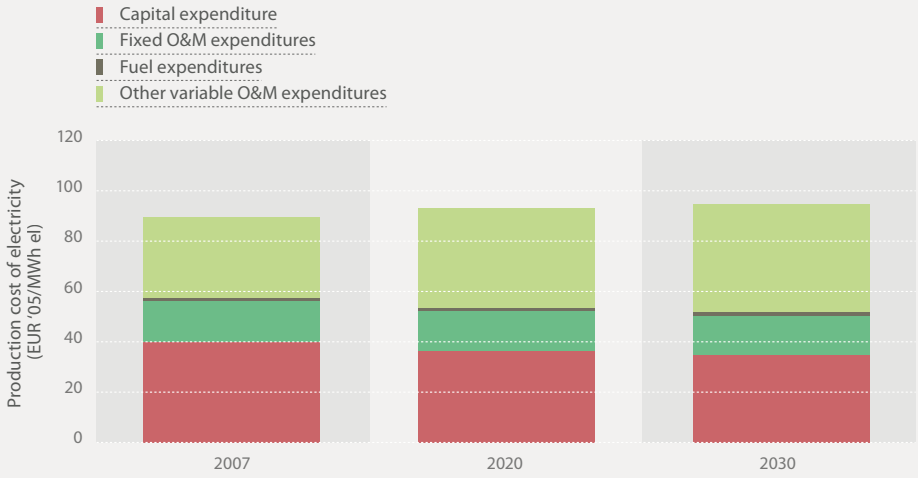
FIGURE 103



EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM WIND OFF-SHORE (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

FIGURE 104 ([75])



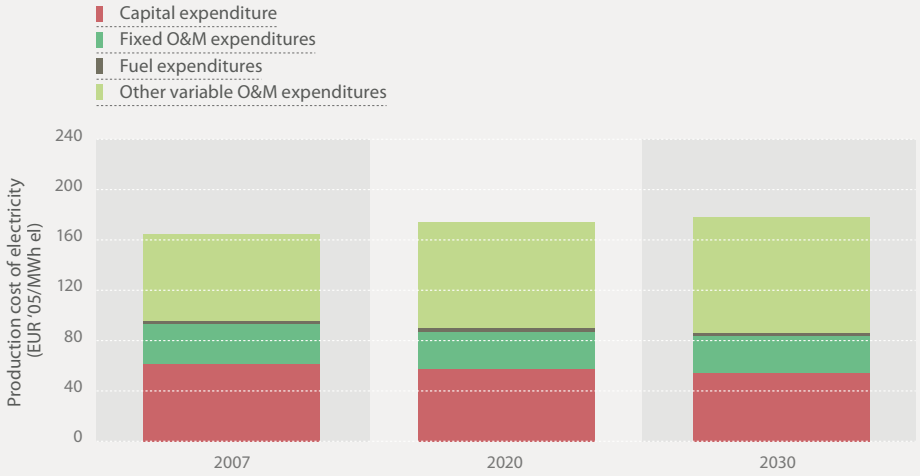
EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM SOLID BIOMASS (30MW) (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

19/ The largest EU off-shore wind park is in Denmark, with a capacity of 209 MW. Also the second and third largest parks are in Denmark (165 and 160 MW), whereas the fourth and fifth largest ones are situated in the Netherlands (120 MW) and Sweden (110 MW).

([75]) *For biomass, it is expected that demand for fuel will rise and this is reflected in higher fuel prices. However, increased conversion efficiencies in the biomass energy sector are not taken into account.*

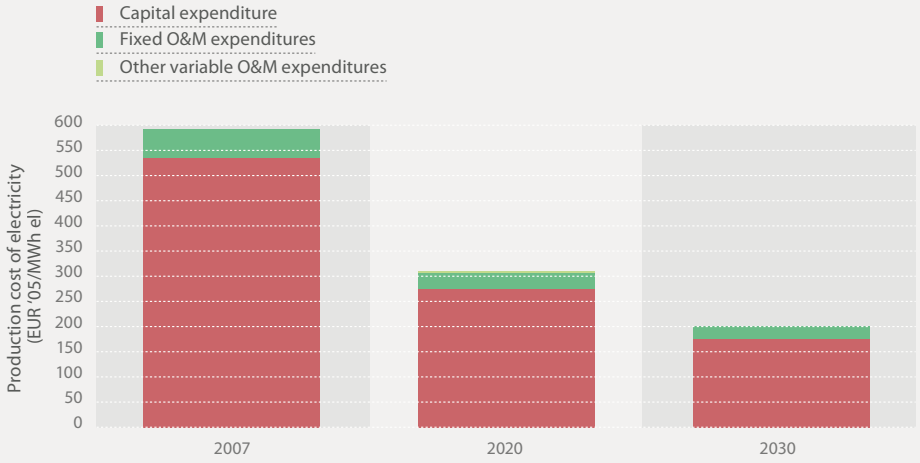
FIGURE 105



EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM SOLID BIOMASS (SMALL) (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

FIGURE 106

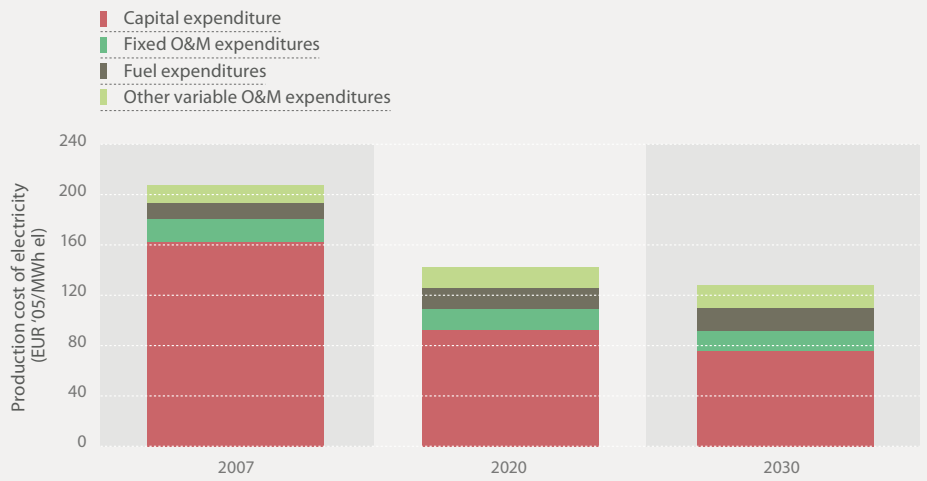


EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM SOLAR PHOTOVOLTAICS (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

20/ The largest EU photovoltaic power plant is in Spain (Castilla-La Mancha), with a capacity of 50 MW. The second largest is again in Spain (47 MW), whereas the third and fourth largest are located in Portugal (46 MW) and Germany (40 MW).

FIGURE 107



EUROPEAN AVERAGE OF THE COST OF PRODUCTION OF ELECTRICITY FROM CONCENTRATING SOLAR THERMAL POWER (in EUR MWh el) (2007-2030)

Source: European Commission (JRC)

With binding targets for the share of renewable energy in 2020, the EU has created certainty for investors in renewable energy technologies. It has also provided for a wide range of instruments and for flexibility for Member States to achieve their 2020 targets on time. Member States have now to develop their National Renewable Energy Action Plans ([76]). In preparing these plans, Member States will have to consider the best option to attract investment and support the development of RES in a cost efficient way, taking into account the differences between each sector.

At the same time, market developments such as falling production costs and hopefully a rising carbon price, will also support RES investment. In the power generation sector, trading RES-power between Member States could reduce the costs of support schemes by encouraging construction in low-cost locations. Member States also have the opportunity to consider their support mechanisms in a regional perspective, in particular for electricity. Converging national solutions whenever possible can help avoid distorting price signals. Greater regional integration of electricity markets, generated through the Third internal energy market liberalisation package and including coordination of 10-year grid management plans and the building of more inter-connectors constitutes a means to help manage the higher penetration of RES electricity. It would thus render investment in RES more attractive. In turn, the need to integrate more RES could help drive electricity markets integration. Electricity grid development requires transparent and non-discriminatory market mechanisms, rules and procedures and an adapted infrastructure to allow electricity management. Market developments and physical infrastructure are mutually inter-dependent and ENTSO-E's ten-year investment plan for electricity networks, due in 2010, need to take this into account.

Deploying RES infrastructure and developing RES markets at a larger scale will have further consequences for energy markets and in particular for electricity. As mentioned, it is estimated that RES electricity will account for around 35 % of total electricity, up from 15.6 % today. Wind power will account for the bulk of it. Beyond possible market integration, the large amount of RES electricity and in particular of wind power is expected to increase price volatility and to produce a new merit-order curve.

Given the huge challenges ahead, monitoring the development of capacities will be necessary to make sure that investment projects are implemented on time. In July 2009, the European Commission has proposed to establish a regular monitoring of investment projects in energy infrastructure, including RES. This monitoring could foster transparency, help to anticipate the evolution of the EU energy system and contribute to shaping a better investment environment.

21/ The largest EU solar thermal power plants are in Spain (Andalusia and Castilla-La Mancha), which has three plants with a 50 MW capacity. The second and third largest are again in Spain, with a capacity of 20 and 11 MW.

([76]) These plans will detail long-term renewable energy measures and policies for RES development and RES investment. They will have to cover enabling measures such as revising administrative procedures, building codes, information and training, energy infrastructure development and access, support schemes and flexibility measures.

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.

Renewables

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 hydropower 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 hydropower 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 codes: D (Manufacturing) + F (Construction) – DF (Manufacture of energy products).

Non-Metallic Mineral Products Industry – the sector is defined according to the NACE code DI 'Manufacture of other non-metallic mineral products', which includes for example the manufacture of cement, clinker and glass products.

Chemical Industry – the sector is defined according to NACE code DG 'Manufacture of chemicals, chemical products and man-made fibres'.

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

Paper and Printing Industry – the sector is defined according to NACE code DE 'Manufacture of pulp, paper and paper products; publishing and printing'.

Services – the sector is defined according to the following NACE codes: G + H + J + K + L + M + N + O.

Transport – the sector covers all types of transport. To calculate energy intensity the final energy consumption in transport was divided by the value added at basic prices of the whole economy.

Abbreviations

1000T – kilo tonnes
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
ERGEG – European Regulators' Group for Electricity and Gas
EUR – Euro
EUR million – Million euro
EUR million'00 – Million euro (2000)
EUR/bbl – Euro per barrel
GDP – Gross Domestic Product
GW – Gigawatt
GWh – Gigawatt Hour
HDD – Heating degree days
IEA – International Energy Agency
LNG – Liquefied Natural Gas
Mb/d – Million barrels per day
Mbbl – Million barrels
MMBtu – Million British Thermal Units
Mt – Million tonnes
Mtoe – Million tonnes of oil equivalent
MW – Megawatt
MWe – Megawatt electrical
MWc – Megawatt crête
MWh el – Megawatt hour electrical
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 – Tera joules
Toe – Ton of oil equivalent
TSO – Transmission system operator
TWh – Terawatt Hour
USD – US dollar

Post-its – List of sources

Carbon Calculator – © European Union	post-its 2, 3, 4
European Commission	post-its 1, 5, 7, 11 ,12, 14, 17
European Environment Agency	post-it 8
Gas Infrastructure Europe	post-it 13
Intergovernmental Panel on Climate Change	post-it 6
National Geographic Society 'Energy for tomorrow'	post-it 9
© Platts (2009)	post-its 10, 15, 16, 18-21

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