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Quarterly Report on European Electricity Markets

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DG Energy

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Commission européenne, B-1049 Bruxelles / Europese Commissie, B-1049 Brussel – Belgium

E-mail: ENER-MARKET-OBSERVATORY-QUARTERLY-REPORTS@ec.europa.eu

Content

Highlights of the report

- Wholesale electricity prices in the EU, represented by the PEP index, fell to 30 €/MWh in February 2016, which was the lowest since March 2007.

- Generally mild winter conditions reduced the demand for electricity and natural gas for heating, eliminating most of the upward pressure on wholesale electricity prices on the demand side.

- High wind power generation in several months, coupled with falling natural gas and coal prices at the beginning of 2016, reduced power generation costs and resulted in low wholesale prices in most of Europe.

- Fall in natural gas prices improved the competitiveness of gas-fired generation in many markets, and gas deliveries to power plants increased at the beginning of 2016.

- In the first quarter of 2016 differentials in wholesale electricity prices across European regions decreased compared to the previous year.

- In December 2015 two electricity interconnectors (Sweden-Lithuania and Poland-Lithuania) were inaugurated, improving electricity supply in the Baltic region.

- As of 20 January 2016 wholesale power trading started in the IBEX market in Bulgaria.

- In April 2016 retail electricity prices in most of EU capital cities decreased in year-on-year comparison, primarily owing to decreasing energy and supply costs within final prices.

Executive summary

- **Electricity consumption in the EU increased by 1.5% in 2015** compared to the previous year, whereas in the fourth quarter of 2015 consumption was up by 0.6% compared to Q4 2014. Economic growth in the EU-28 continued and GDP was up by 1.7% in year-on year comparison in the first quarter of 2016, after a growth of 1.9% measured in Q4 2015. Decoupling of the evolution of electricity consumption from the economic growth in the EU continued in 2015 and in early 2016, pointing to decreasing energy intensity of the EU economy.

- **The Platts' European Power Index (PEP)**, expressing the average evolution of the wholesale power prices in the European markets **fell to as low as 30 €/MWh in February 2016, being the lowest monthly average since March 2007.** This nearly decade-low wholesale price was the result of the combination of low demand for electricity, largely owing to mild weather conditions reducing domestic heating needs, abundant renewable power generation due to good wind availability, and to falling natural gas and coal prices, reducing fossil fuel generation costs. In Central Western Europe improving nuclear availability also contributed to low electricity prices at the beginning of 2016.

- **In parallel with significant falls in energy commodity prices, gas fired generation became more competitive against coal in many European markets,** which was reflected in increasing gas deliveries to power generation in the EU at the beginning of 2016. The profitability of gas fired generation improved, even amid decreasing emission allowance prices. In the United Kingdom the share of gas in power generation rose to six year high in February-March 2016. In wholesale markets, where natural gas has of particular importance in setting marginal electricity generation costs (UK, Netherlands, Italy, etc.) the electricity price fell significantly in Q1 2016, and thus the difference in wholesale prices across the EU decreased.

- Contrarily to the generally mild weather during the whole winter period in Europe, **January 2016 was colder than usual in the Nordic countries, and during the month there were several price spikes** (on 20 January the Nordpool system price rose to four-year high, 81 €/MWh). Demand for electricity in the region is sensitive to temperatures as electricity has an important role in domestic heating. During these periods the Nordic region, being normally the cheapest in Europe, became net electricity importer, which also influenced wholesale prices in Central Western Europe.

- **In December 2015 two electricity interconnectors (NordBalt, linking Sweden with Lithuania and LitPol, linking Poland with Lithuania) were inaugurated**, helping to eradicate the 'energy island' nature of the Baltic electricity markets. In February 2016, as the real test phase of NordBalt started, the price premium of the Lithuanian electricity market to the Nordpoolspot system price measurably decreased compared to earlier periods.

- **On 20 January 2016 wholesale electricity trading has started in the new IBEX market in Bulgaria.** Bulgarian day-ahead wholesale prices closely tracked the developments in the neighbouring Romanian market. The country's electricity generation is largely based on domestic lignite and nuclear, enabling cheap baseload power generation and competitive power exports to its neighbours.

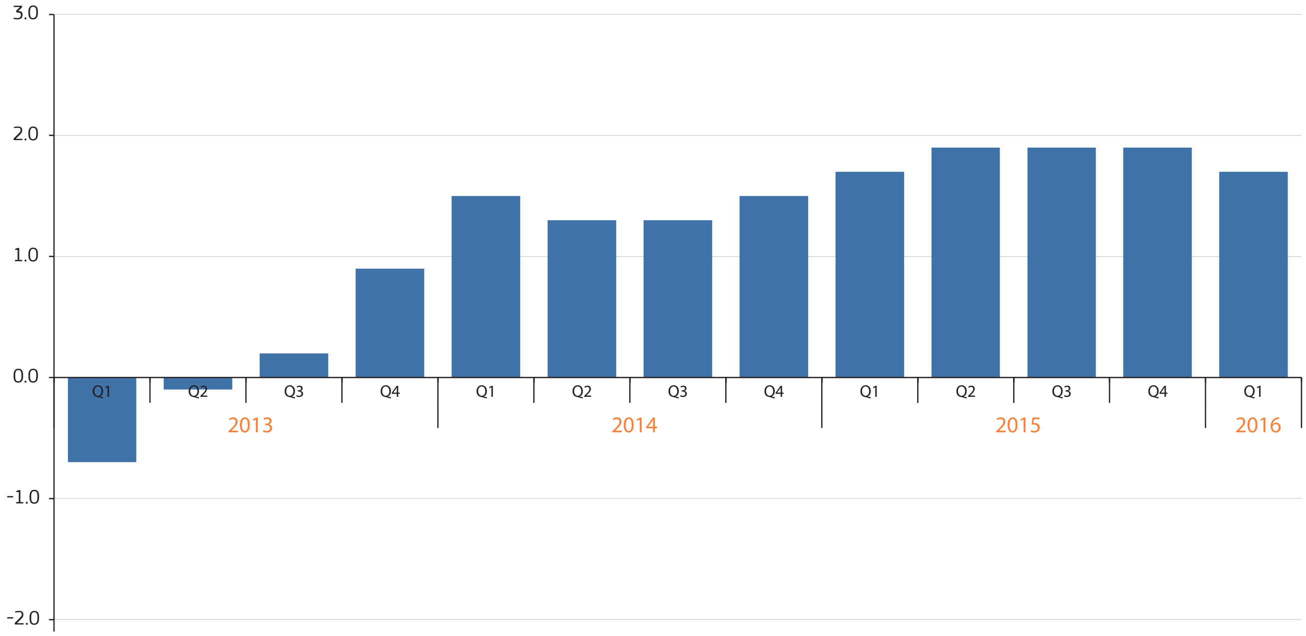
- Over the last few years **industrial retail electricity prices showed signs of gradual convergence across the EU, especially in the case of customers having high annual electricity consumption**, while in the case of households not too many signs of convergence could be observed. As of 2016 we have a complete set of electricity prices in EU capital cities, showing around threefold price difference between the lowest and the highest price across the EU. **In April 2016 retail electricity prices decreased in most of the EU capital cities compared to April 2015, mainly driven by decreasing energy and supply costs, which reflect the decreasing wholesale electricity prices in most the EU markets.**

1. Electricity demand drivers

As Figure 1 shows, economic growth in the EU-28 continued in the first quarter of 2016, and GDP grew by 1.7% in year-on-year comparison, showing a slight deceleration compared to the previous quarter, when economic growth reached 1.9% in the EU. Since the third quarter of 2013 the EU-28 economy has been steadily growing.

Electricity consumption in the EU-28 increased by 1.5% (40.4 TWh) in 2015 compared to the previous year, and it was up by 0.6% (4.9 TWh) in the fourth quarter of 2015 in year-on-year comparison. In 2015 the increase in electricity consumption in the EU was slower than the economic growth, implying improving electricity intensity of the EU economy.

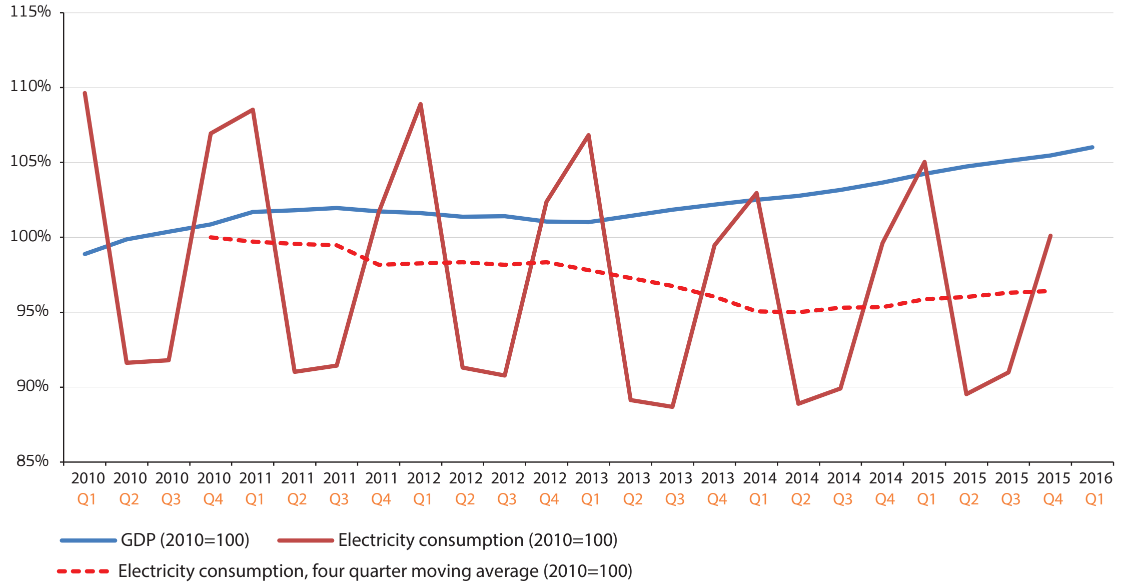
FIGURE 1 – EU 28 GDP Q/Q-4 CHANGE (%)



Source: Eurostat

- Looking at longer time series, there is a clear sign of decoupling between economic growth and consumption of electricity in the EU-28, as Figure 2 shows. While EU electricity consumption decreased between 2010 and 2015 by 3.5%, GDP was up by almost 6% at the turn of 2015/2016 compared to 2010. However, it must be noted that divergence between economic growth and decreasing electricity consumption might not fully be attributed to improving electricity intensity of the EU economy, as decentralised forms of electricity generation do not fully appear in statistics provided by electricity transmission system operators, serving as the basis for electricity consumption statistics, and thus the actual electricity consumption might be underestimated.

FIGURE 2 - QUARTERLY EVOLUTION OF THE EU-28 GDP AND ELECTRICITY CONSUMPTION, 2010=100

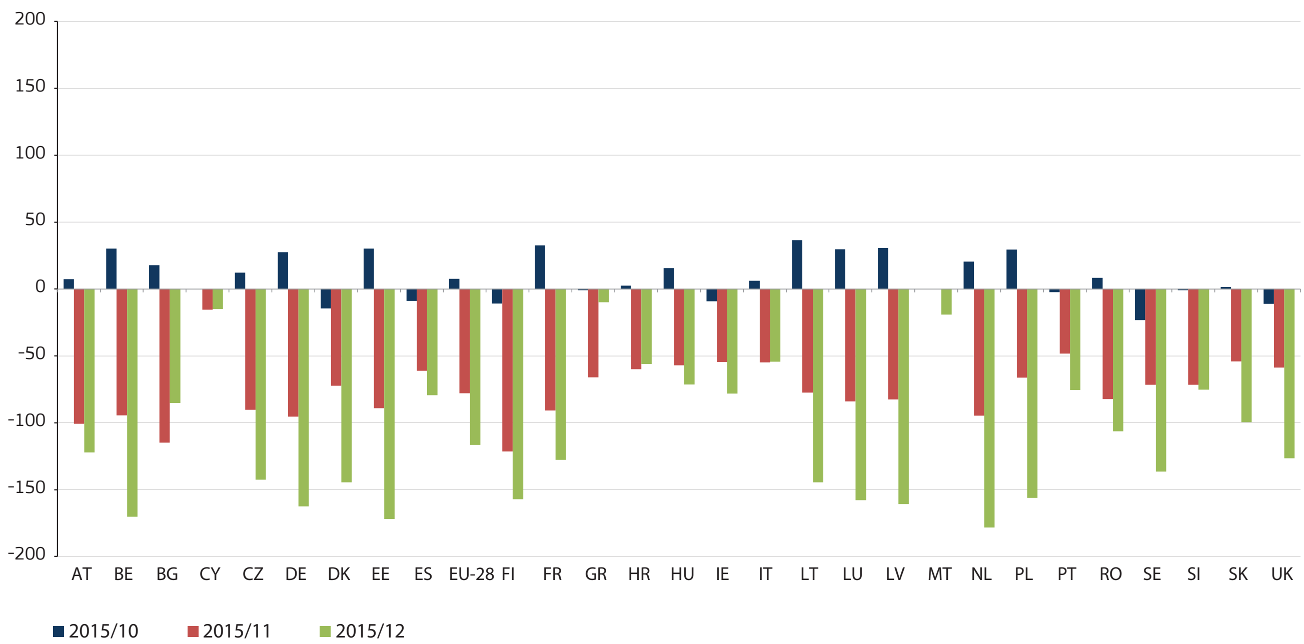


Source: Eurostat and ENTSO-E data

- Figure 3 show the monthly deviation of actual Heating Degree Days (HDDs) from the long term averages in October-December 2015 in the twenty-eight member states of the EU. Due to a week-long cold spell in mid-October 2015 the month as a whole was colder than usual in many European countries, which also impacted electricity demand and demand for fuels used for residential heating, such as natural gas. November and December 2015 was generally mild across the European continent, reducing the demand for electricity and residential heating.

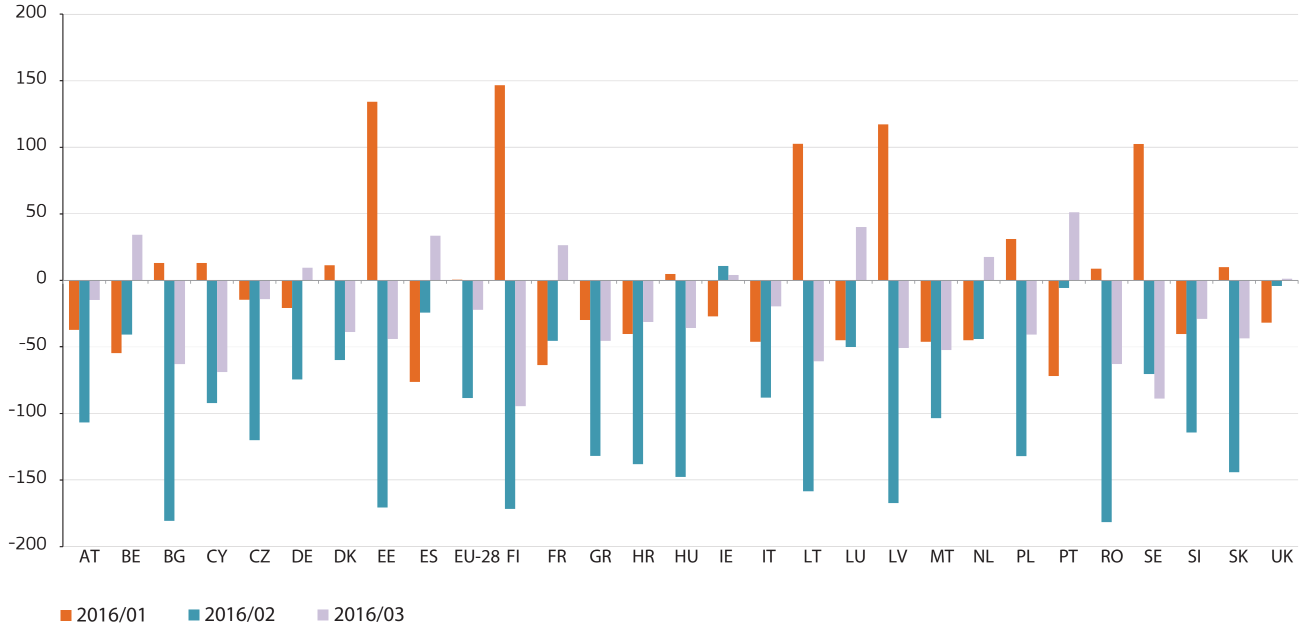
- In January-March 2016 the weather in most of the European countries was generally milder than usual, however, in Northern Europe January 2016 was significantly colder, implying HDD numbers being higher than the long term average, as Figure 4 shows. Cold weather impacted demand for electricity and wholesale electricity prices in the Nordic countries (See in Chapter 4.3). February 2016 was very mild compared to the normal seasonal temperatures in whole Europe, and in March mild weather generally prevailed, however, in some countries this month was colder than usual.

FIGURE 3 - DEVIATION OF ACTUAL HEATING DEGREE DAYS (HDDS) FROM THE LONG TERM AVERAGE, IN OCTOBER- DECEMBER 2015



Source: Eurostat/JRC.
The colder is the weather, the higher is the number of HDDs

FIGURE 4 - DEVIATION OF ACTUAL HEATING DEGREE DAYS (HDDS) FROM THE LONG TERM AVERAGE, IN JANUARY-MARCH 2016



Source: Eurostat/JRC.
The colder is the weather, the higher is the number of HDDs

2. Evolution of commodity and power prices

2.1 Evolution of power prices, and the main factors affecting power generation costs

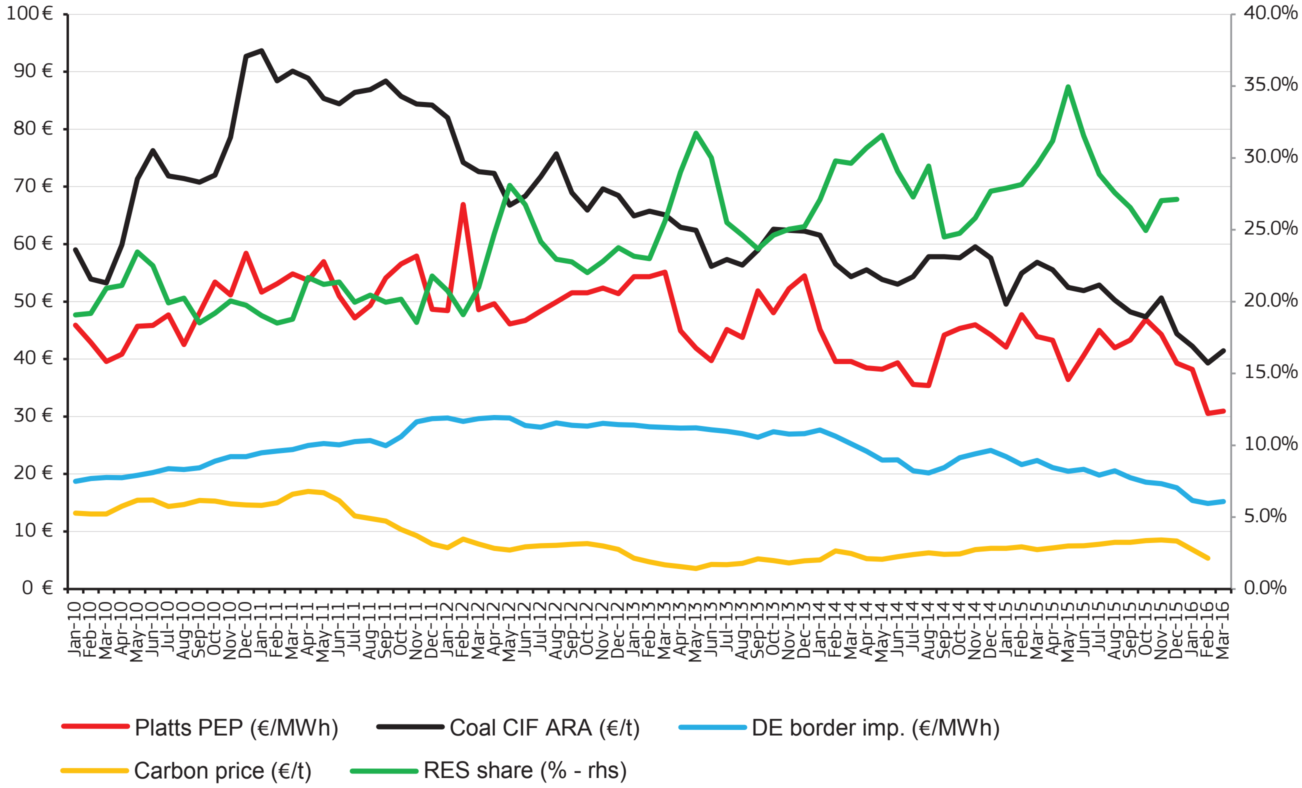
- Coal prices (as represented by CIF ARA contracts, an import price benchmark widely used in North-Western Europe), as Figure 5 shows, continued to follow the decreasing trend of the last few years and in Febraury 2016 they fell below 40 €/Mt, which was the lowest monthly average since mid-2003. Decrease in coal prices went hand in hand with the overall price fall of energy commodities, reaching their trough in the first quarter of 2016. In parallel with decreasing fossil fuel prices emission allowance prices also fell signficantly, from 8-9 €/tCO2e to 5 €/tCO2e throughout the first quarter of 2016.

- Natural gas prices (measured as import prices on the German border) were around 15 €/MWh on average in the first quarter of 2016, which lows were last seen in the summer of 2005. The impact of falling crude oil prices filtered in oil-indexed long term gas imprt contracts, in parallel with falling gas prices on Western European hubs, largely owing to higher than normal winter temperatures, significantly reducing residential heating needs.

- The share of renewable energy sources, including hydro, remained stable in the fourth quarter of 2015 and in December they assured 27% the EU power generation mix, as Figure 5 shows. While in many countries the share of wind generation reached in December 2015 this highest in the last few years, hydro generation receded in some European countries due to dry weather conditions, balancing off the impact of high wind.

- Fall in fossil fuel prices resulted in decreasing conventional generation costs, being the main factor in driving down wholesale electricity prices in most of the European countries. In February-March 2016 the Platts Pan-European Power Index (PEP, used as an electricity price benchmark in Europe, fell to 30 €/MWh, as the red curve in Figure 5 shows. This was the lowest price level since March 2007.

FIGURE 5 - EVOLUTION OF EUROPEAN AVERAGE WHOLESALE POWER PRICE COMPARED WITH COAL, GAS AND CARBON PRICES AND THE SHARE OF RENEWABLES IN POWER GENERATION

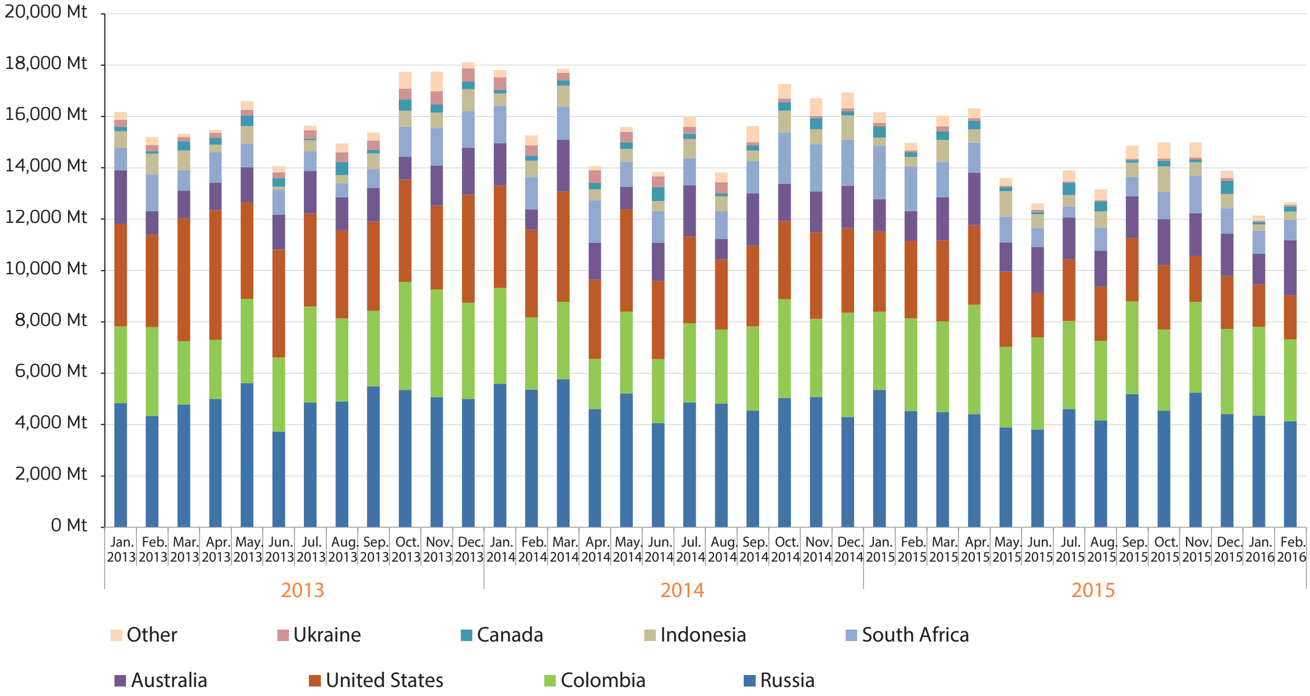


Source: Source: Platts, BAFA, ENSTO-E
Platts PEP: Pan European Power Index (in €/MWh)
Coal CIF ARA: Principal coal import price benchmark in North Western Europe (in €/Mt)
DE border imp. stands for long term contract based import natural gas price on the German border (in €/MWh)
RES (renewables) includes hydro, wind, solar and biomass; RES share in the total power generation estimation for the EU-28 as a whole (right hand scale)

- Figure 6 shows the major extra-EU coal import sources and the monthly amount of imported coal in the EU. In 2015 coal imports from extra-EU sources decreased by 8% compared to the 2014, and in January-February 2016, primarily owing to the mild winter and to the saturation of the European coal market, extra-EU imports decreased by more than 20% compared to January-February 2015.

- In 2015 the largest chunk of extra EU coal imports came from Russia (31%), followed by Colombia (24%), United States (17%), Austrailia (11%), South Africa (7%) and Indonesia (4%). Looking at import quantities, total imports from the United States were down by one quarter in 2015 compared to the previous year, while imports from South Africa decreased by 19%, and Russian imports went down by almost 8%. However, imports from Colombia and Australia mangaged to increase (respectively by 10% and 6%).

FIGURE 6 – THE MOST IMPORTANT EXTRA-EU COAL IMPORT SOURCES AND MONTHLY IMPORTED QUANTITY IN THE EU-28



Source: Eurostat, COMEXT database

The next two charts (Figure 7 and Figure 8) show the monthly evolution of clean spark spreads and clean dark spreads, measuring the profitability of gas-fired and coal-fired power generation.

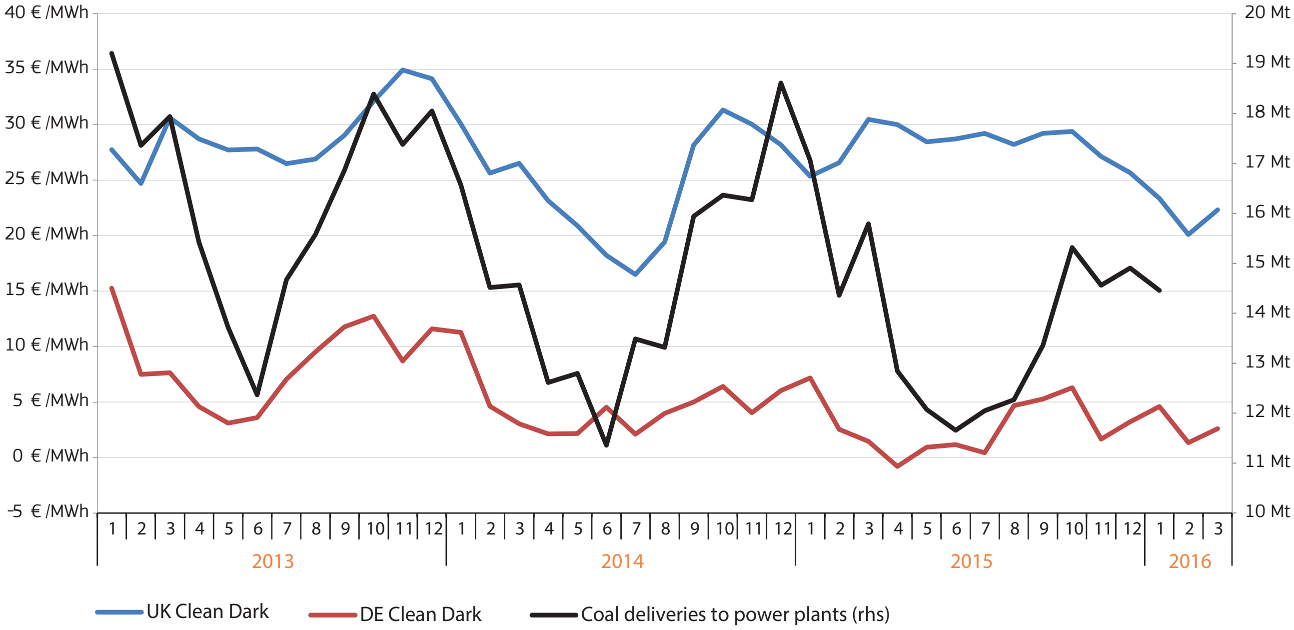
- With the exception of the UK clean spark spreads were in the negative range during most of the time since 2013, implying that gas-fired generation was not profitable in the continetal markets presented on Figure 7 (Germany, the Netherlands and Belgium). However, since the fourth quarter of 2015 most of clean spark spreads were in positive range in the cosequence of falling gas prices, accelerating in the first quarter of 2016.

- This can also be tracked in the evolution of natural gas deliveries to power generation facilities, as at the end of 2015 and at the beginning of 2016 gas deliveries to power plants increased in year-on-year comparison, in parallel with clean spark spreads moving into positive ranges. Clean spark spreads largely depend on the wholesale electricity price level in a given market, which were strongly influenced in the last few years by other factors in the power generation mix (e.g.: renewables in Germany, nuclear availability in Belgium, etc.).

- The difference in wholesale electricity prices between the UK and Germany also impacted the local profitability of coal fired generation: while in the UK high clean dark spreads signalled the competitiveness of coal in the country (though signficiant coal-fired capacities had to be decommissioned in recent years, primarily owing to power generatrion emission standards, which has also contributed to high UK wholesale electricity prices), in Germany clean dark spreads fell in the range of 0-5 €/MWh in Q4 2015 and Q1 2016.

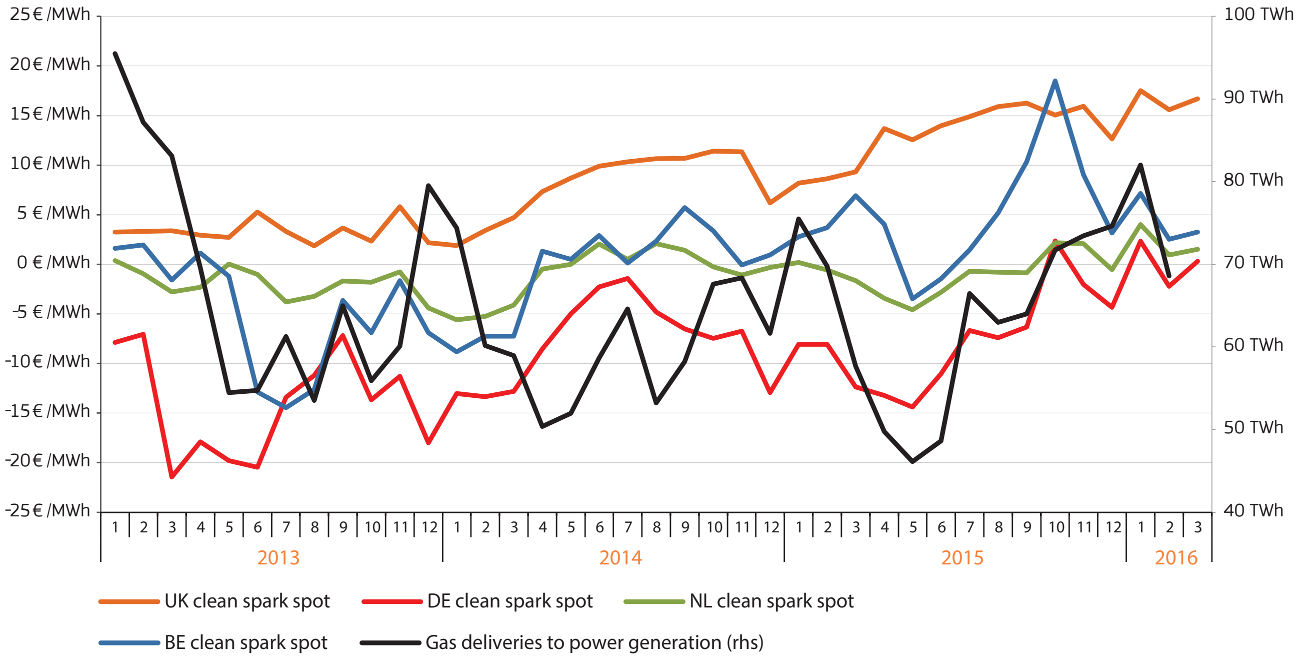
- Coal deliveries to power plants in the EU also showed a highly seasonal and gradually decreasing trend over the last few years, implying that increasing share of renewable generation can also diminish the role of coal in many EU countries. However, coal's competitive advantage over natural gas has been challenged by the recent fall in natural gas prices. Amid improving coal-gas price ratio (from the ascpect of natural gas), even with the current low level of emission allowance prices, competitiveness of gas-fired generation significantly improved compared to earlier periods; as it can be seen from the divergence between inceasing gas deliveries and decreasing coal deliveries to the power plants in the EU.

FIGURE 7 – EVOLUTION OF CLEAN DARK SREADS IN SELECTED MARKETS AND COAL DELIVERIES TO POWER GENERATION IN THE EU



Source: Platts and Eurostat

FIGURE 8 – EVOLUTION OF CLEAN SPARK SREADS IN SELECTED MARKETS AND GAS DELIVERIES TO POWER GENERATION IN THE EU



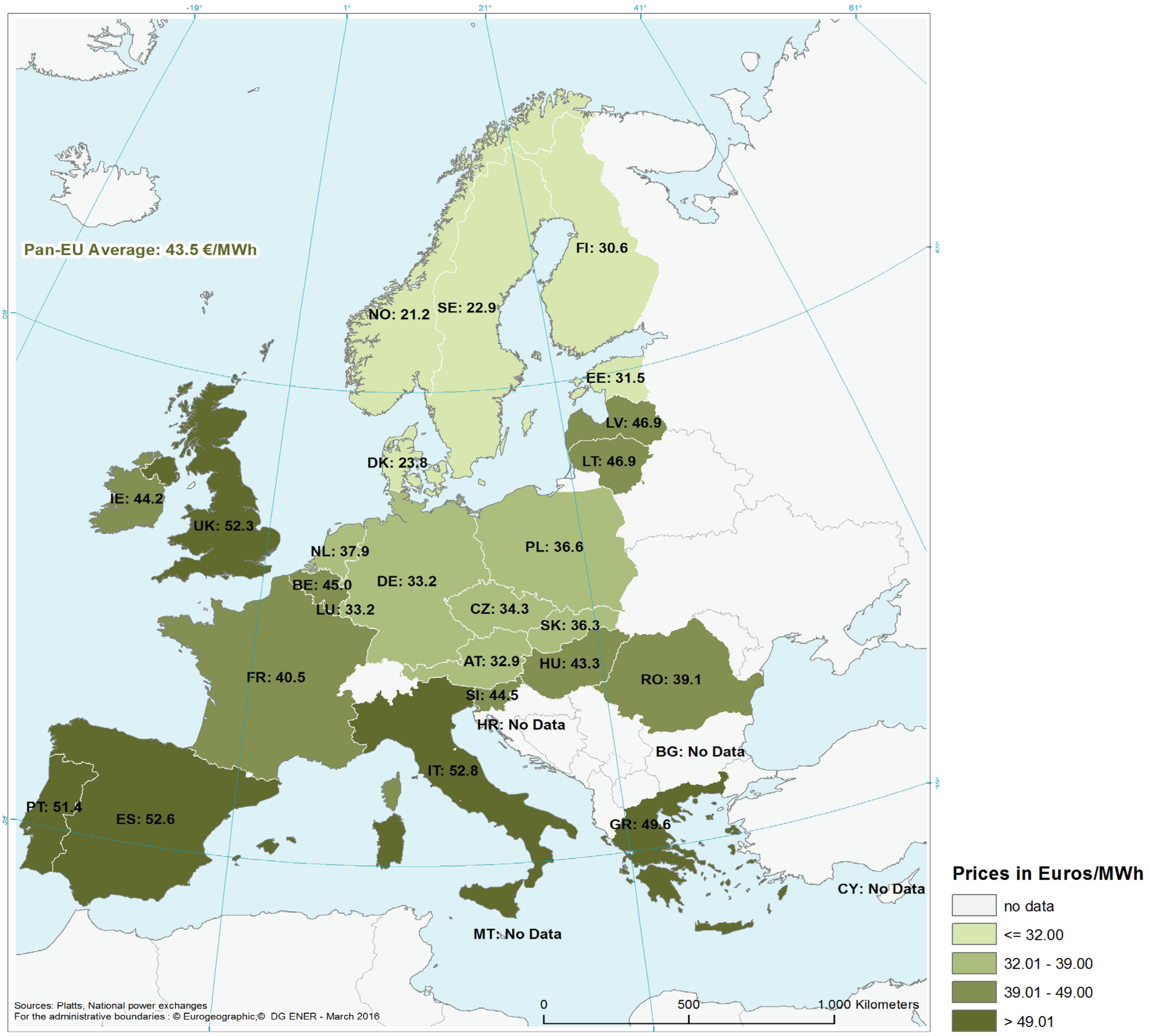
Source: Platts, Eurostat

2.2 Comparisons of monthly electricity baseload prices on electricity markets

- As the next two maps (Figure 9 and Figure 10) show, there were significant price differences in the wholesale electricity prices across the EU in both Q4 2015 and Q1 2016, though in the first quarter of 2016 the range between the cheapest and the most expensive wholesale electricity markets shrunk. Both in Q4 2015 and Q1 2016 the cheapest market in Europe was Norway (with an average price of 21-22 €/MWh), and among the EU Member States the lowest wholesale prices could be found in the neighbouring Sweden (23-24 €/MWh). In Q4 2015 the most expensive EU wholesale market was Spain (53 €/MWh), while in Q1 2016 it was the UK (46 €/MWh).

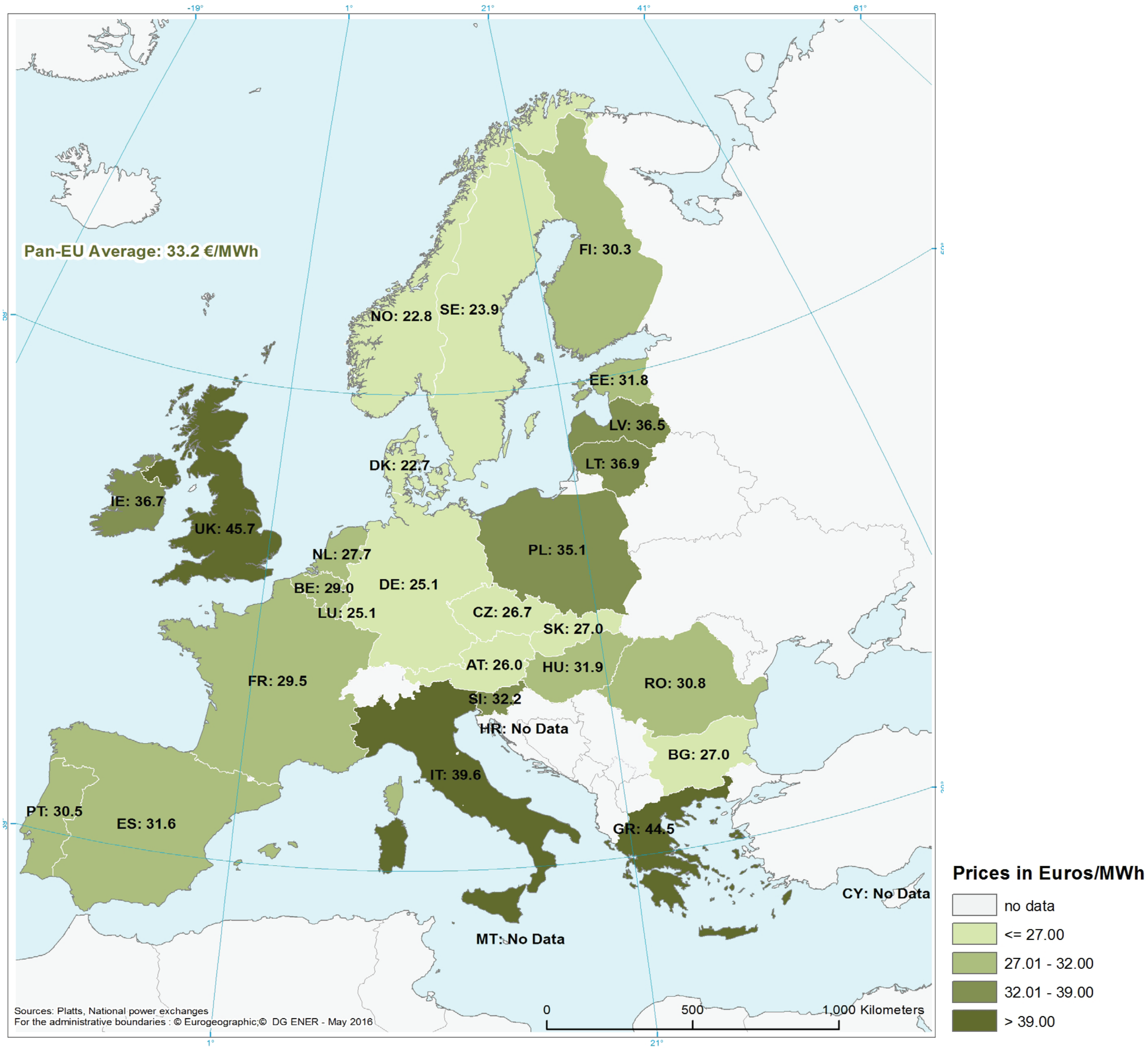
- In comparison to the previous quarter, in Q1 2016 the average wholesale electricity price decreased the most in Spain and Portugal (40%) and in Belgium (36%). In the Iberian market improving hydro and wind availability played the key role in decreasing prices, while in Belgium significant nuclear capacities were reconnected to the grid, increasing supply of electricity. In year-on-year comparison there was not any market in Europe where prices increased in Q1 2016; the biggest decreases occurred in Belgium (38%), Netherlands (36%), France (35%), Spain and Portugal (33%). More details on the drivers behind price changes in each market can be found in Chapter 4.

FIGURE 9 – COMPARISON OF AVERAGE WHOLESALE BASELOAD ELECTRICITY PRICES, FOURTH QUARTER OF 2015



Source: European wholesale power exchanges

FIGURE 10 – COMPARISON OF AVERAGE WHOLESALE BASELOAD ELECTRICITY PRICES, FIRST QUARTER OF 2016

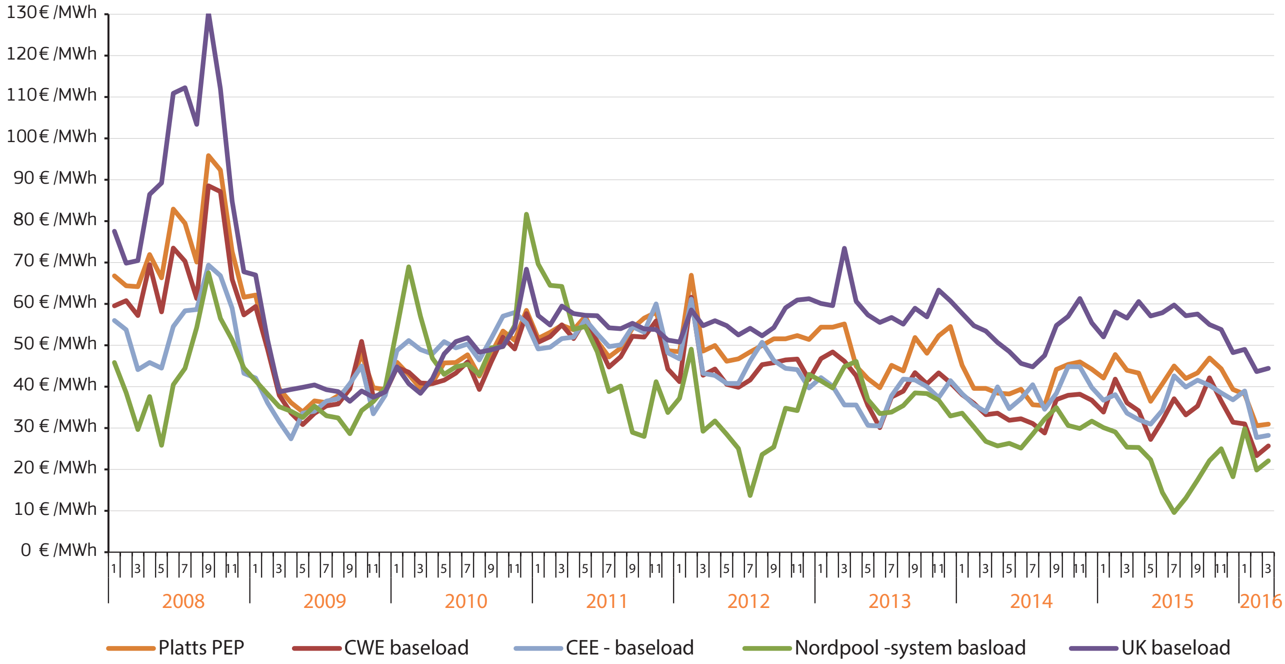


Source: European wholesale power exchanges

- Figure 11 and Figure 12 show the evolution of monthly average baseload wholesale electricity prices in the main power regions in the EU; in parallel with the Platts European Power Index (PEP) since 2008. As Figure 11 shows, the Nordpool-spot system price in Q4 2015 and Q1 2016 slightly recovered from the lows measured in summer 2015, however, it still remained the cheapest benchmark in whole Europe. On the other hand, in parallel with decreasing natural gas prices the UK wholesale price went down significantly in the last two quarters, however, it still remained the highest in the EU by the end of Q1 2016. Over the last few years regional prices in both Central Western and Central Eastern Europe were well aligned with the PEP index and were slightly lower than the European average during most of the time. In the last two quarters prices in these two regions fell significantly, primarily owing to healthy power supply and subdued demand for electricity in Central Europe.

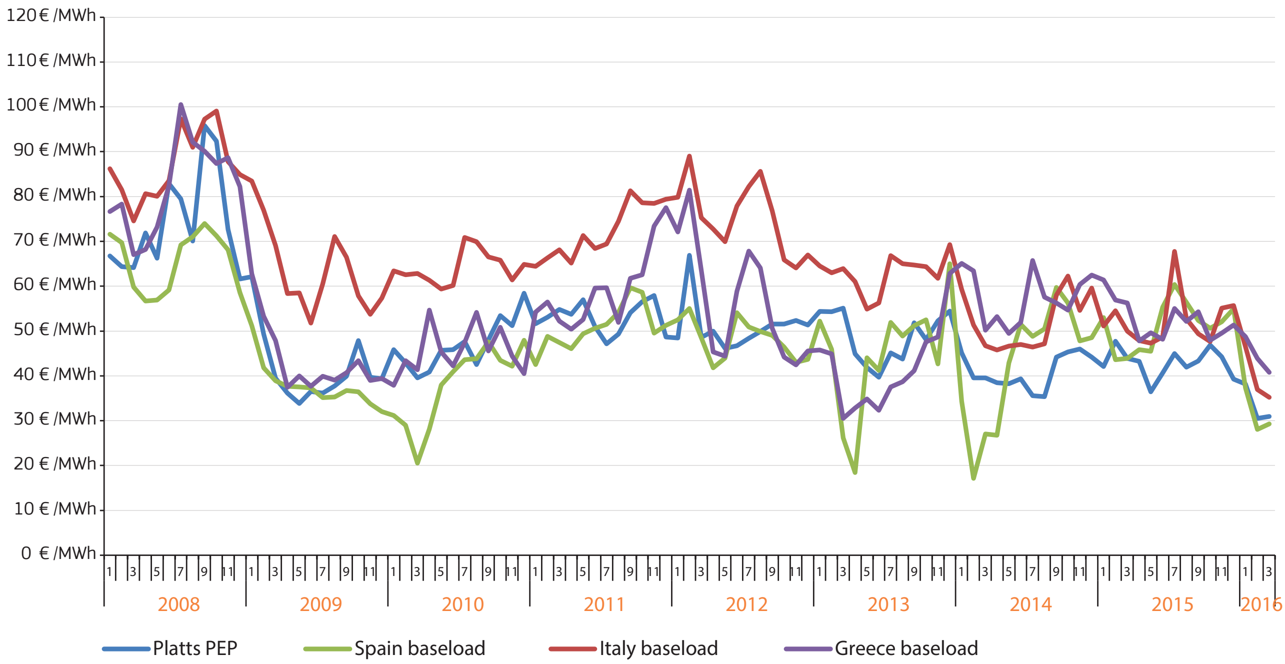
- Over the last few years the Italian market used to belong to one of the highest priced markets in Europe, however, in Q4 2015 and Q1 2016 wholesale prices became significantly lower, in parallel with falling natural gas prices. Wholesale prices in the Spanish market, being permanently high during most of 2015 owing to low hydro generation, underwent a significant decrease as hydro generation ramped up following the arrival of the rainier weather. Greek baseload contracts also followed the generally decreasing price trend of the EU benchmark, however, the average price remained above the PEP index during these two quarters.

FIGURE 11 – COMPARISONS OF THE PLATTS PEP AND MONTHLY ELECTRICITY BASELOAD PRICES IN REGIONAL ELECTRICITY MARKETS (CWE, CEE, NORDPOOL AND THE UK)



Source: Platts, European power exchanges

FIGURE 12 – COMPARISONS OF THE PLATTS PEP AND MONTHLY ELECTRICITY BASELOAD PRICES IN REGIONAL ELECTRICITY MARKETS (SPAIN, ITALY AND GREECE)

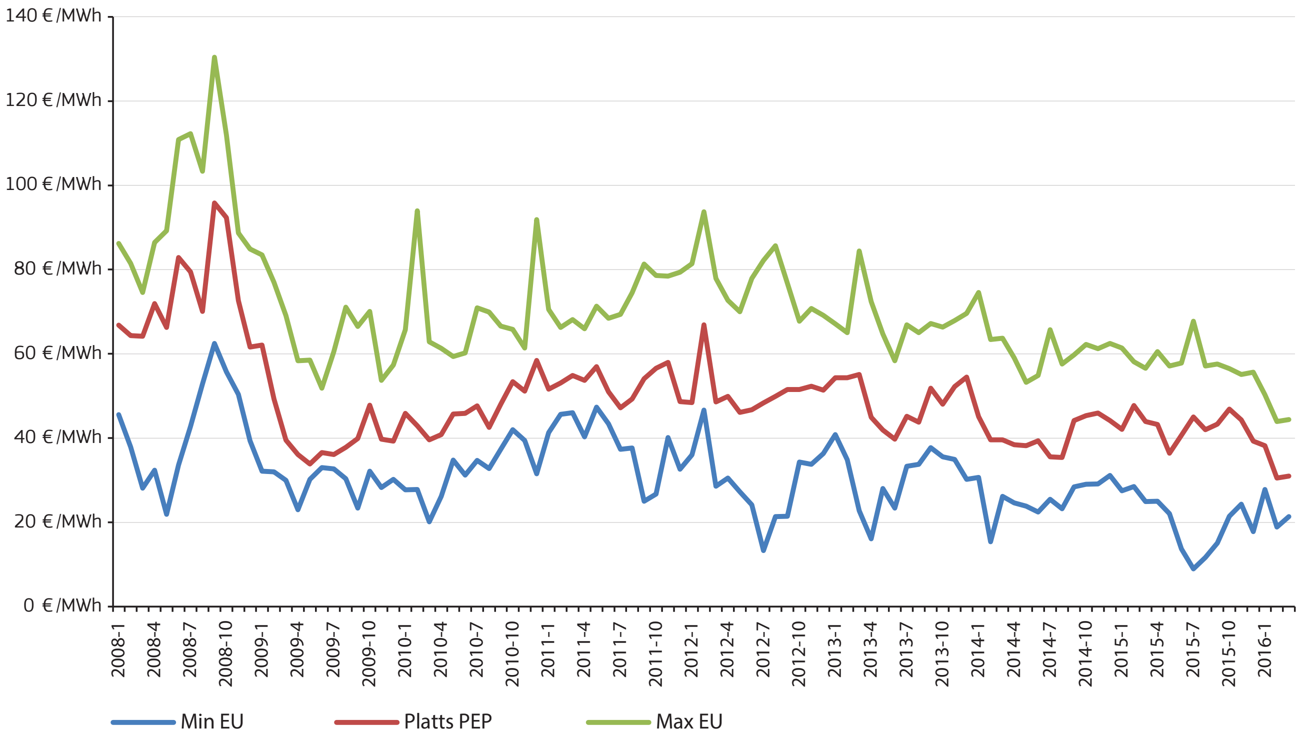


Source: Platts, European power exchanges

- In the consequence of these market developments, in Q1 2016 the price difference between the cheapest and the most expensive European regional markets reached the lowest since the second quarter of 2011. In Q1 2016 the average difference between lowest and the highest price across Europe was 24 €/MWh, whereas in 2015 it was more than 38 €/MWh on average, as it can be followed on Figure 13. As a result of decreasing fossil fuel prices, those markets, where the wholesale price largely depends on fossil generation costs, showed significant price decreases, closing the gap with other markets, where renewables and hydro generation had big influence on market prices.

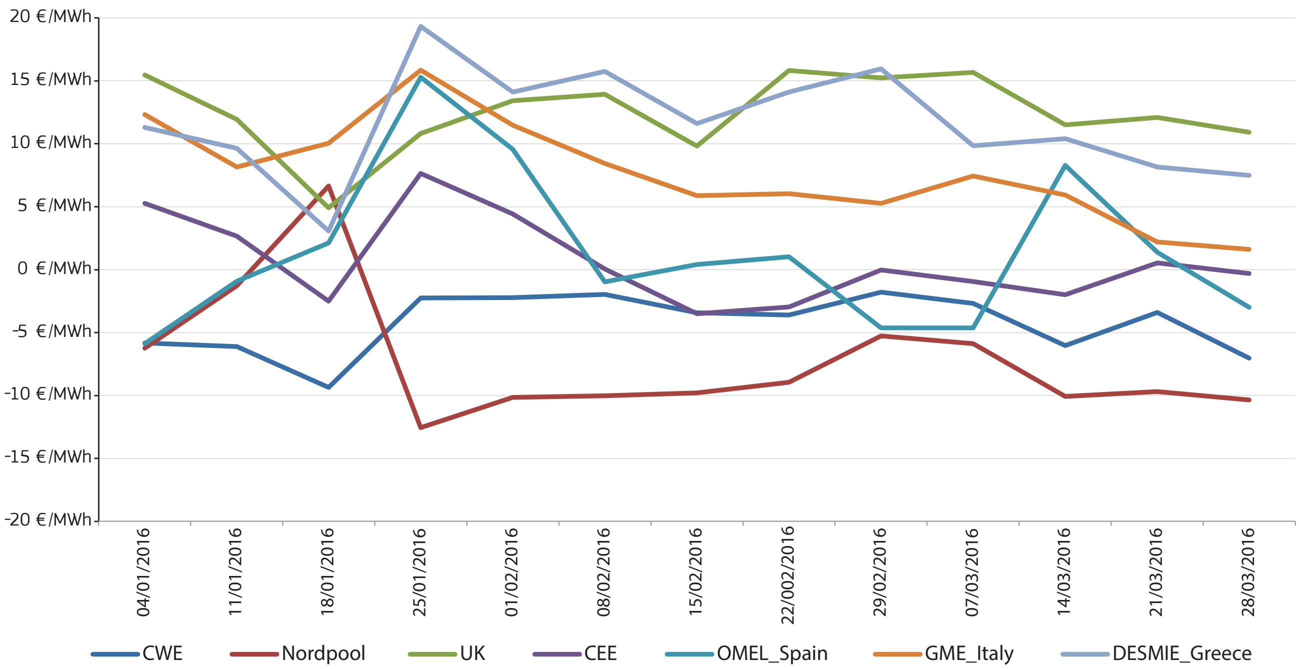
- Regional price differences are also reflected on Figure 14, showing the weekly evolution of regional price premiums or discounts to the PEP benchmark index in Q1 2016. In January 2016 Nordic prices had a short-lived premium to the PEP benchmark, whereas the Italian premium practically disappeared by the end of Q1 2016. Spanish market premium also showed a decreasing trend over time, while the UK retained its positive price differential compared to the PEP benchmark through the whole quarter.

FIGURE 13 – THE EVOLUTION OF THE LOWEST AND THE HIGHEST REGIONAL WHOLESALE ELECTRICITY PRICES IN THE EU AND THE PEP BENCHMARK



Source: European power exchanges, own computations. In January-March 2016 the cheapest market was Sweden in the EU, while the highest wholesale electrcity prices could be observed in the UK. It is important to note that not only the price range, but the location of the cheapest and the most expensive markets within the EU might change over the timespan presented on this chart.

FIGURE 14 – DIFFERENCE BETWEEN THE PEP INDEX AND THE WEEKLY REGIONAL WHOLESALE ELECTRICITY PRICES

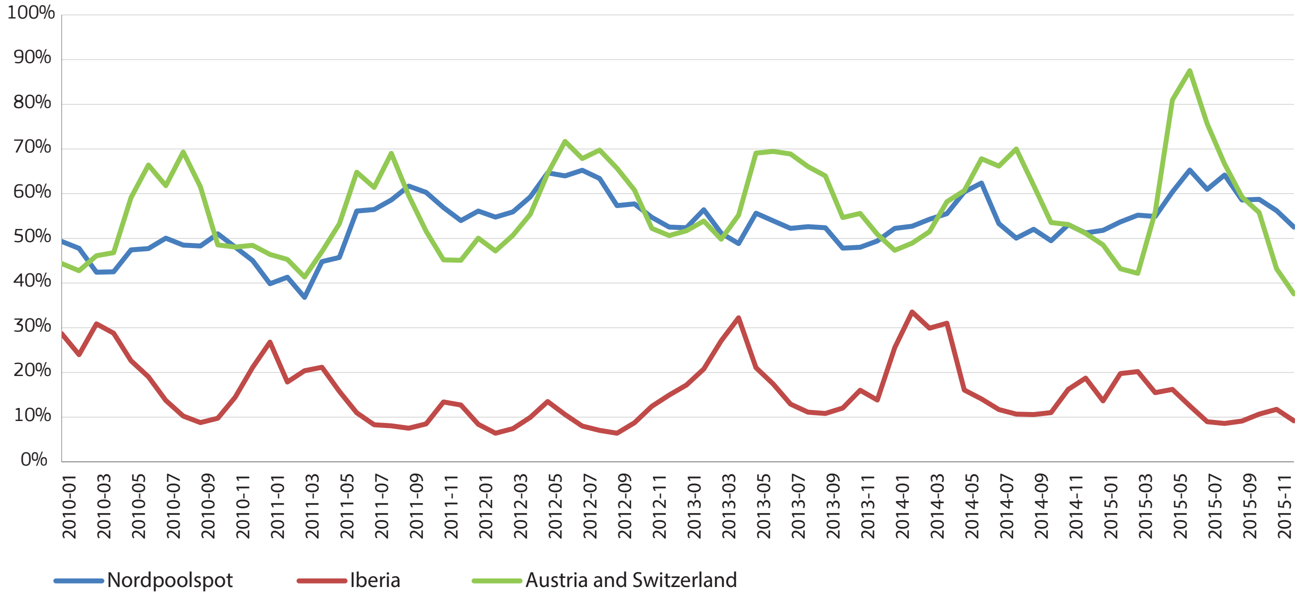


Source: Platts, European power exchanges, own computations

- Figure 15 shows the monthly ratio of actual hydro generation compared to the domestic consumption in three regions (or country groups: Nordic region, Austria and Switzerland, the Iberian region) where hydro generation is an important factor in affecting wholesale electricity prices.

- In Austria and Switzerland the share of power generation from hydro sources fell from one of the highest over the last few years registered in summer 2015 to the lowest by the end of 2015, contributing to the significant wholesale electricity price premium in Switzerland to other markets in Central Western Europe. In Spain the ratio of hydro generation to electricity consumption remained close to three year low in the second half of 2015 and only started to pick up at the beginning of 2016. In the Nordic region high level of hydro reserves and generation started to decrease after its peak in July 2015, however, this was in line with the normal seasonal decrease and did not have an extraordinary impact on the regional wholesale price level.

FIGURE 15 – THE RATIO OF HYDRO COMPARED TO THE POWER CONSUMPTION IN DIFFERENT EU REGIONS



Source: ENTSO-E

3. Traded volumes, market liquidity and cross border trade of electricity

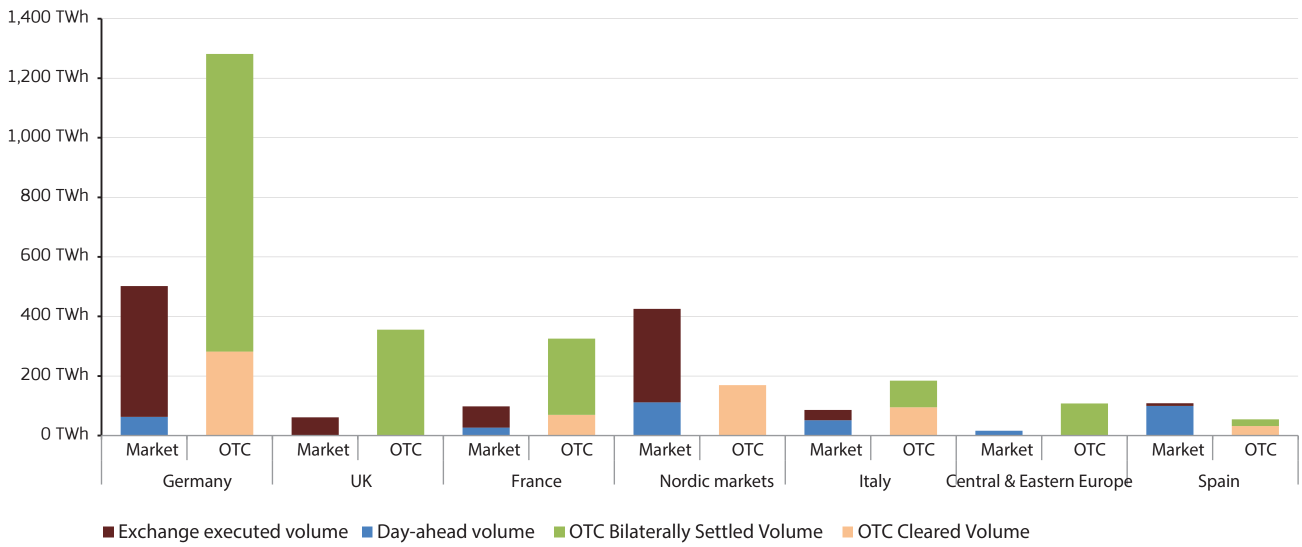
3.1 Comparison of wholesale market trading platforms and the over-the-counter (OTC) markets

- Figure 16 shows the comparison of volumes in different market segments in electricity trading on the most liquid electricity trading platforms in the EU. In order to show the significance of spot and forward traded volumes on organised trading platforms, as well as bilateral trade and cleared trade on the so-called over-the-counter (OTC) markets, two different columns represent the two types of electricity trade in each market on the chart. In some countries and regions the role of OTC markets might be much more important if we take a look at traded volumes of electricity. If OTC trade is significant in a given market, price assessments of cleared OTC trade can also be an indicator on market prices besides price data of organised markets.

- In year-on-year comparison the combined traded volume (market trade and OTC together) significantly increased in. France in 2015 compared to the previous year (43%) and in the first quarter of 2016 it kept on growing (21%). Although in 2015 traded volumes in Germany and Italy rose by 8%, in Q1 2016 they remained practically the same compared to the first quarter of 2015. In the Nordic markets traded volumes decreased in 2015, though in Q1 2016 a huge upturn (+52%) could be observed, if compared with the same period of the previous year.

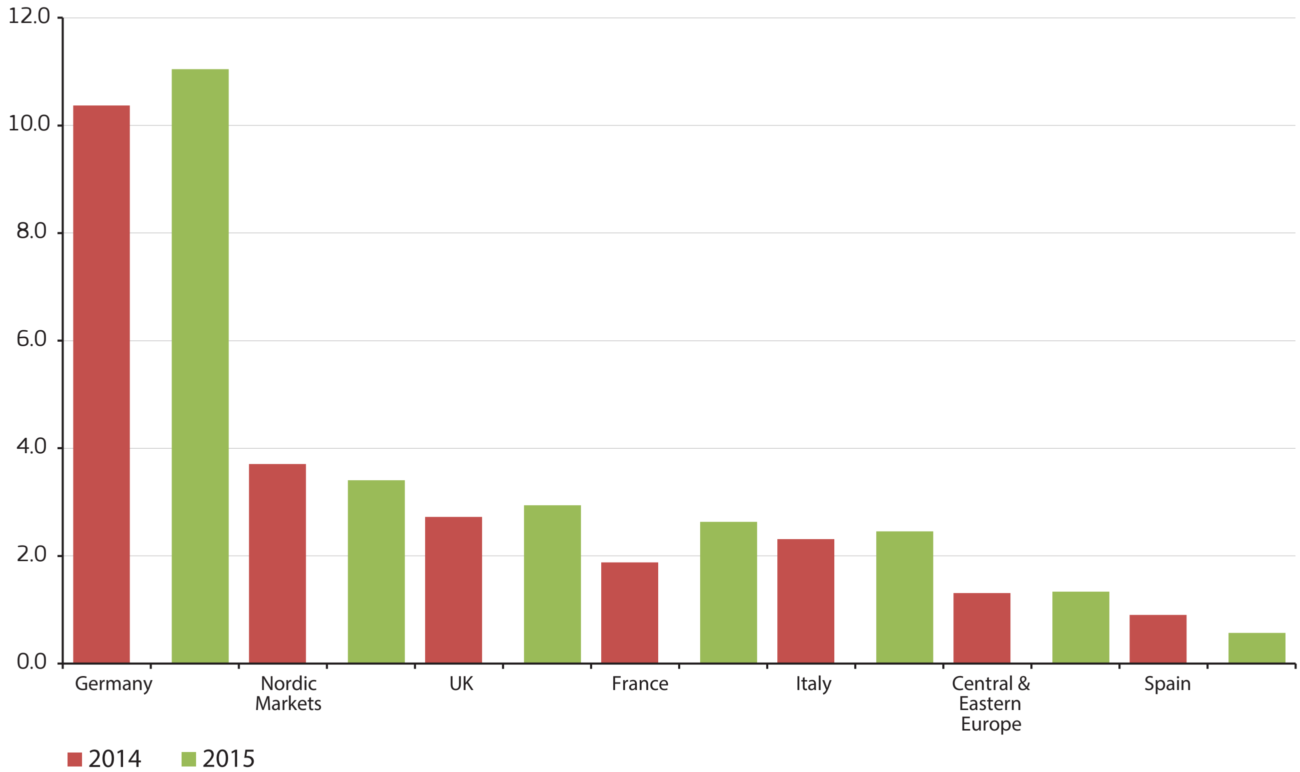
- Market liquidity can be measured by the so-called churn rates, providing information on the ratio of the total volume of power trade (including exchange executed and OTC markets) and electricity consumption in a given time period. Figure 17 shows the evolution of the annual churn rates between 2014 and 2015. The German market proved to be the most liquid one in Europe in both years, having a churn rate of 10-11. With the exception of the Nordic markets and Spain, churn rates continued to increase in 2015 compared to 2014; the biggest increase could be observed in France.

FIGURE 16 – COMPARISON OF ELECTRICITY TRADED VOLUMES IN SOME IMPORTANT DAY-AHEAD, FORWARD AND OTC MARKETS, FIRST QUARTER OF 2016



Source: Platts, wholesale power markets, Trayport, London Energy Brokers Association (LEBA) and own computations

FIGURE 17 – ANNUAL CHURN RATES ON SELECTED EUROPEAN WHOLESALE ELECTRICITY MARKETS



Source: Trayport, London Energy Brokers Association (LEBA), ENTSO-E and own computations

3.2 Cross border trade of electricity

- As Figure 18 shows, in the fourth quarter of 2015 the Central Western Europe (CWE) power region reached its strongest net electricity exporter position over the last few years, primary owing to its abundant and cheap renewable based power generation. The region could export significant amount of electricity to the UK, Italy and the Iberian market. In the first quarter of 2016, as price differentials decreased across power regions in Europe, net exports from the CWE region also started to decrease.

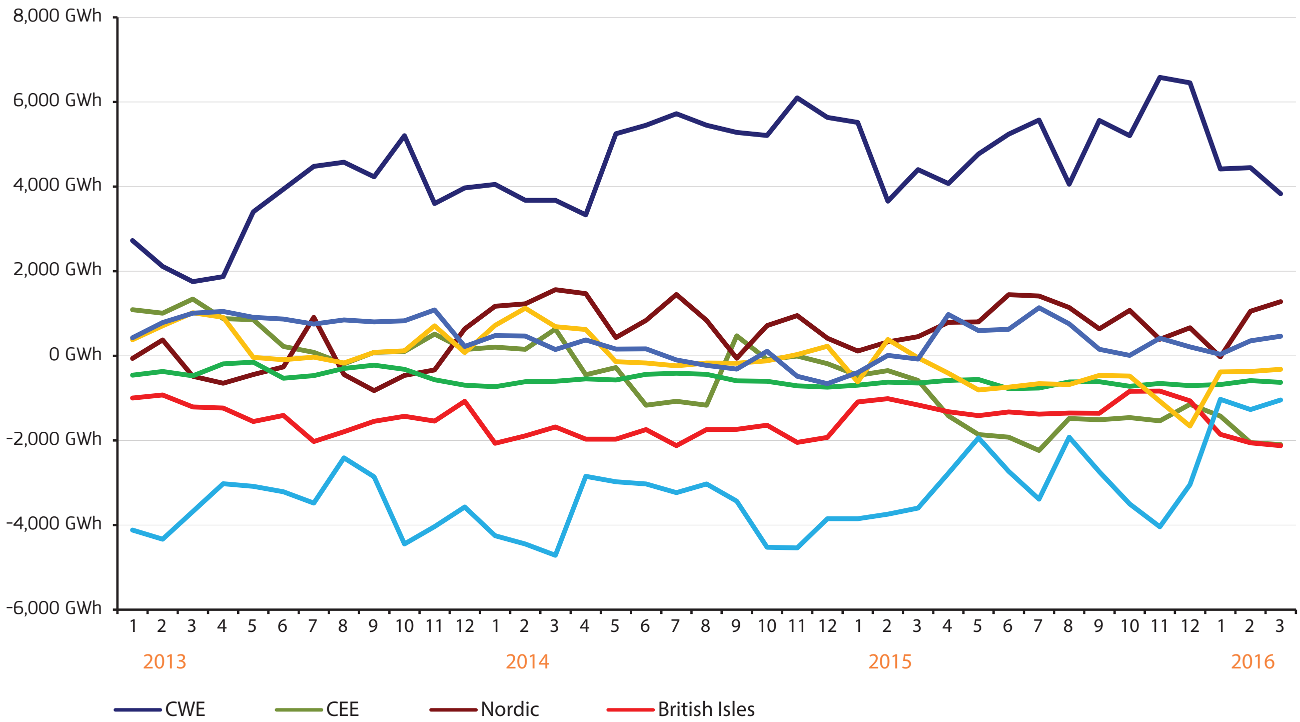
- The net electricity exporter position of the Nordic region fell close to zero in January 2016, as several price spikes in Nordpoolspot market occurred during this month, resulting in net electricity inflow from the CWE region, which is normally a rare event. Later, as the period characterised by cold weather and low generation was over, the region regained its net electricity exporter position.

- Central Eastern Europe (CEE) have become increasingly net importer over time; as abundant renewable generation in the CWE region represents in many periods cheap import alternative to domestic electricity generation. In abundant hydro generation periods, South Eastern Europe can also export electricity to CEE.

- As the UK wholesale electricity price premium to the continent widened between Q4 2015 and Q1 2016, the country's net import position also strengthened as electricity imports became even more competitive compared to domestic electricity generation. However, due to interconnector capacity constraints, net electricity imports never permanently exceeded 2 GWh per month in the last few years.

- As in Q1 2016 domestic gas fired capacities were able to generate electricity at such costs that could compete with import prices, Italy's net importer position reached the lowest in the last few years. In Spain hydro generation increased in Q1 2016, which enabled cheaper domestic electricity production, reducing import needs.

FIGURE 18 – EU MONTHLY CROSS BORDER PHYSICAL FLOWS BY REGION



Source: ENTSO-E

European countries are grouped in the following regions:

Central Western Europe	*DE, NL, FR, LU, BE, AT, CH*	*Nordic*	*SE, FI, DK, NO*
Central Eastern Europe	*PL, CZ, HU, SK, HR, SI*	*British Isles*	*UK, IE*
Iberian-Peninsula	*ES, PT*	*Apennine Peninsula*	*IT*
South Eastern Europe	*RO, BG, GR, RS, BA, ME, FYROM, AL*	*Baltic*	*EE, LT, LV*

4. Regional wholesale electricity markets

4.1 Central Western Europe (Austria, Belgium, France, Germany, the Netherlands, Switzerland)

- As Figure 19 shows, in October 2015 both the monthly averages of baseload and peakload day-ahead power prices in the CWE region rose to the highest since November 2013 (42 €/MWh and 48 €/MWh, respecrively). This steep increase in wholesale electricity prices was mainly due to colder than normal temperatures, low wind and low nuclear availability across the whole region, which factors counter-balanced the generallly decreasing trend of fossil fuel prices, normally setting the marginal electricity generation costs in most of the countries.

- However, as from November 2015 wholesale electricity prices started to decrease. In February 2016 both the monthly baseload and peakload averages fell to twelve year lows (24 €/MWh and 28 €/MWh, respectively). In March 2016 the monthly average baseload price managed to pick up slighltly, reaching 26 €/MWh.

- Between November 2015 and February 2016 the weather was milder than usual in the whole CWE region, reducing heating related demand for electricity, which was an important factor, especially in France. At the end of December 2015 industrial demand for electricity decreased during the Christmas holidays, whlile at the end of March 2016 Easter holidays had similar impact on electricity demand and wholesale market prices.

- Nuclear availability in the CWE region also played an important role during these two quarters. In October 2015 high regional prices were also due to reduced nuclear capacities in Germany, France and Switzerland, wheras in Belgium two reactors were still offline. In December 2015 the Doel-3 and Tihange-2 reactors in Belgium resumed operation and two others units were brought back online as an agreement on their lifetime extension by ten years was reached. Increasing nuclear power generation in Belgium contributed to low wholesale baseload prices during the winter period across the whole region.

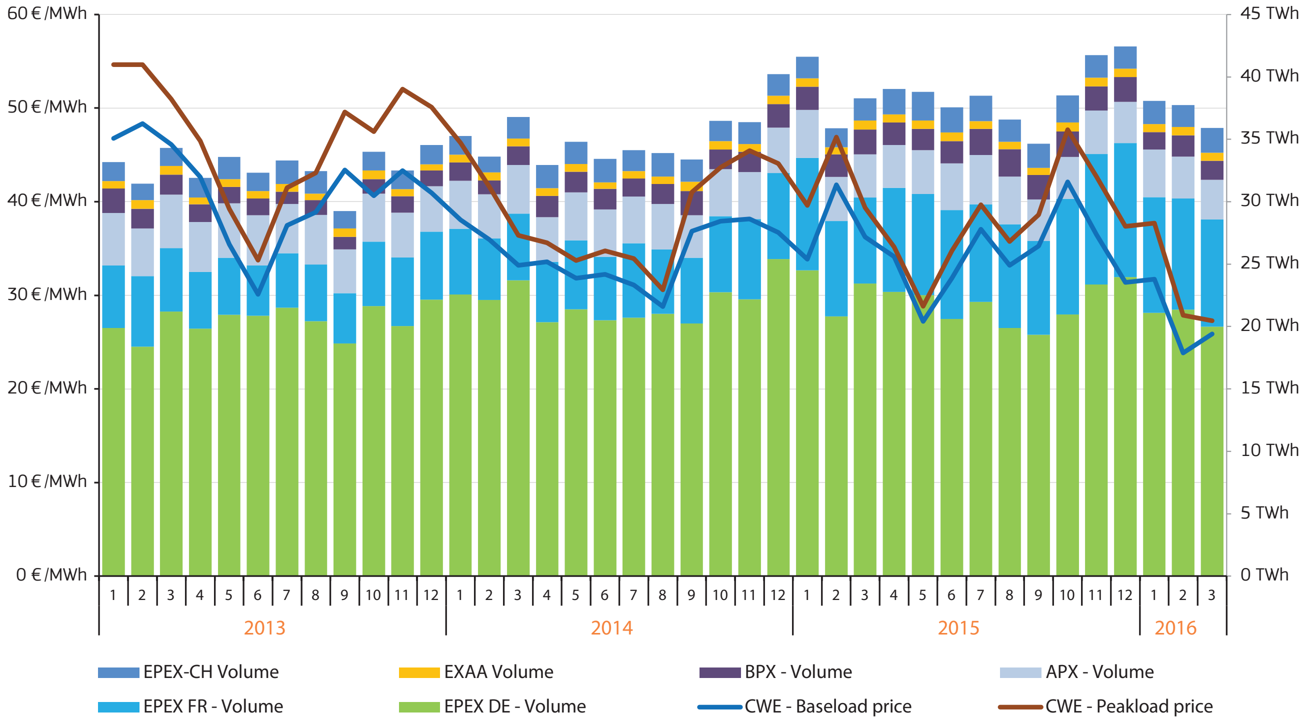
- Although in October 2015 wind power generation receded in the whole region, as from November it started to increase again and in December 2015 wind assured 13% of the CWE regional power supply, wheras in Germany its share amounted to 22%, both being the highest in the last five-six years. February 2016 was also a strong month regarding wind power generation, while in March 2016 decreasing wind availability also contributed to the general increase in wholelsale electricity prices in Central and Western Europe.

- Fossil fuel prices (coal, natural gas and crude oil) fell to several year lows in January-February 2016 and in parallel with this decrease emission allowance prices sharply reversed their increasing trend being observable throughout 2015. Decreasing fossil fuel prices impacted marginal electricity generation costs; also adding to the downward pressure on wholesale electricity prices.

- Wholesale electricity prices in the CWE region were well aligned during most of the time in Q4 2015 and Q1 2016, as Figure 20 shows. However, some local factors played an important role in temporary price divergences. For example, at the beginning of Q4 2015 Belgian wholesale prices showed sudden spikes in the consequence of questions around nuclear availability in the country. In January 2016 a short-lived cold spell and a strike in the electricity sector in France resulted in temporary price increases. In Switzerland outages at the Beznau nuclear power plant in November-December 2015 resulted in increasing reliance on hydro generation. In cosequence, hydro reservoir levels fell to lowest in the last twenty years at the beginning of 2016, which resulted in a significant Swiss power price premium (15-20 €/MWh) compared to other CWE markets.

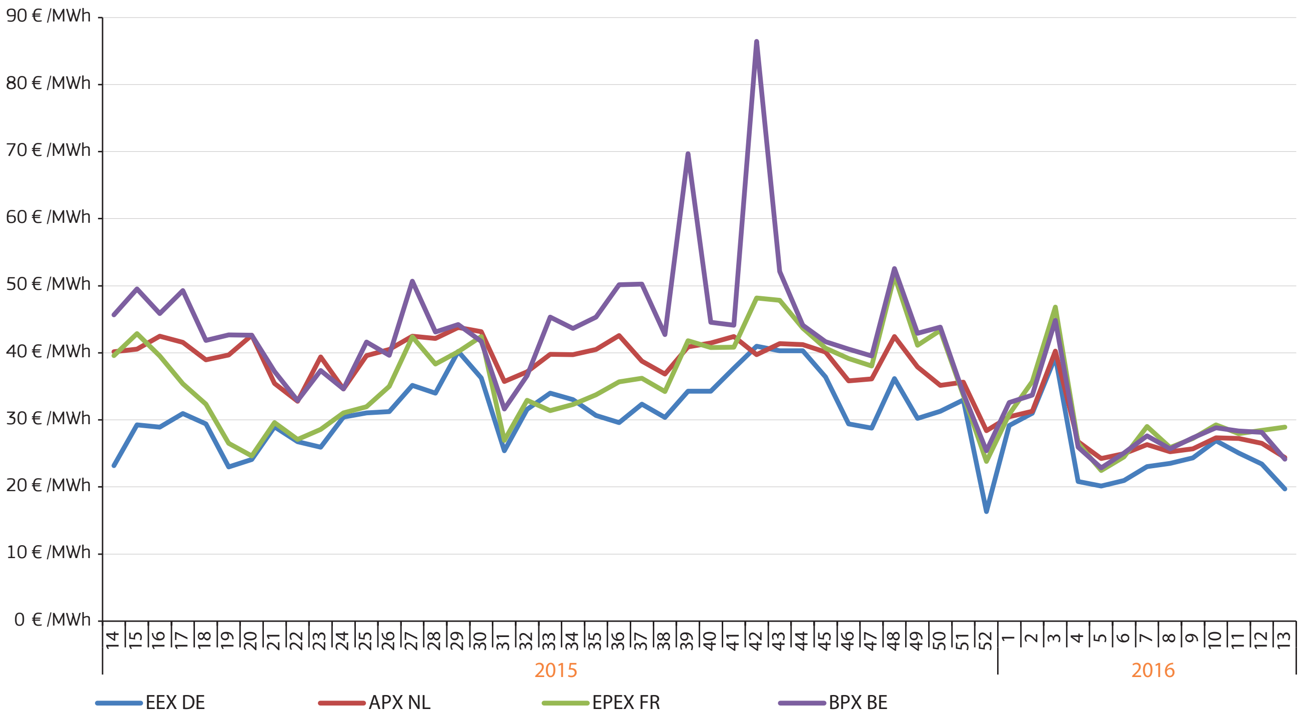
- Net cross border electricity flow positions were generally stable in the fourth quarter of 2015 in the CWE region, however, in Q1 2016 there were apparent changes. Increasing nuclear generation capacity in Belgium can be tracked in switching of its net import balance with France (in Q1 2016 Belgium became net electricity exporter to France, contrarily to earlier periods), as Figure 21 shows. France also tended to export less baseload electricty to Germany in Q1 2016 compared to the previous two quarters.

FIGURE 19 – MONTHLY TRADED VOLUMES AND PRICES IN CENTRAL WESTERN EUROPE



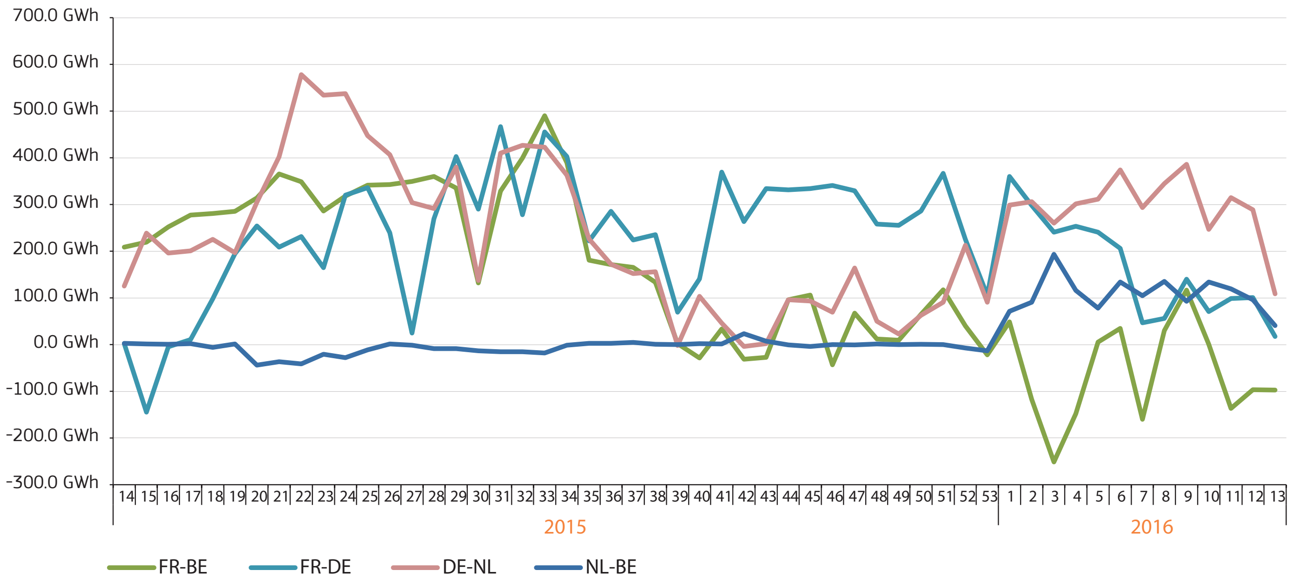
Source: Platts, EPEX

FIGURE 20 – WEEKLY AVERAGE WHOLESALE POWER PRICES IN THE CWE REGION



Source: Platts.

FIGURE 21 – NET WEEKLY CROSS BORDER PHYSICAL POWER FLOWS IN THE CENTRAL WEST EUROPEAN REGION



Source: ENTSO-E, own computations

4.2 British Isles (UK, Ireland)

- At the beginning of the fourth quarter of 2015 the monthly average day-ahead wholesale electricity price in the UK was around 57-58 €/MWh, while in February-March 2016 it fell to 43-44 €/MWh, being the lowest monthly price since March-April 2010. At the same time in Ireland the monthly average day-ahead wholesale price decreased from 47 €/MWh to 35 €/MWh, also being the lowest in the last six years.

- As Figure 22 shows, baseload power contracts both in the UK and Ireland followed closely the decreasing natural gas prices of the NBP hub in the UK, which, for the first time in six years, fell below 13 €/MWh on monthly average in March 2016. Cheap natural gas prices resulted in rapid increase in gas fired generation in the UK, reaching the highest since October 2011 (10.8 TWh, 42% of the total generation mix, squeezing out coal whose share fell back to 16% in the same month).

- During the winter period the share of renewables, especially wind, reached the highest in the last five-six years (since the beginning of the availability of time series on detailed generation data) both in the UK and Ireland. In December 2015 the share of renewables in the UK power generation mix was around 18%, while in the case of Ireland renewables assured a remarkably high share (38%) of the total generation.

- Similarly to other countries in North-Western Europe, demand for electricity and for heating related fuels, such as natural gas, was impacted by the milder-than-usual weather conditions; in February 2016 in many parts of the UK temperatures were the highest in this time of the year since 1910.

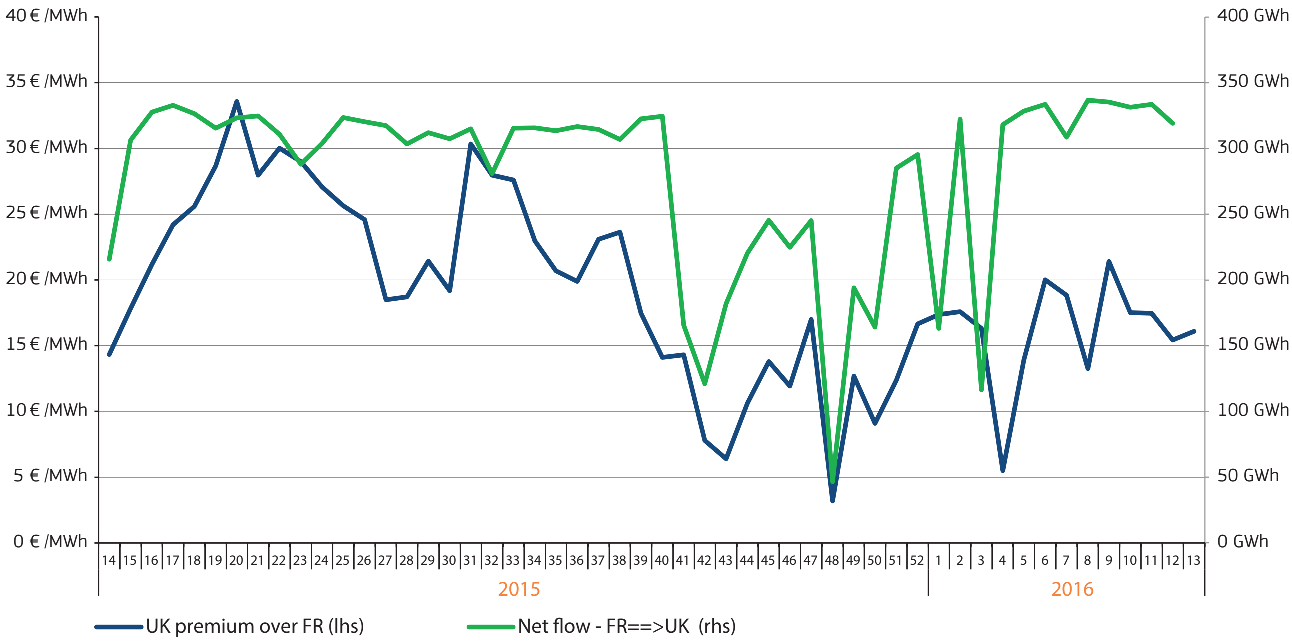
- In spite of both supply and demand side factors, which pointed towards low electricity generation costs and subdued demand for power, implying low wholesale market prices, the UK remained one of the most expensive markets in the EU, reaching a price premium of 12 €/MWh in Q4 2015 and 16 €/MWh in Q1 2016 to France on quarterly average.

- In spite of the existence of permanent price premium over the continent, providing incentives to import electricity to the UK, the electricity interconnector with France seemed to reach saturation several occasions, as Figure 23 shows. This reflects the need of further upgrading electricity interconnections between the UK and continental Europe, as much cheaper source of power generation could assure good opportunities to import electricity if it is competitive vis-à-vis UK domestic electricity generation.

FIGURE 22 – DAILY AVERAGE POWER PRICES IN THE UK AND IRELAND, IMPACTED BY GAS PRICES

Source: Platts, SEMO

FIGURE 23 – THE UK WHOLESALE ELECTRICITY PRICE PREMIUM OVER FRANCE AND WEEKLY NET ELECTRICITY FLOWS FROM FRANCE TO THE UK



Source: Platts, ENTSO-E

4.3 Northern Europe (Denmark, Estonia, Finland, Latvia, Lithuania, Norway, Sweden)

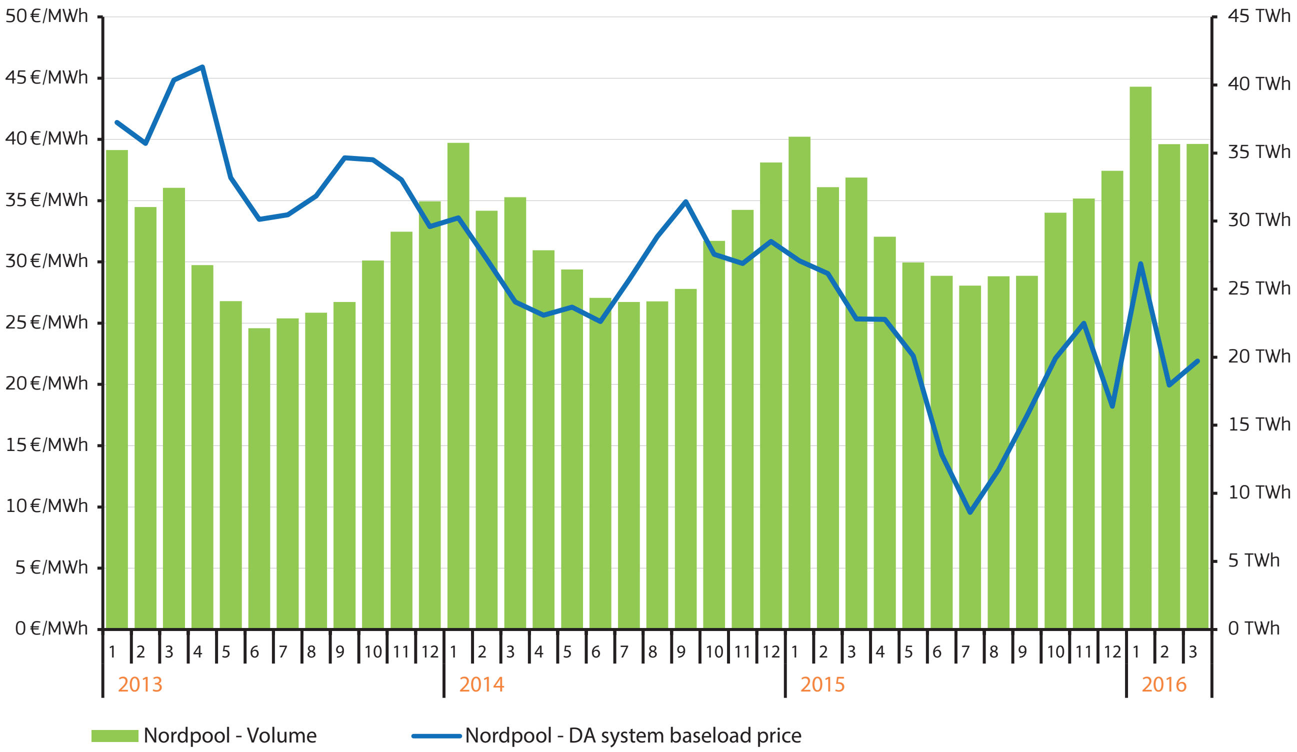
- The electricity wholesale system price in the Nordpoolspot market has recovered from the lows measured in July 2015 in parallel with seasonally receding hydro generation, and in October-November 2015 it reached 22-25 €/MWh on monthly average, as Figure 24 shows. The weather in Q4 2015 was milder than usual in the Nordic region, similarly to most of the European continent, putting a lid on electricity demand, as in some Nordic countries (e.g.: Sweden and Finland) electricity has an important share in domestic heating.

- In December 2015 the share of renewable power generation rose to the highest in the last six years in Sweden (23%) and in Lithuania (40%), due to increasing wind generation in both countries. High wind generation also contributed to the increasing share of renewables in the Danish power mix (66% in December 2015), while in the same month the share of renewables also rose to 21% in Finland, primarily owing to increasing biomass generation. These developments in the Nordic electricity generation mixes have also contributed to low electricity prices in December 2015, besides subdued demand primarily owing to mild temperatures.

- Contrarily to many other parts of Europe, January 2016 was significantly colder than usual in the Nordic region, which resulted in a measurable increase in wholesale electricity prices (from 18 €/MWh in December 2015 to 30 €/MWh in January 2016). On 21 January 2016, due to a cold snap and receding wind and hydro power generation across the region, the Nordpoolspot system price rose to 81 €/MWh on daily average, which was the highest daily average since 9 February 2012. During these days the direction of power flow between the Nordic and Central West European markets was reversed and Nordpool had to import electricity, which also impacted wholesale electricity prices in the CWE region.

- In December 2015 important developments took place in the regional electricity interconnector capacities, as both LitPol and NordBalt cables, linking Lithuania with Poland and Lithuania with Sweden, were inaugurated and both interconnectors[1] became operational as of early 2016. As Figure 25 shows, after mid-February 2016, as the test phase of the operation started at NordBalt link, Lithuanian price premium to the Nordpoolspot system price began to shrink. However, ahead of the Easter weekend at the end of Q1 2016, capacity curtailments on NordBalt resulted in widening price gaps between the Lithuanian area and the system price.

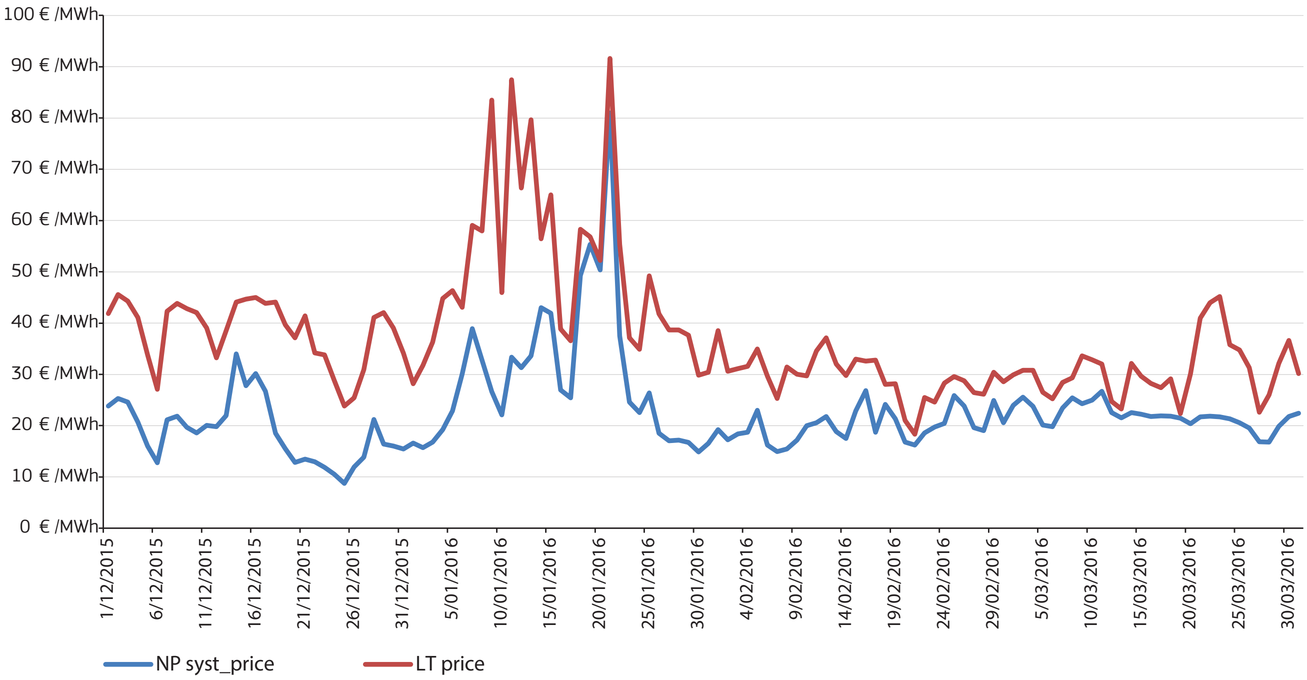
FIGURE 24 – MONTHLY TRADED DAY-AHEAD VOLUMES AND PRICES IN NORTHERN EUROPE



Source: Nordpool spot market

1. *See more information at : https://ec.europa.eu/energy/en/news/new-electricity-connections-between-lithuania-poland-and-sweden-create-baltic-ring*

FIGURE 25 – THE DAILY EVOLUTION OF WHOLESALE ELECTRICITY PRICES IN THE NORDPOOL SYSTEM AND IN THE LITHUANIAN AREA



Source: Nordpool spot market

4.4 Apennine Peninsula (Italy)

- In October 2015 the Italian monthly average wholesale baseload price was 47 €/MWh, and by November-December 2015 it rose to 55-56 €/MWh. In the first three months of 2016 the Italian system average price started to decrease and in March 2016 it fell until 35 €/MWh, which was unprecedentedly low in the last twelve years. Italy could be characterised by having significant price premium to Central Western Europe over the last few years, however, in Q1 2016 this premium has significantly shrunk.

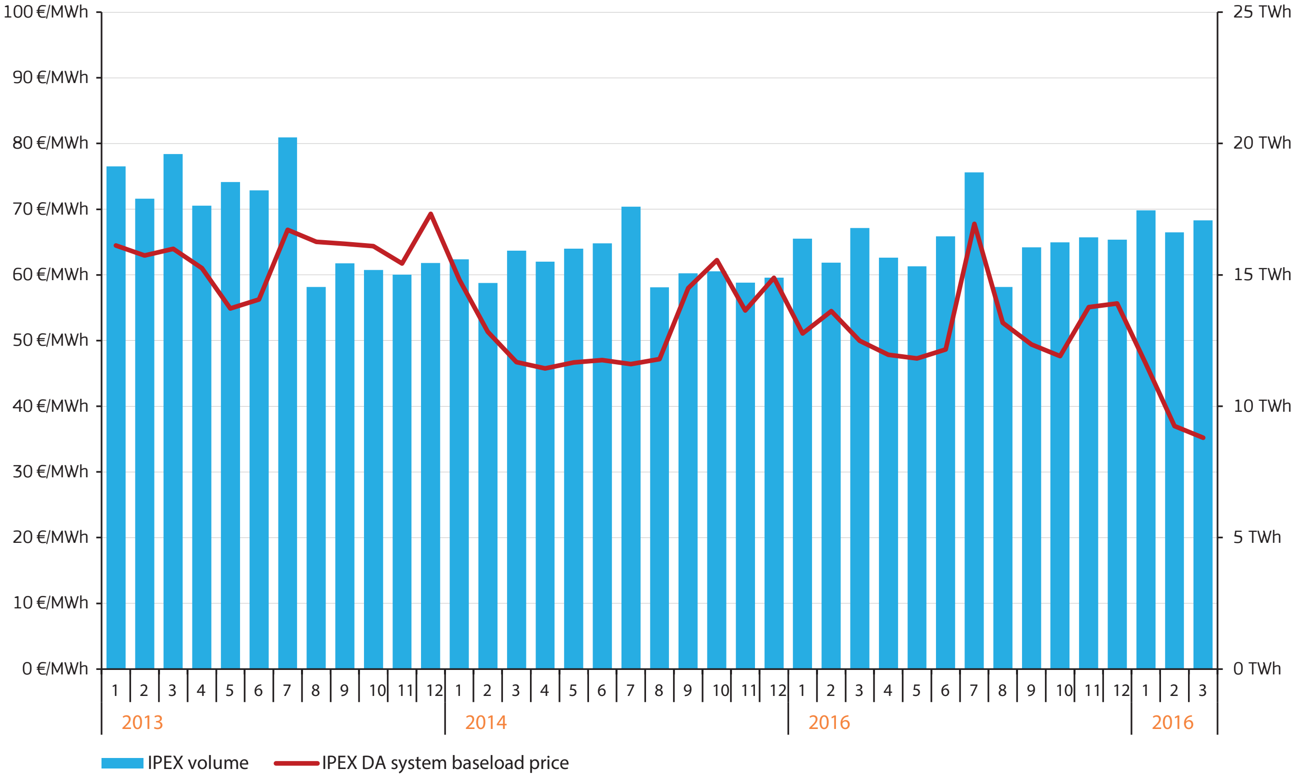
- The aforementioned gradual wholesale price increase in Q4 2015 could mainly be explained by the decreasing share of hydro generation and receding renewables generation. In December 2015 the share of wind in the Italian generation mix fell to nearly four-year low (9%). Meanwhile, the share of renewables fell below 20%, while the share of natural gas rose to 41%, being the highest since October 2013.

- In January 2016, in parallel with the onset of the rainier season, hydro generation started to pick up and as wind generation also increased, the share of cheaper sources went up within the electricity generation mix. Meanwhile, strongly decreasing gas prices also had a downward impact on generation costs.

- In February 2016, though pumped storage hydro generation fell back by 33% on year-on-year comparison, run-of-river hydro managed to catch up that offset decreasing pump storage hydro availability.

- During winter periods, as the share of hydro and renewable generation decreases in the Italian power mix, the country's seasonal dependence on power imports increases. In Q4 2015 the country had to import around 17% of its total power consumption, up from 11% in Q3 2015. However, as in Q1 2016 domestic electricity generation costs went down, the country's electricity import need also decreased.

FIGURE 26 – MONTHLY TRADED DAY-AHEAD VOLUMES AND PRICES IN ITALY



Source: GME (IPEX)

4.5 Iberian Peninsula (Spain and Portugal)

- In October 2015 the monthly average baseload wholesale electricity price in Spain and Portugal was around 49-50 €/MWh. By the end of the year the Spanish baseload price rose to 53 €/MWh, while the Portuguese baseload went up to 55 €/MWh.

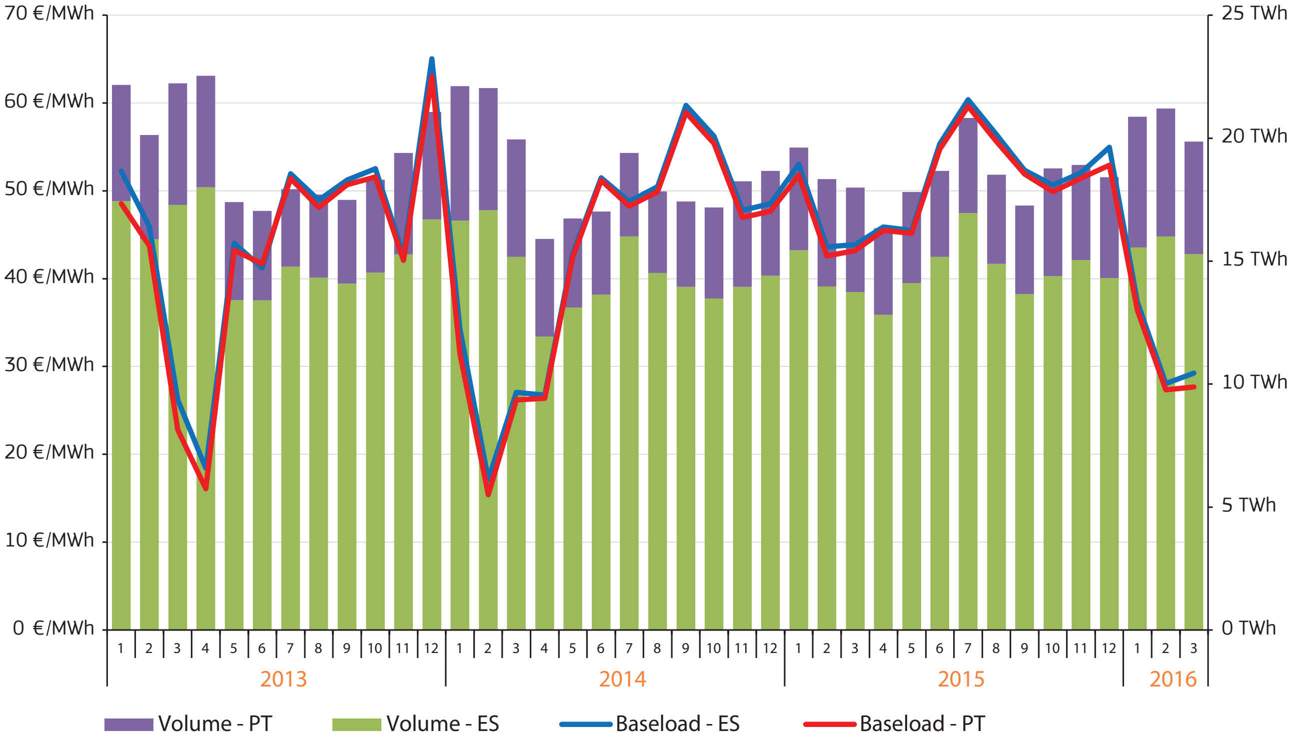
- In contrast to many other parts of Europe, where the end of the year saw a surge in wind power generation, in Spain wind availability remained limited. Low wind generation coupled with the dry season with dwindling hydro reservoir levels and subsequently low hydro based generation resulted in increasing electricity generation costs, as the share of fossil fuels went up in the power mix. However, decrease in natural gas and coal prices kept a lid on the increase in electricity generation costs.

- In the first quarter of 2016 the monthly average baseload price in Spain and Portugal underwent a rapid decrease; in March 2016 the Spanish baseload price fell below 28 €/MWh, while to Portuguese baseload decreased to 29 €/MWh, both being the lowest since spring 2014, as Figure 27 shows.

- The significant price fall in wholesale electricity prices in the Iberian-peninsula was mainly due to the arrival of rainier weather, enabling the ramp-up of hydro generation in the country in January 2016. Furthermore, wind generation also picked up in January and February, and in the second month of 2016 renewables and hydro together assured 54% of the electricity generation in Spain, which was a remarkable increase compared to December 2015, when this share was only 28%. Fossil fuel prices reached their lows in Q1 2016, which also helped in decreasing electricity generation costs.

- Sudden price falls in the Iberian market resulted in increasing electricity flows from Spain to France in some periods, however, given the limited electricity interconnections between the two countries, the existing market coupling between Spain and the CWE region could not be fully exploited and price differentials between the two markets persisted over most of the time in Q1 2016.

FIGURE 27 – MONTHLY TRADED DAY-AHEAD VOLUMES AND PRICES IN THE IBERIAN PENINSULA



Source: Platts, OMEL

4.6 Central Eastern Europe (Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia)

- In October 2015 the regional monthly average baseload price in Central and Eastern Europe (CEE) was 40 €/MWh, while the monthly average peakload reached almost 50 €/MWh. With the exception of the short-lived price upturn in January 2016, both baseload and peakload monthly averages kept on decreasing and in March 2016 the baseload fell to 28 €/MWh and the peakload decreased to 34 €/MWh, as Figure 28 shows. Both baseload and peakload average prices in March 2016 were the lowest since spring 2010.

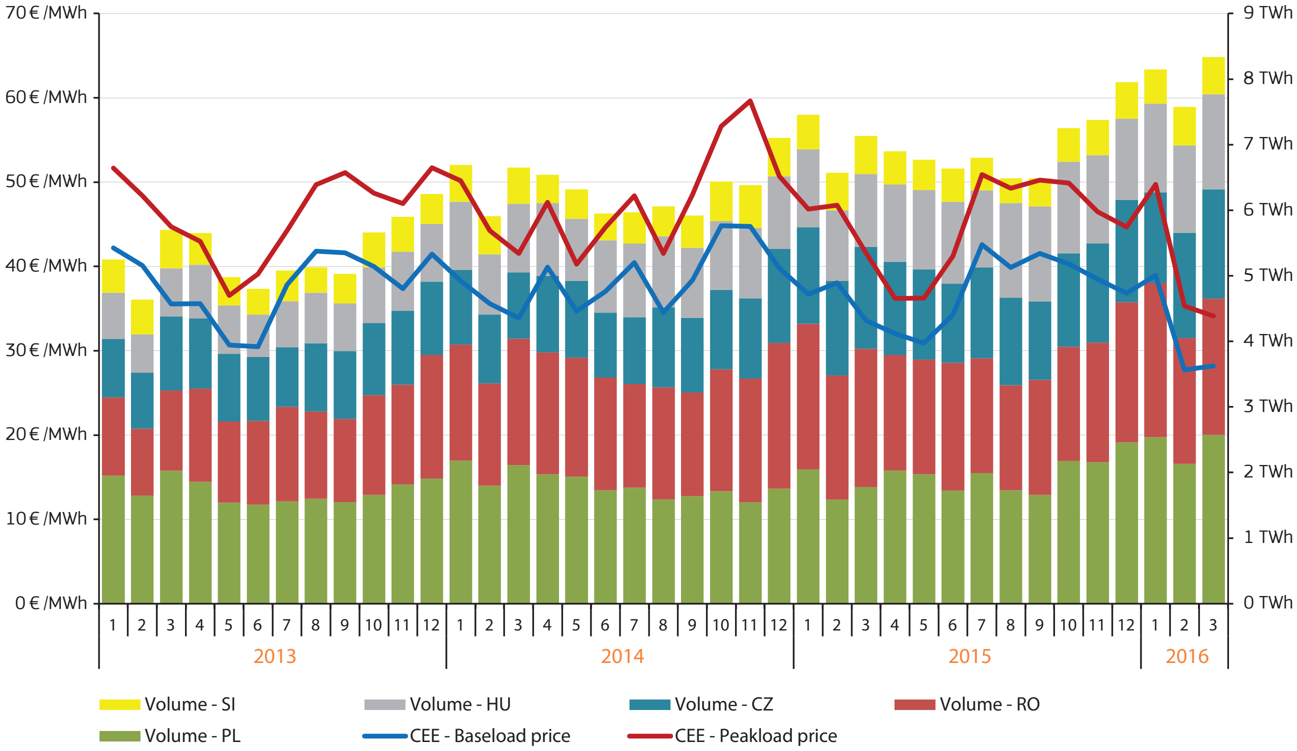
- At the beginning of October 2015 significant combined heat and power (CHP) generation capacities returned to the grid in Poland, and as this capacity increase offset the dwindling wind and lignite based electricity generation, Polish prices started to decrease. Later in Q4 2015 and in January 2016 the Polish baseload electricity price had only minor premium to the German market, as Figure 29 shows. However, in March 2016, due to the aforementioned curtailment on the NordBalt link, this premium widened and by the end of Q1 2016 the Polish wholesale electricity market became the most expensive in the CEE region.

- In December 2015 the share of coal in the power generation mix fell as 'low' to 80% in Poland, mainly as the result of increasing renewable (mainly wind) generation. By the end of 2015 installed wind power capacities in Poland reached 4 GW, showing a gradual diversification of the country's power mix and shifting away from the almost exclusive reliance on coal.

- In the Czech Republic nuclear availability played an important role in impacting local wholesale electricity prices in Q4 2015. At the beginning of October 2015 two nuclear reactors at Dukovany power plant went offline that resulted in increasing Czech price premium to the German market. Until mid-February 2016 Czech prices remained volatile, influenced by wind availability in the region.

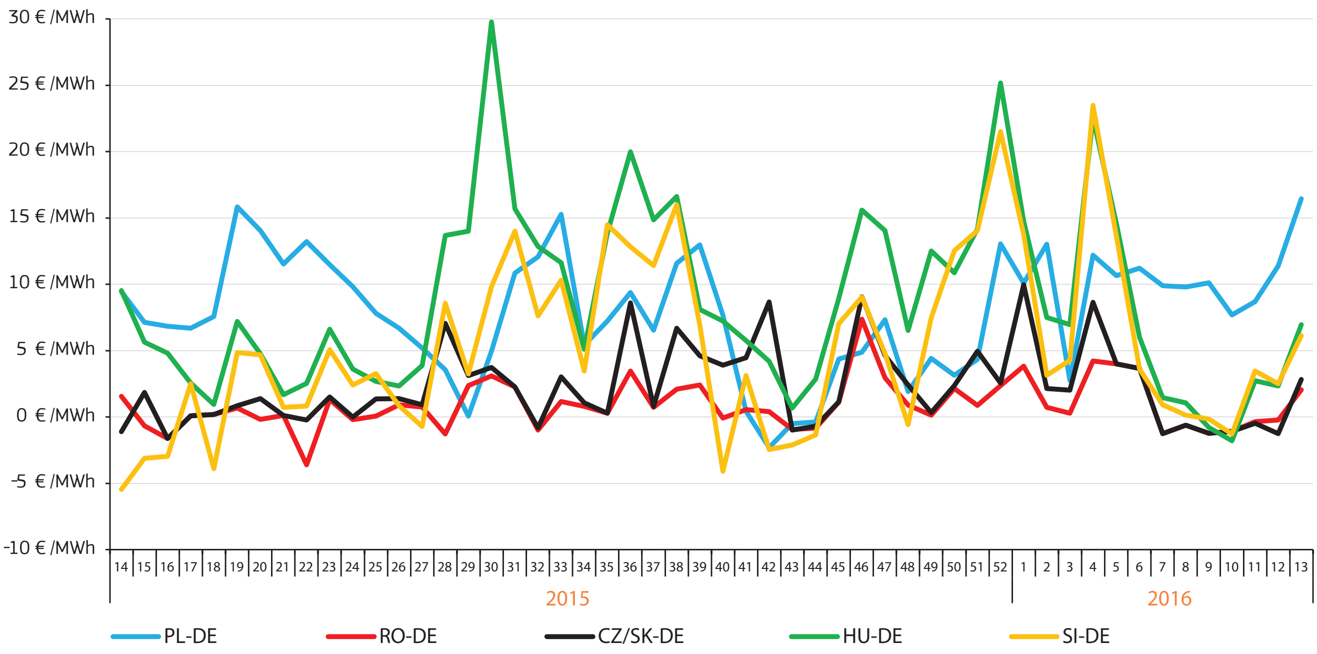
- In Hungary baseload wholesale prices were significantly higher than other peers in the region between November 2015 and January 2016, being impacted by dry weather in the Balkans that reduced power import opportunities of cheap hydro based electricity. As Hungary is a structural net electricity importer (in Q4 2015 it imported almost 30% of its electricity consumption), hydro levels in the Balkans can significantly impact the local wholesale electricity level in the country. Hydro generation in Romania was also lower at the end of 2015 than earlier in that year, however, given the country's net electricity exporter position and its diversified generation mix wholesale prices remained the cheapest in the CEE region in both Q4 2015 and Q1 2016.

FIGURE 28 – MONTHLY TRADED DAY-AHEAD VOLUMES AND PRICES IN CENTRAL EASTERN EUROPE



Source: Regional power exchanges, Central and Eastern Europe (CEE)

FIGURE 29 – REGIONAL WEEKLY BASELOAD PRICE PREMIUMS OR DISCOUNTS TO THE GERMAN MARKET



Source: Platts (EPEX), CEE Regional power exchanges

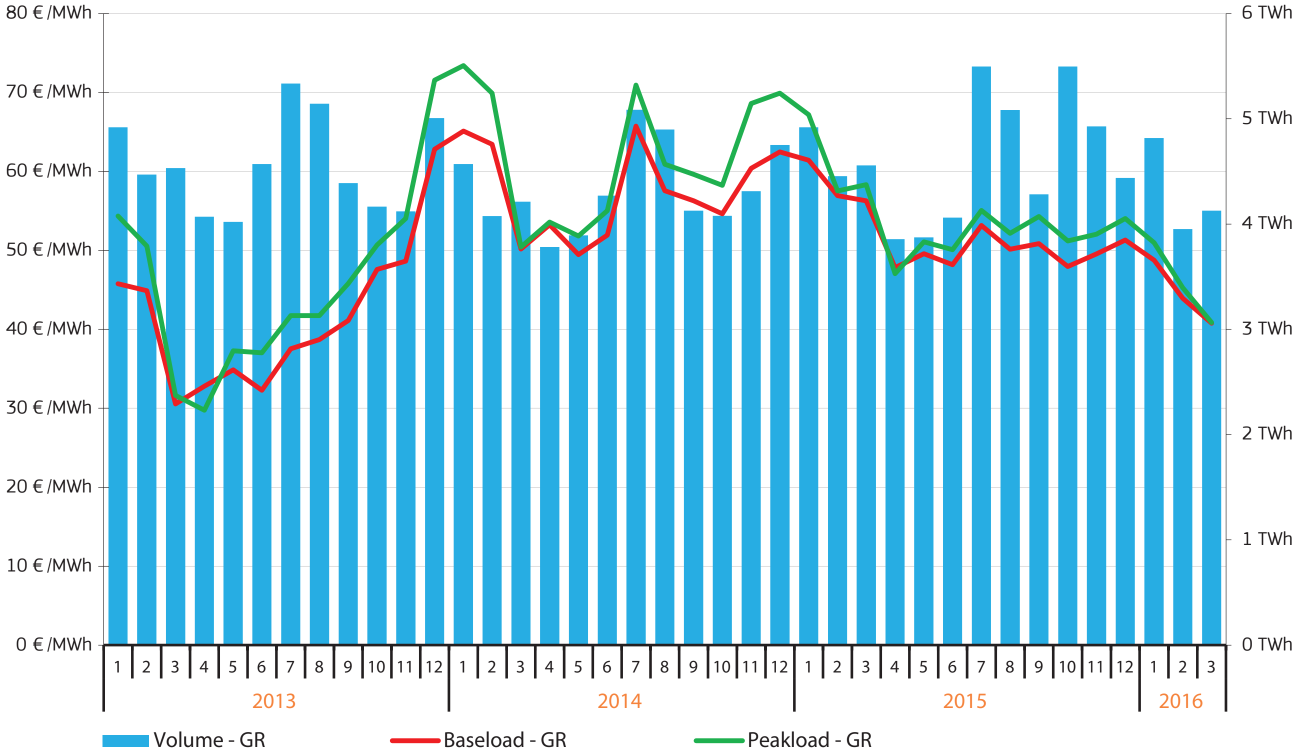
4.7 South Eastern Europe (Greece and Bulgaria)

- In Greece the monthly average baseload electricity price rose from 48 €/MWh to 51 €/MWh between October and December 2015. In March 2016 the baseload average fell below 41 €/MWh. Meanwhile, the monthly average peakload, having an average premium of 3 €/MWh to baseload prices in Q4 2015, also decreased to 41 €/MWh in March 2016, practically eliminating its price difference from the baseload contracts, as Figure 30 shows. Both baseload and peakload averages fell to the lowest since August-September 2013.

- Although in Q4 2015 the share of hydro and renewables receded in the Greek electricity generation mix, as of the beginning of 2016 falling natural gas prices started to filter in power generation costs, enabling a significant decrease in wholesale marker prices as well.

- In spite of decreasing generation costs and market prices, the country still had to import around 20-30% of its electricity consumption from the neighbouring countries in Q4 2015 and Q1 2016. The country mainly imported electricity from Bulgaria, the Former Yugoslav Republic of Macedonia and Turkey in this period.

FIGURE 30 – MONTHLY TRADED DAY-AHEAD VOLUMES AND PRICES IN GREECE

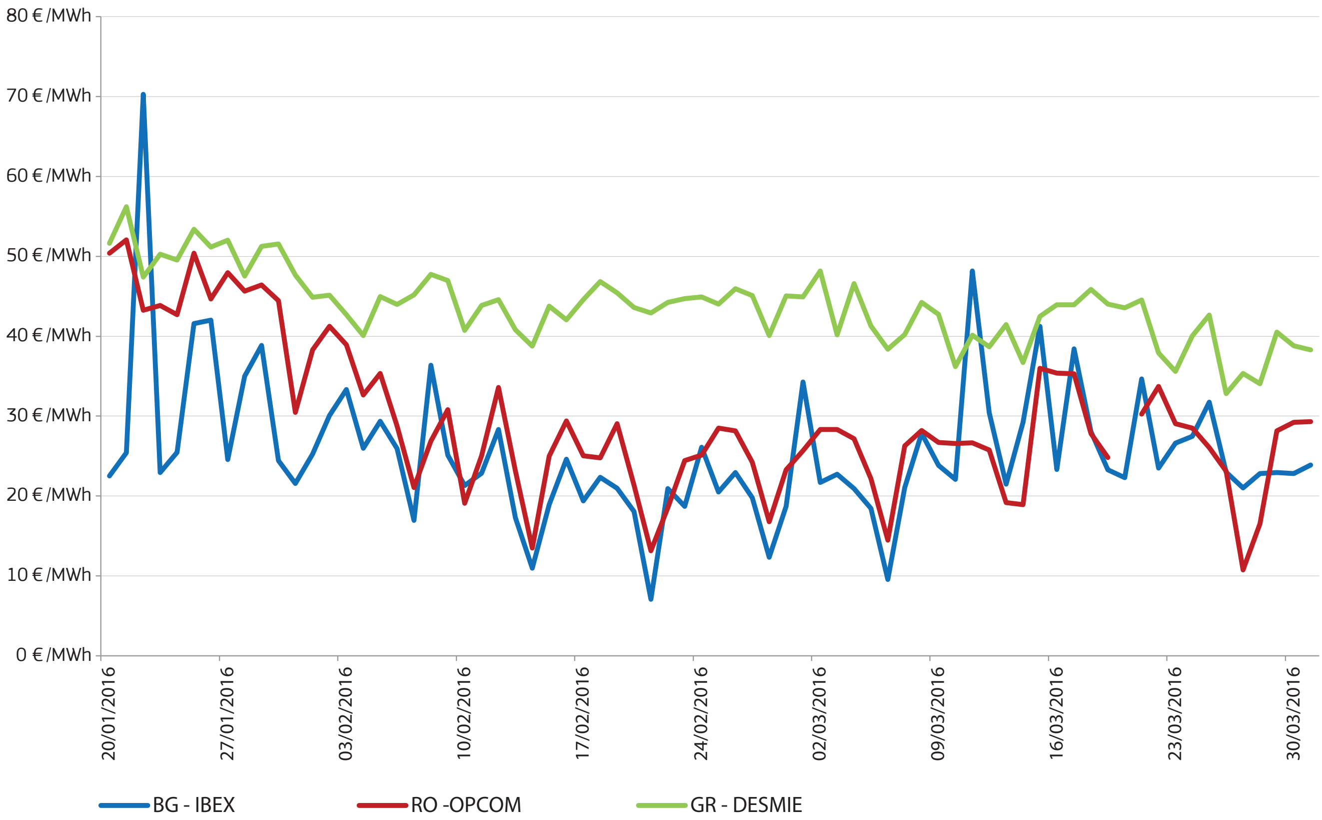


Source: DESMIE

- On 20 January 2016 wholesale electricity trade has started in Bulgaria at the new IBEX platform. Comparing with its two neighbours, the evolution of wholesale electricity prices in Bulgaria tracked closely the Romanian market, while it had significant price discount to Greece, as Figure 31 shows.

- Electricity generation in Bulgaria is largely based on domestic lignite sources and nuclear power, resulting in low baseload electricity generation costs, making the Bulgarian wholesale electricity market one of the cheapest in the EU. This is also helped by export tariffs that aim at keeping domestically generated electricity within the country. However, the country exports an amount of electricity equalling 20-30% of its domestic consumption.

FIGURE 31 – COMPARISON OF DAY-AHEAD PRICES IN BULGARIA, GREECE AND ROMANIA



Source: IBEX, DESMIE, OPCOM

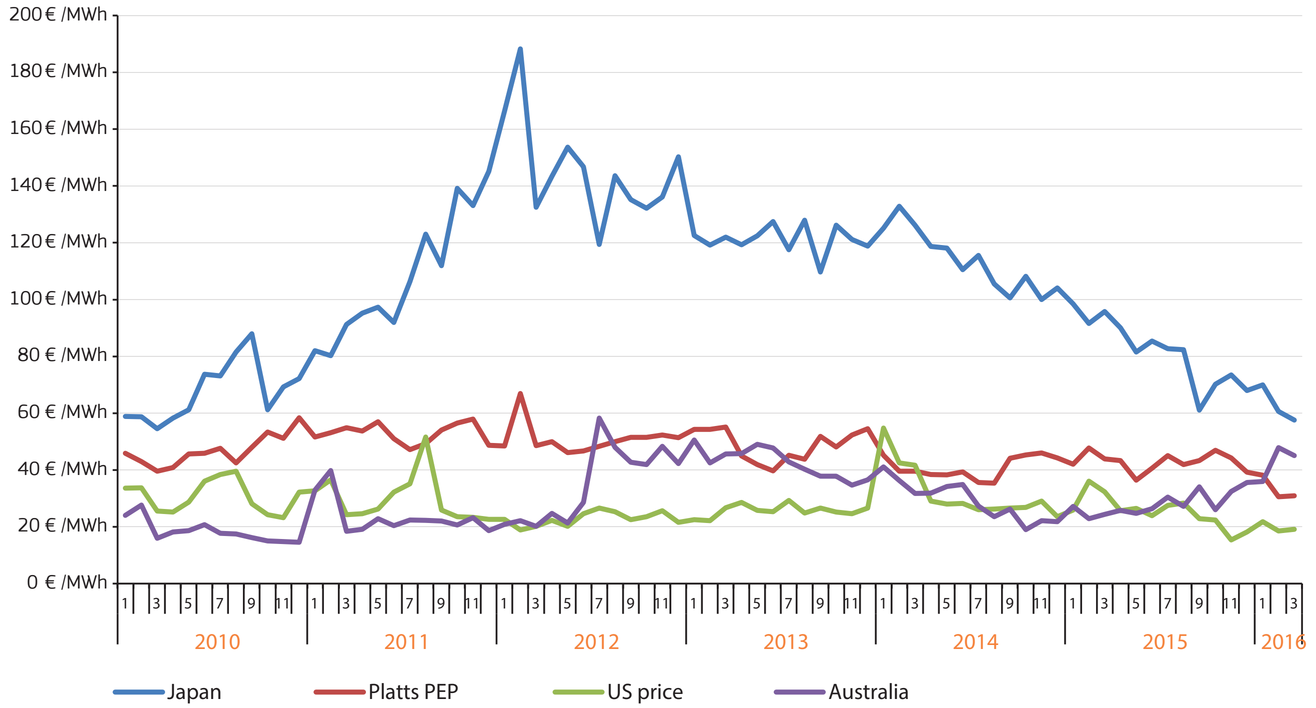
5. International outlook comparing EU power prices with international peers

- Figure 32 shows the European wholesale electricity benchmark index (PEP) in comparison with wholesale price benchmarks in some important international trading partners (United States, Japan and Australia). Putting EU wholesale electricity prices into international comparison is important from the aspect of analysing the competitiveness of the EU economy, especially in the case of those products and industrial activities where energy costs make a significant part of total production cost (in the so-called energy intensive industries). Energy intensive industries are normally large energy consumers and the wholesale market price is a good proxy for the price these industries purchase their electricity needs.

- As wholesale electricity prices remained practically stable in the US in Q4 2015 and Q1 2016, and in the same time electricity prices in the EU decreased significantly, the price gap between the two regions became narrower, however, in Q1 2016 wholesale electricity price level in the EU was still 60-70% higher than in the US.

- By the end of the first quarter of 2016 wholesale electricity prices in Japan were the lowest since the beginning of 2010, and were about one third of the peak registered at the beginning of 2012. After restarting some parts of its nuclear generation capacities Japan is less dependent on LNG imports in its power generation. Meanwhile, as LNG import prices fell significantly, conventional electricity generation costs also decreased. However, in March 2016 the average wholesale electricity price in Japan was twice as high as in the EU and three times as high as in the US. In Australia the average wholesale electricity price showed a significant upturn in the last two quarters, and by the end of Q1 2016 the Australian wholesale price level was higher than in the EU and the US.

FIGURE 32 – COMPARISON OF THE AVERAGE US, JAPANESE, AUSTRALIAN AND THE EUROPEAN WHOLESALE ELECTRICITY PRICES



Source: Platts, PEP: Pan-European Power index US electricity hubs including PJM West: Pennsylvania-Jersey-Massachusetts hub (Western part); ERCOT: Texas hub, JPEX, (Japan) and AEMO: Australian wholesale power market

6. Retail electricity prices in the EU

- Figure 33 and Figure 34 show the convergence across the EU countries between retail electricity prices for household and industrial customers in three different consumption bands, using as metric the relative standard deviation of retail electricity prices in the twenty-eight EU member states. Relative standard deviation enables to compare the dispersion of values of different magnitudes, as by dividing the standard deviation by the average the impact of absolute values is eliminated, making possible the comparison of different time series on a single chart.

- Retail prices paid by households include all taxes, while retail prices paid by industrial customers are prices without VAT and recoverable taxes and levies. Monthly retail electricity prices are estimated by using the Harmonised Consumer Price Indices (HICP) for the household prices and the Producer Price Indices (PPI) for the industrial customers, based on the time series of twice-yearly retail energy price data from Eurostat.

- As Figure 33 shows, over the past few years retail electricity prices paid by industrial customers showed a measurable degree of convergence. Electricity prices paid by large industrial customers showed the highest degree of convergence, while in the case of industrial customers with lower annual consumption this convergence was less visible. It must be noted here that the convergence of retail prices is of course limited by the convergence of wholesale prices, as these latter ones did not reach full convergence either, as Figure 13 shows.

- In the case of large industrial customers the impact of the wholesale electricity prices convergence across Europe can be better tracked in the convergence of retail prices, as the share of the so-called energy supply component is higher in the final retail price than in the case of customers with lower annual consumption (as opposed to non-market elements, such as network costs and taxes, whose share is lower for large consumers). However, it must be noted that large customers in some specific industries are often subject to exemptions from various taxes and levies in many Member States, and the national average retail price numbers might overestimate their actual electricity purchase costs, especially if they consume self-generated power, not covered by Eurostat retail price statistics.

- As Figure 34 shows, in the case of household customers retail electricity prices in different member states did not show too many signs of convergence, in the case of customers having low annual consumption even price divergences occurred over the last few years. Less intensive competition for household customers and the existence of regulated retail prices might have also put an obstacle to better price convergence across the EU, and in the case of households with lower annual consumption the ratio of fix elements (being independent from the actual electricity consumption, e.g.: ground fees) is higher, which may also lead to less price convergence across different countries.

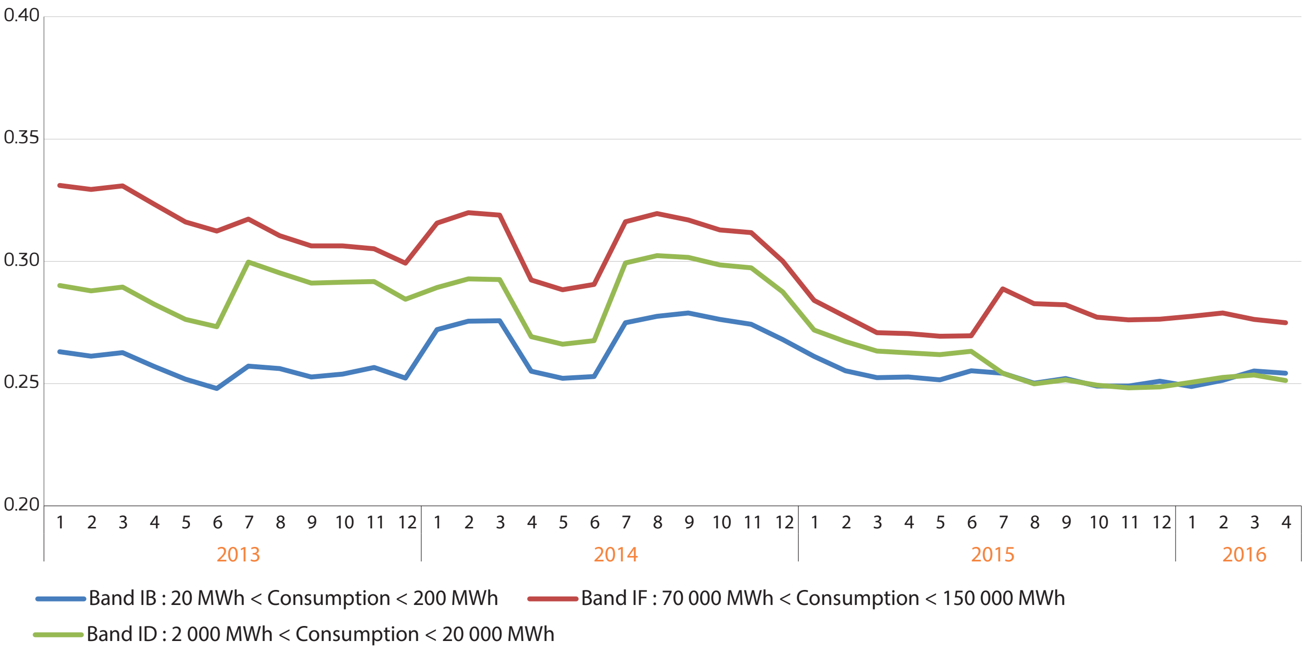
- In the case of industrial customers having medium level annual electricity consumption the monthly ratio of the highest and the lowest price in the EU was 2.6 (Sweden: 5.9 Eurocent/kWh, Malta: 18.6 Eurocent/kWh), in the case of large industrial customers it was 3.1 (Sweden: 4.4 Eurocent/kWh, Italy: 15.5 Eurocent/kWh) and in the case of households with medium level annual consumption it was 3.2 (Bulgaria: 9.6 Eurocent/kWh, Denmark: 30.5 Eurocent/kWh) in April 2016.

- Looking at retail household electricity prices on purchasing power parities, in the second half of 2015 we saw a different picture regarding the cheapest and the most expensive EU Member States. Households with medium level annual consumption had to pay the most in Portugal (29.3 Eurocent/kWh) and the least in Finland (12.3 Eurocent/kWh) in the EU, if purchasing power parities are taken into account. The price ratio of the most expensive and the cheapest country was 2.4 in the second half of 2015. However, price convergence could not be observed after purchasing power correction either, as the price ratio of the most expensive and the cheapest Member States after PPP correction fluctuated in a range of 2.1 to 2.6 over the last eight years.

- Figure 35 shows the retail electricity price element of the so-called Household Energy Price Index (HEPI), calculated with a methodology developed by Vaasaett on the basis of monthly collection of electricity invoices in the capital cities of the EU. In April 2016 the highest retail electricity prices paid by households could be observed in Copenhagen (31.7 Eurocent/kWh) and Berlin (30.3 Eurocent/kWh), while the cheapest capitals in the EU were Sofia (10.6 Eurocent/kWh) and Tallinn (10.7 Eurocent/kWh). Compared with April 2015, the biggest price increase could be observed in Athens (10.4%), while retail electricity prices decreased the most in Nicosia (22%), Amsterdam (17%), London (10.5%) and Madrid (10.1%).

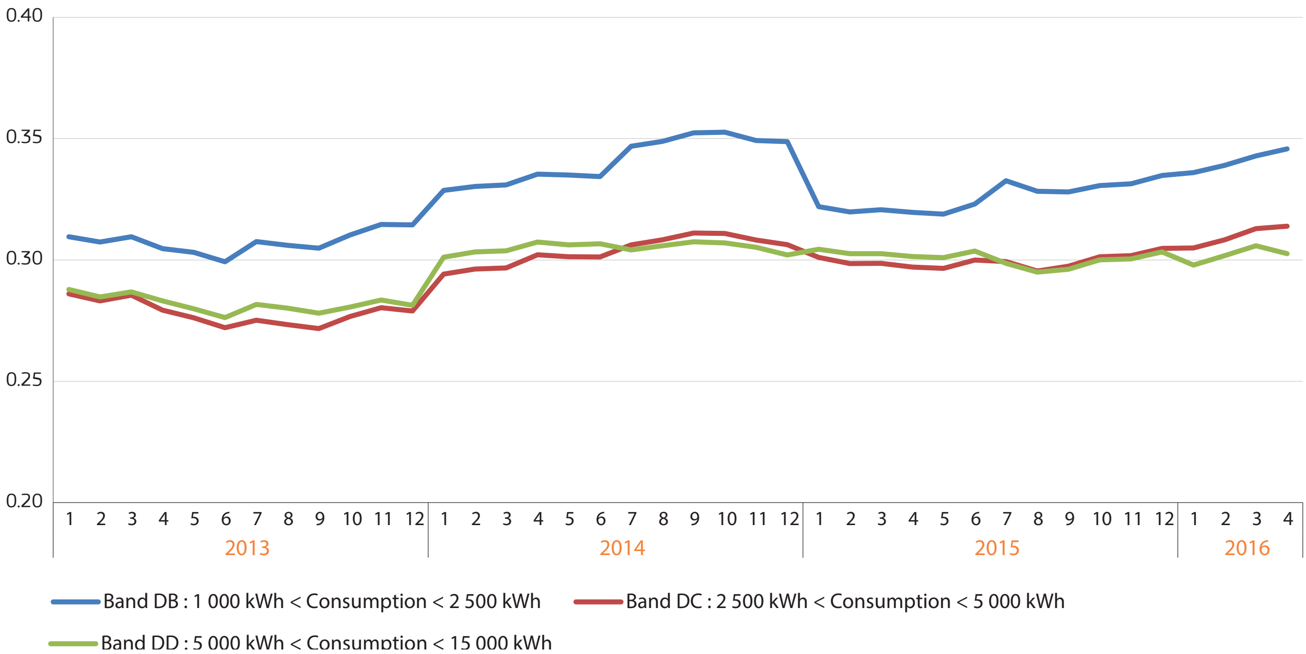
- Figure 36 shows the change in household retail electricity prices between April 2015 and April 2016, expressed in Eurocent/kWh, and the contribution of cost components (energy costs, transmission and distribution costs, energy taxes and VAT) to the price change in the European capital cities. Energy costs decreased by the most in Nicosia, Riga and Brussels. Energy taxes decreased measurably in Amsterdam, while they went up significantly in Riga and Athens. Transmission and distribution costs had the biggest downward impact on the final retail prices in Madrid and Bucharest, while they increased the final price in Lisbon, Vilnius and Rome between April 2015 and April 2016.
- The two maps (Figure 37 and Figure 38) show the estimated quarterly average retail electricity prices paid by households and industrial customers, having medium level of annual electricity consumption, in the first quarter of 2016.

FIGURE 33 – RELATIVE STANDARD DEVIATION OF RETAIL ELECTRICITY PRICES IN EU MEMBER STATES IN DIFFERENT INDUSTRIAL CUSTOMER CONSUMPTION GROUPS



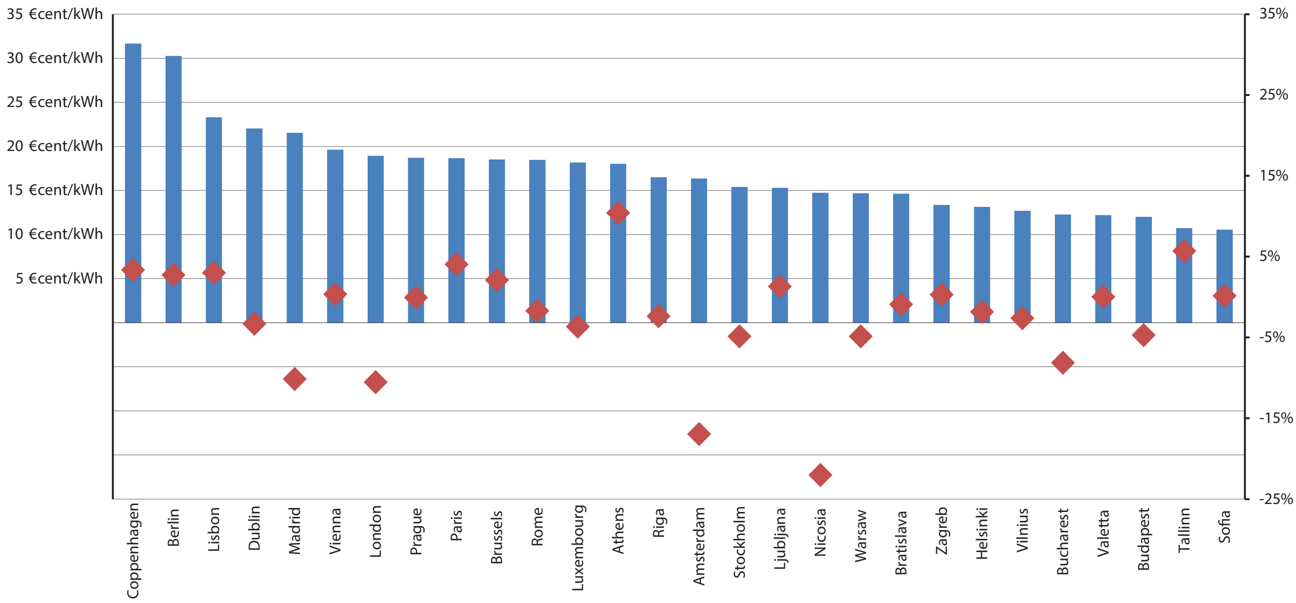
Source: Eurostat, own computations

FIGURE 34 – RELATIVE STANDARD DEVIATION OF RETAIL ELECTRICITY PRICES IN EU MEMBER STATES IN DIFFERENT HOUSEHOLD CUSTOMER CONSUMPTION GROUPS



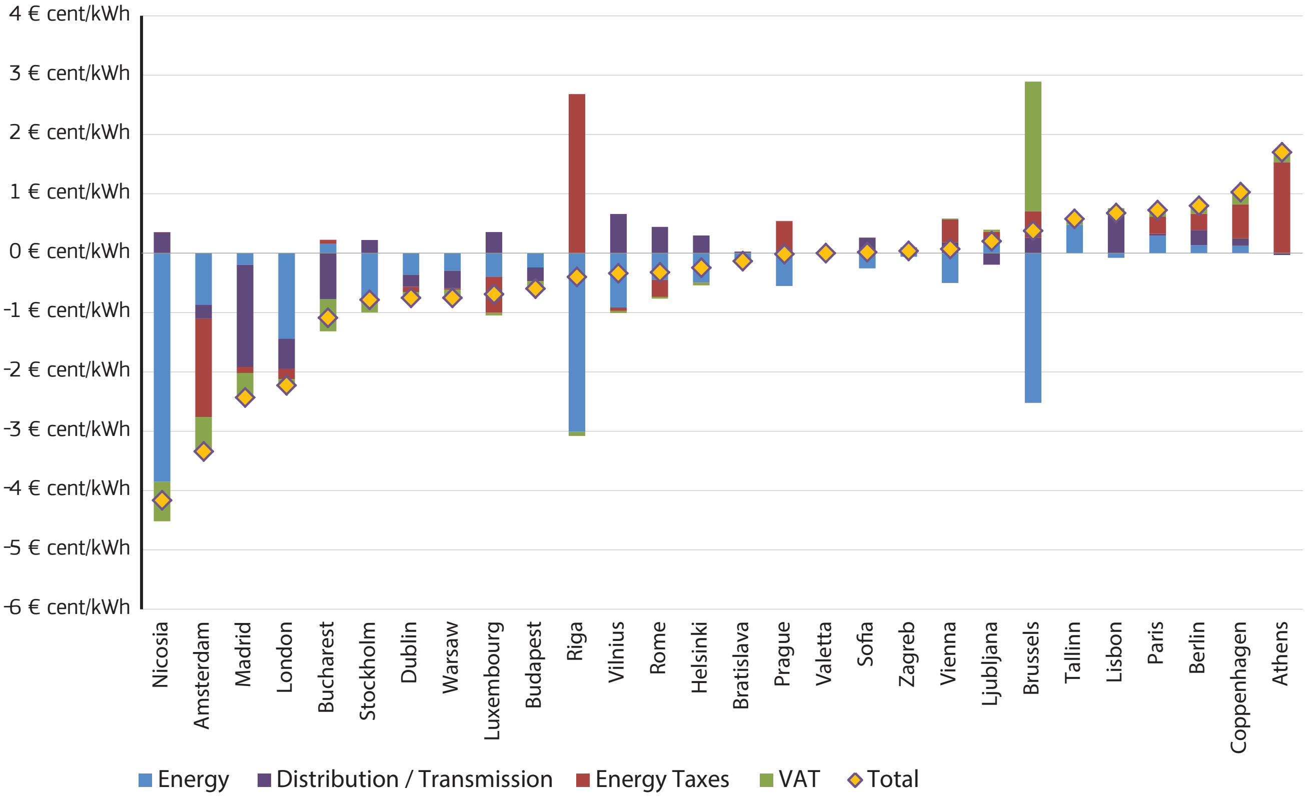
Source: Eurostat, own computations

FIGURE 35 – THE HOUSEHOLD ENERGY PRICE INDEX (HEPI) IN EUROPEAN CAPITAL CITIES – ELECTRICITY PRICES IN APRIL 2016, AND CHANGES IN HOUSEHOLD ELECTRICITY PRICES COMPARED TO APRIL 2015



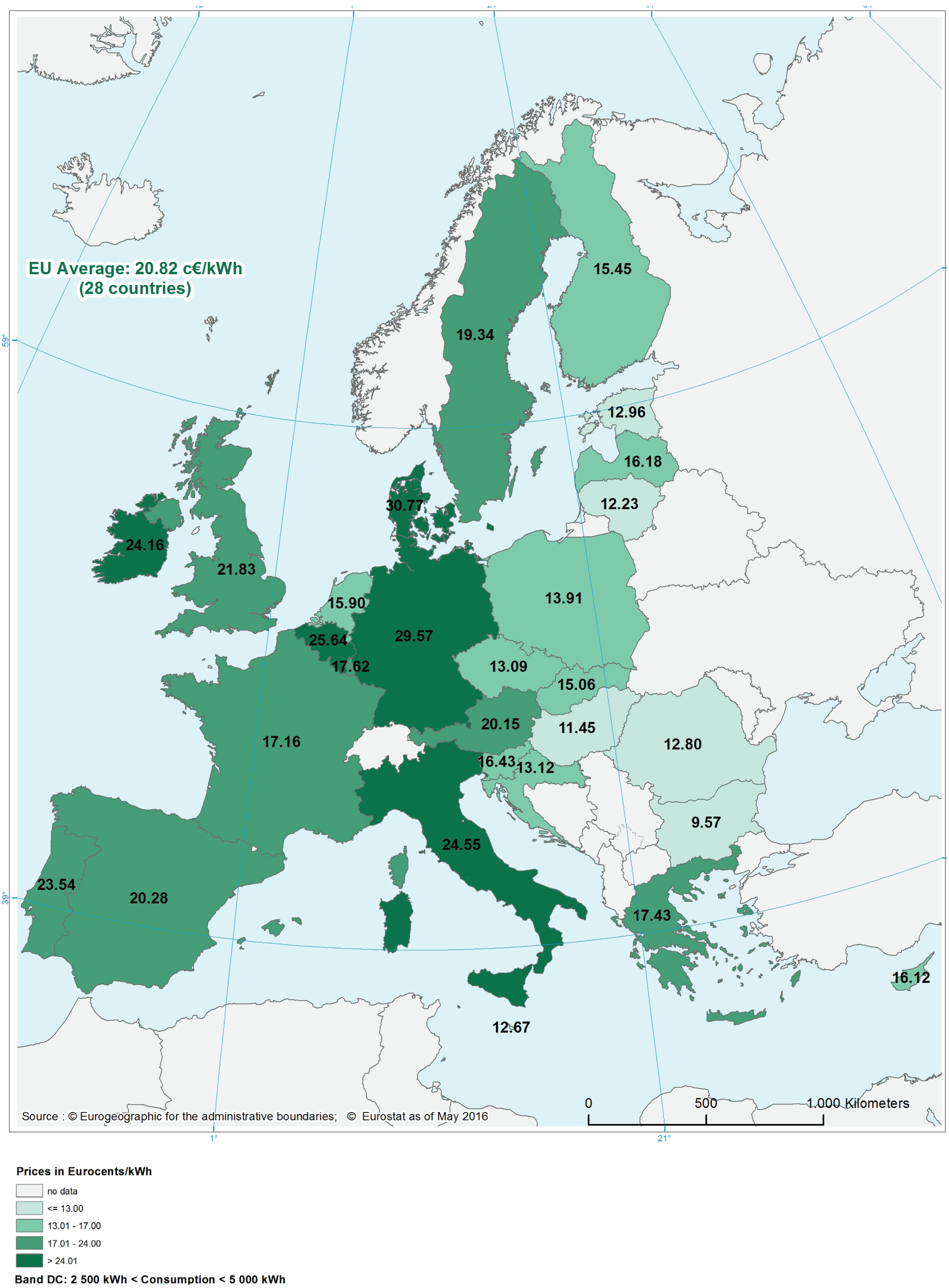
Source: Vaasaett

FIGURE 36 – CHANGE IN ELECTRICITY PRICES AND THEIR COST COMPONENTS IN EUROPEAN CAPITAL CITIES, BETWEEN APRIL 2015 AND APRIL 2016, IN EUROCENT/KWH



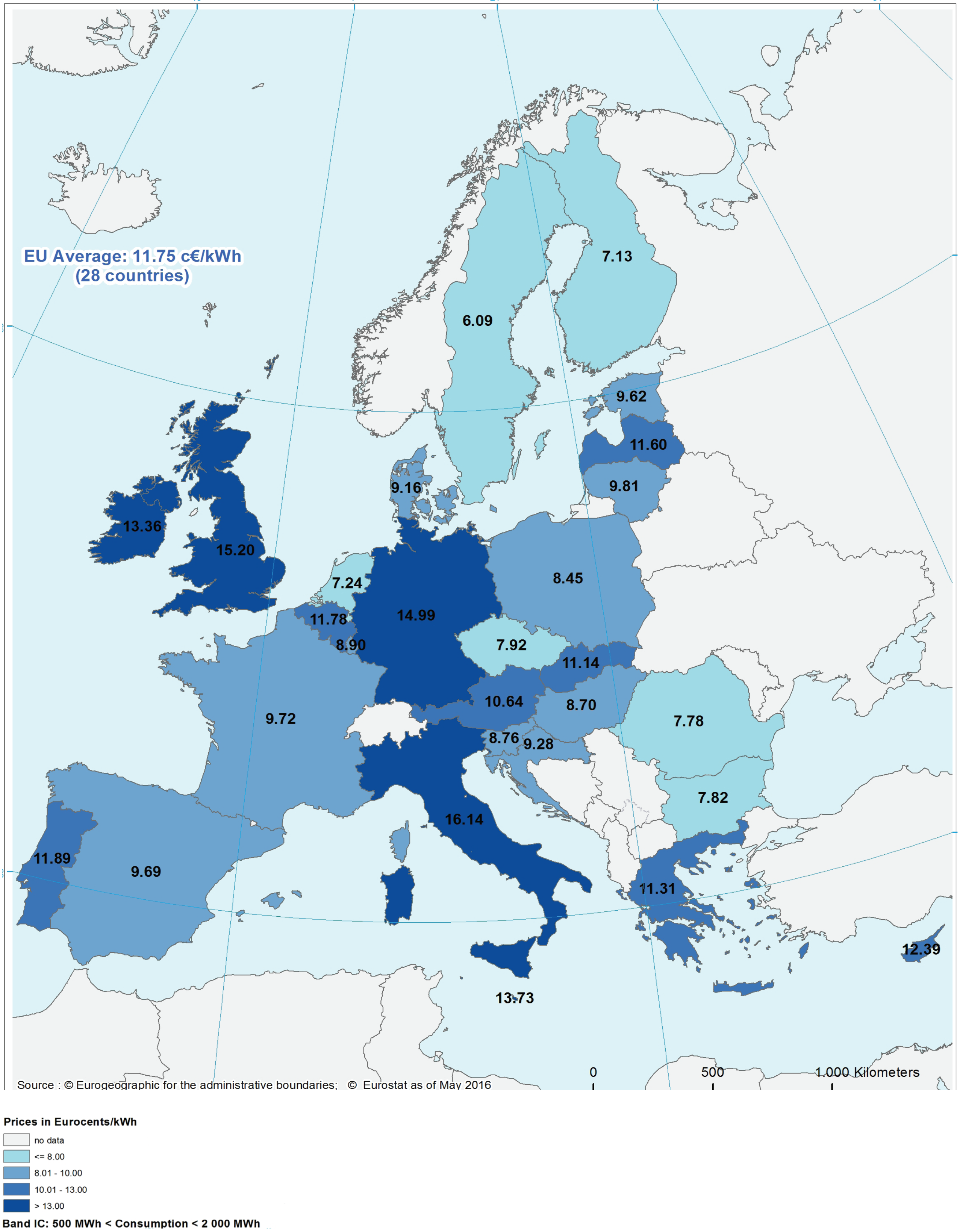
Source: Vaasaett

FIGURE 37 – ELECTRICITY PRICES (INCLUSIVE OF TAXES) – HOUSEHOLDS



Source: data computed from Eurostat half-yearly retail electricity prices and consumer price indices

FIGURE 38 – ELECTRICITY PRICES (WITHOUT VAT AND NON-RECOVERABLE TAXES) – INDUSTRIAL CONSUMERS



Source: data computed from Eurostat half-yearly retail electricity prices and consumper price indices

7. Glossary

Backwardation occurs when the closer-to-maturity contract is priced higher than the contract which matures at a later stage.

Clean dark spreads are defined as the average difference between the price of coal and carbon emission, and the equivalent price of electricity. If the level of dark spreads is above 0, coal power plant operators are competitive in the observed period. *See dark spreads.*

Clean spark spreads are defined as the average difference between the cost of gas and emissions, and the equivalent price of electricity. If the level of spark spreads is above 0, gas power plant operators are competitive in the observed period. *See spark spreads.*

Contango: A situation of contango arises in the when the closer to maturity contract has a lower price than the contract which is longer to maturity on the forward curve.

Cooling degree days (CDDs) are defined in a similar manner as Heating Degree Days (HDDs); the higher the outdoor temperature is, the higher is the number of CDDs. On those days, when the daily average outdoor temperature is higher than 21°C, CDD values are in the range of positive numbers, otherwise CDD equals zero.

Dark spreads are reported as indicative prices giving the average difference between the cost of coal delivered ex-ship and the power price. As such, they do not include operation, maintenance or transport costs. Spreads are defined for a coal-fired plant with 35 % efficiency. Dark spreads are given in this publication for UK and Germany, with the coal and power reference price as reported by *Platts.*

Flow against price differentials (FAPDs): By combining hourly price and flow data, FAPDs are designed to give a measure of the consistency of economic decisions of market participants in the context of close to real time operation of electrical systems.
With the closure of the day-ahead markets (D-1), the prices for each hourly slot of day D are known by market participants. Based on the information from the power exchanges of two neighbouring areas, market participants can establish hourly price differentials. Later in D-1, market participants also nominate commercial schedules for day D. An event named 'flow against price differentials' (FAPD) occurs when commercial nominations for cross border capacities are such that power is set to flow from a higher price area to a lower price area. The FAPD chart in this quarterly report provides detailed information on adverse flows, presenting the ratio of the number of hours with adverse flows to the number of total trading hours in a quarter.

Heating degree days (HDDs) express the severity of a meteorological condition for a given area and in a specific time period. HDDs are defined relative to the outdoor temperature and to what is considered as comfortable room temperature. The colder is the weather, the higher is the number of HDDs. These quantitative indices are designed to reflect the demand for energy needed to heat a building.

Spark spreads are reported as indicative prices giving the average difference between the cost of natural gas delivered ex-ship and the power price. As such, they do not include operation, maintenance or transport costs. Spreads are defined for a gas-fired plant with 50 % efficiency. Spark spreads are given for UK and Germany in this publication, with the gas and power reference price as reported by *Platts.*

Tariff deficit expresses the difference between the price (called a tariff) that a *regulated utility*, such as an electricity producer is allowed to charge and its generation cost per unit..