



# Quarterly Report

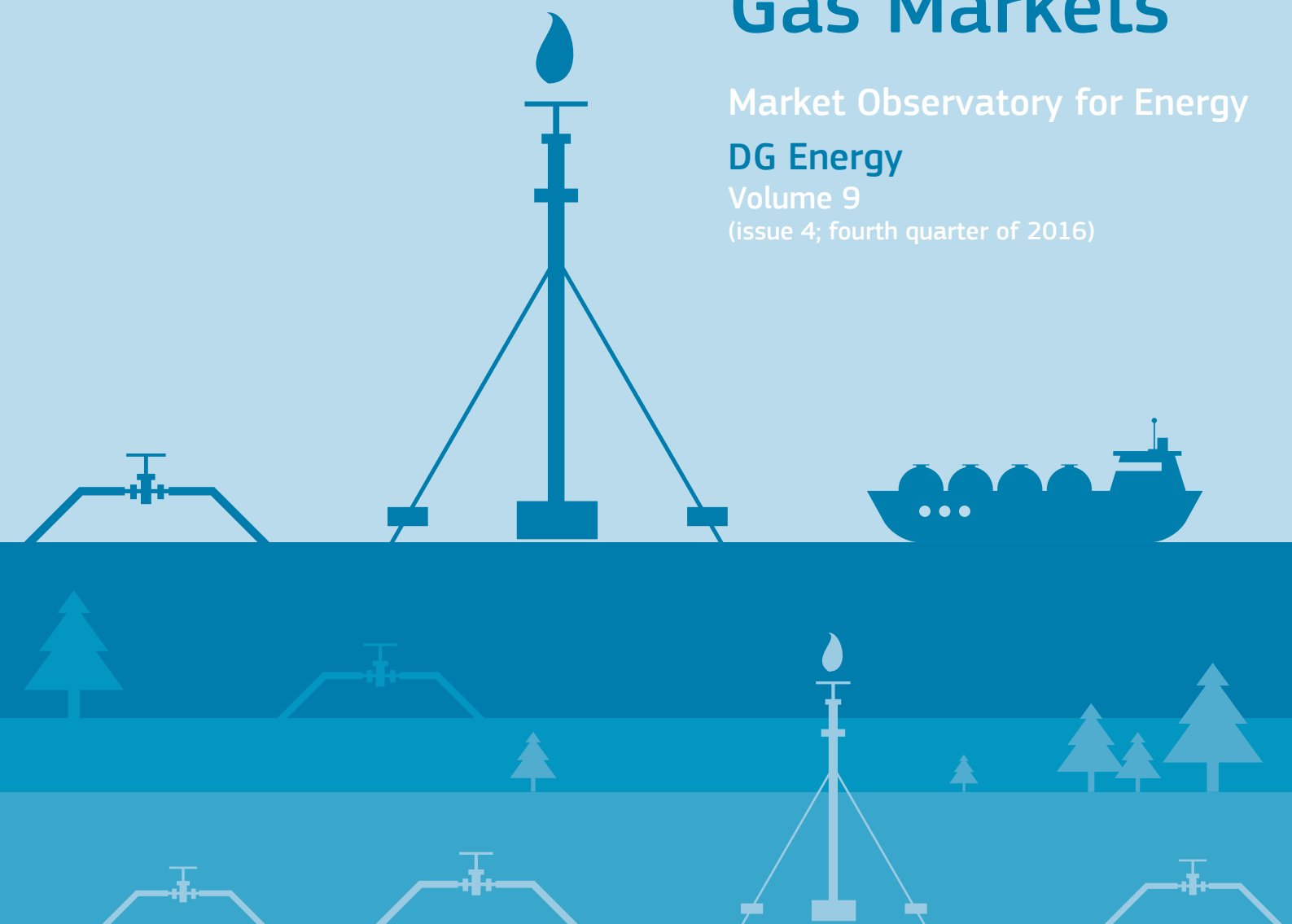
## on European Gas Markets

Market Observatory for Energy

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DISCLAIMER: This report prepared by the Market Observatory for Energy of the European Commission aims at enhancing public access to information about prices of natural gas in the Members States of the European Union. Our goal is to keep this information timely and accurate. If errors are brought to our attention, we will try to correct them. However the Commission accepts no responsibility or liability whatsoever with regard to the information contained in this publication.

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# Highlights of the report

- EU gas demand increased by 2% in the first nine months of 2016 but, according to preliminary data, the growth accelerated in the last quarter when demand grew by 18% year-on-year. This would mean that EU gas demand was about 464 bcm in 2016, 7% more than in 2015, marking the second consecutive year of increasing consumption and the highest absolute level since 2013. The sharp increase in the fourth quarter was driven by low temperatures and growing gas use in power generation.
- EU gas production decreased in the first quarter of 2016 but increased in the second and third quarters, year-on-year. This happened mainly due to the fact that the production profile of the Netherlands has become smoother than in previous years, with a lower peak in winter and higher output in summer.
- As a result of growing consumption and falling indigenous production, imports were 12% higher in 2016 than in the previous year. Driven by the higher demand, in the fourth quarter imports increased by 15% year-on-year. Russia remained the top supplier of the EU in 2016 and falling oil-indexed prices allowed the country gradually to increase its market share, reaching 42% of total extra-EU imports for the whole year. In the last quarter, imports from Russia were 22% higher than a year earlier, with most of the additional supplies arriving through Ukraine – imports on this route rose by 45% year-on-year. The 2016 gas import bill amounted to an estimated 59 billion euros; in spite of the growing volumes, this is nearly 20% less than in 2015.
- LNG imports fell by 14% in the fourth quarter after a small year-on-year increase in the first nine months of 2016. Deliveries significantly decreased in Northwest Europe but increased in most Mediterranean countries. France's new terminal in Dunkirk started commercial operations on 1 January 2017. In the last quarter of 2016, one LNG cargo arrived from the US to the EU.
- At the beginning of the 2016-2017 winter, storage levels were near to maximum capacity. However, withdrawals in the fourth quarter of 2016 were much stronger than in the same period of 2015 and filling rates decreased to unusually low levels. The Rough facility in the UK was partly restarted in December but the outage continues to have an important effect on prices and gas flows.
- European hub prices sharply increased in the last quarter of 2016 after nearly two years of decline, driven by the relatively cold weather, the outages of several French nuclear reactors, low LNG imports in Northwest Europe and uncertainty about the Rough storage site. Oil-indexed prices bottomed out in the summer but increased to a lesser extent than hub prices and, therefore, for most of the fourth quarter, oil-indexed prices were actually lower than hub prices in Northwest Europe. The gap between European and US prices increased in the fourth quarter.
- Trading activity on European hubs slightly decreased in the fourth quarter of 2016 as the declining liquidity of the UK hub offset the increase in other hubs. The uncertainty triggered by the Brexit vote contributed to the declining trading activity at the UK hub.
- The decrease of retail prices accelerated in 2016, for both household and industrial consumers.

# Executive summary

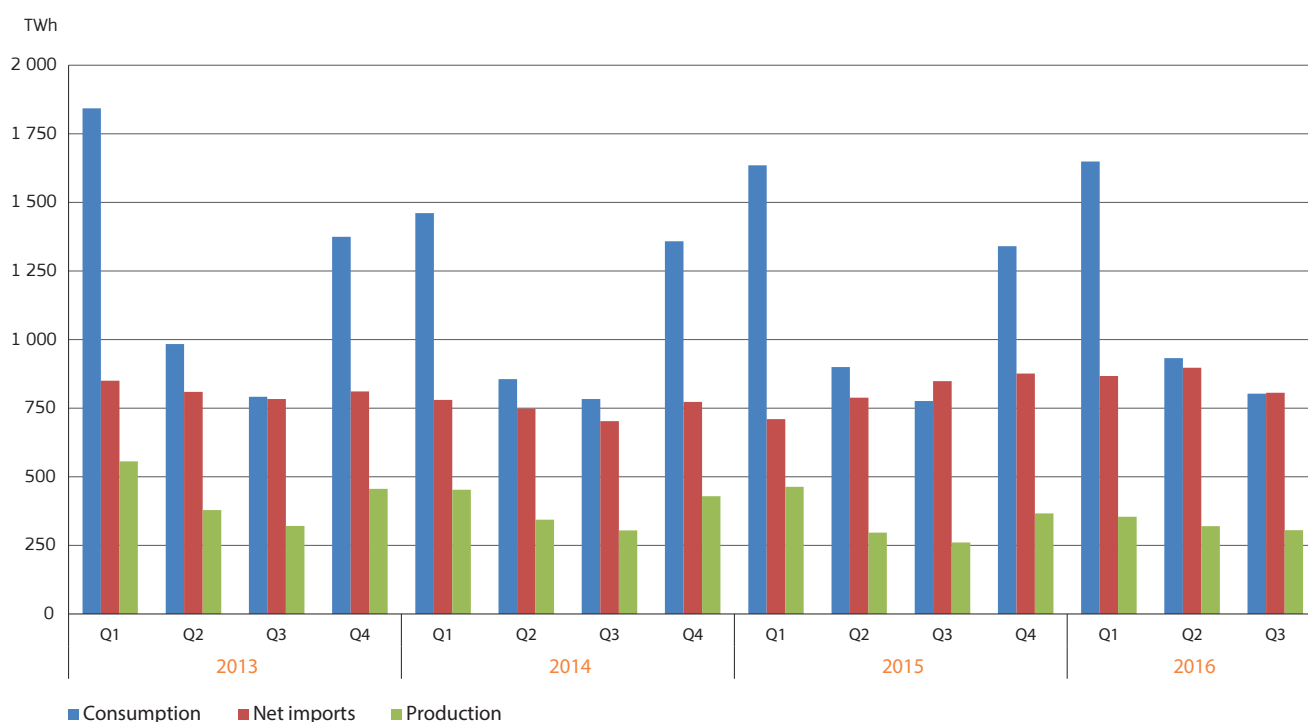
- EU gas **consumption slightly increased in the first nine months of 2016**: by 1% in the first quarter, by 4% in the second quarter and by 3% in the third quarter, in each case compared to the same period in 2015. Preliminary Eurostat data shows that **the increase accelerated in the last quarter: consumption increased by 18%** year-on-year. The relatively cold temperatures in the last quarter (especially when compared to the previous year) increased gas demand for space heating, while high coal prices and French nuclear issues helped gas to gain ground in power generation. If the preliminary fourth quarter data are confirmed, it would mean that EU gas demand grew by 7% in 2016 and reached the highest level since 2013. It also means that EU gas consumption showcased another annual increase after the 4% growth seen in 2015.
- EU gas **production decreased by 24% in the first quarter of 2016 but increased by 8% in the second quarter and by 17% in the third quarter** on a year-on-year basis. This is explained by the reduced fluctuations in the output of the Groningen field: output in the winter months declined but this was partly offset by increasing production in summer. As a result, the ability of the Groningen field to provide seasonal flexibility has significantly decreased. In the first nine months of 2016, Dutch gas production was 13% lower than in the same period of 2015 while gas output in the UK increased by 5%.
- **In the fourth quarter of 2016, EU gas imports were 15% higher than a year earlier** according to ENTSO-G data. Falling oil-indexed prices allowed Russia to increase its exports by 22% year-on-year while Norwegian imports grew by 6%. Most of the additional Russian supplies arrived through Ukraine: imports on this route rose by 45% year-on-year. Pipeline imports from Algeria steadily increased but those from Libya remained below year-ago levels.
- **In 2016, Russia remained the EU's top supplier**, covering 42% of extra-EU imports, followed by Norway (34%) and Algeria (10%); LNG imports made up 13%. The share of the main supply routes of Russian gas imports was as follows: Ukraine 43%, Nord Stream 28% and Belarus 26%. Volumes arriving through Ukraine were 30% higher in 2016 than in 2015.
- After a slight increase in the first nine months of 2016, **in the fourth quarter EU LNG imports decreased by 14%** year-on-year. Deliveries significantly decreased in Northwest Europe but imports to Lithuania and most Mediterranean countries increased. Rising demand and spot prices in Asia meant that Europe became a less attractive destination for LNG cargoes. Qatar remained the main LNG supplier of the EU but its share from total LNG imports decreased to 38%; US exports continued to play a limited role in the EU: a single cargo arrived in the fourth quarter, unloading in Italy. In 2016 as a whole, EU LNG imports were 1% lower than in 2015.
- The EU's **estimated gas import bill was around 18 billion euros** in the fourth quarter of 2016. In 2016 as a whole, the estimated gas import bill was about 59 billion euros, nearly 20% less than in 2015, despite the fact that both consumption and imports increased year-on-year.
- Europe started the 2016/2017 winter with an average filling rate of more than 90% but **withdrawals in the fourth quarter were much stronger than in the same period of 2015** and, as a result, by the end of the year filling rates decreased to unusually low levels, below the 5-year range. **Withdrawals partly resumed at the Rough facility** in the UK but the outage continued to have widespread impacts on prices and gas flows in the Northwest Europe: helped by a price premium, gas flows from mainland Europe significantly increased in the last two months of 2016.
- **Spot prices at European gas hubs increased** in the fourth quarter, driven by relatively cold weather, strong demand in the power sector, the outages of several French nuclear reactors, low LNG imports in Northwest Europe, uncertainty about the Rough storage site and rising oil prices. **Oil-indexed prices also increased but to a lesser extent** than hub prices and, therefore, for most of the fourth quarter, oil-indexed prices were actually lower than hub prices in Northwest Europe.
- After converging in the third quarter, **differences between international gas prices increased** in the fourth quarter as both European and Asian prices grew substantially.
- **Trading activity on European gas hubs slightly decreased**: traded volumes reached 10,200 TWh in the fourth quarter of 2016, 1% less than in the same period of 2015. Uncertainty triggered by the Brexit vote had a marked impact on the NBP, the UK hub where traded volumes dropped by 22%; in all other markets, traded volumes increased year-on-year. Total volumes traded on the main European gas hubs in 2016 were about twelve times more than the combined annual gas consumption of the seven Member States concerned.
- **The decrease of retail prices accelerated in 2016**, for both household and industrial consumers. On the other hand, no real price convergence could be observed in the last year, either for households or for industrial customers.

# 1. Gas Consumption – Production – Imports

## 1.1 Consumption

- After increasing by 1% in the first quarter and by 4% in the second quarter, EU gas consumption grew by 3% in the third quarter of 2016, year-on-year. (Since the previous report, there have been significant revisions in German consumption data reported by Eurostat which had implications on EU consumption in Q1 and Q2 2016.) In the first nine months of 2016, gas demand was 2% higher than in the same period of 2015.
- In the third quarter, Greece (34%) experienced the biggest year-on-year increase, followed by Latvia and Ireland (15% each). In case of Greece, this was driven by the increasing use of gas in power generation (in this period, gas deliveries to power generation increased by 42% year-on-year) while in Ireland the commissioning of the Corrib field facilitated an increase of gas consumption. From the biggest markets, UK consumption showed above-average growth (9%), facilitated by increasing gas use in the power sector. At the same time, gas demand decreased significantly in Slovakia (-20%), Luxembourg (-16%), Lithuania (-14%) and the Netherlands (-12%).
- According to preliminary Eurostat data, consumption in the fourth quarter of 2016 was about 18% higher than in the same period of 2015, with the Czech Republic, France, Germany, Greece, Portugal, Romania and the UK all showing a growth rate of more than 20% and only two Member States (Ireland and Latvia) experiencing a year-on-year decrease.
- If the preliminary fourth quarter data are confirmed, it would mean that EU gas demand grew by 7% in 2016 as a whole, reaching nearly 5,000 TWh (about 464 bcm), the highest level since 2013. It also means that EU gas consumption showcased another annual increase after the 4% growth seen in 2015.

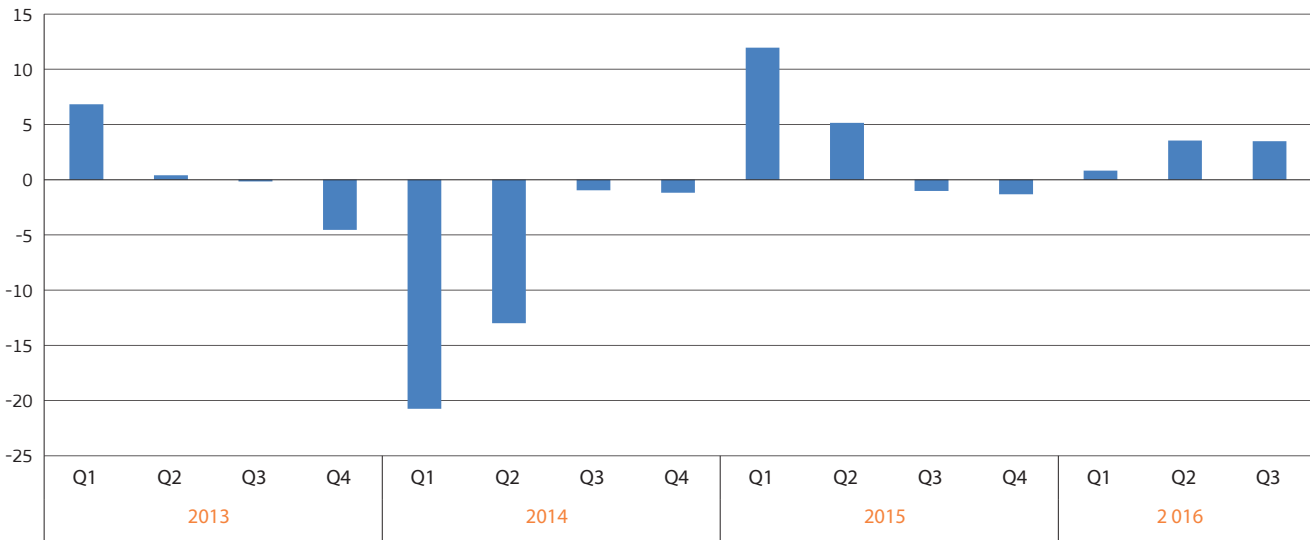
**FIGURE 1 - EU GAS CONSUMPTION, IMPORTS AND PRODUCTION**



Source: Eurostat, data as of 17 February 2017 from data series nrg\_103m. For September 2016, German data is from data series nrg\_ind\_343m. Net imports refer to imports minus exports.

Note: Since the previous report, there have been significant revisions in the consumption data concerning Germany which had implications on EU consumption in Q1 and Q2 2016.

**FIGURE 2 - EU GAS CONSUMPTION Q/Q-4 CHANGE (%)**

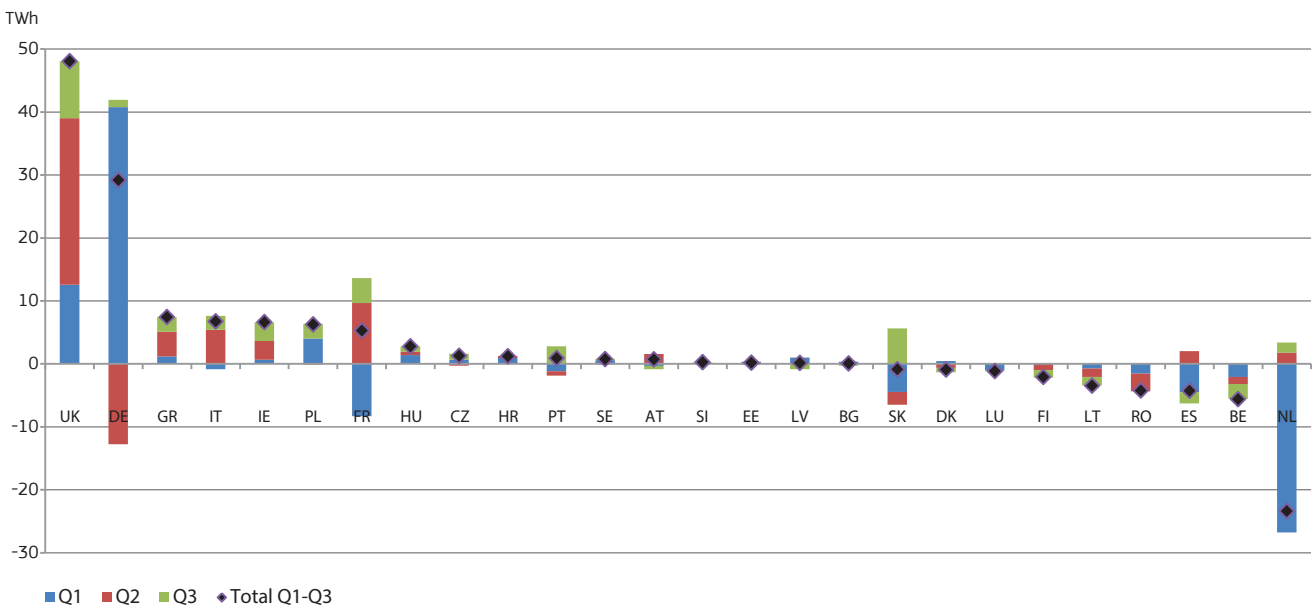


Source: Eurostat, data as of 17 February 2017 from data series nrg\_103m; for September 2016, German data is from data series nrg\_ind\_343m; calculations of DG Energy.

Note: Since the previous report, there have been significant revisions in the consumption data concerning Germany which had implications on the growth of EU consumption in Q1 and Q2 2016.

- In absolute terms, the UK and Germany showcased the biggest consumption growth in the first three quarters of 2016 which was partly offset by a decrease in the Netherlands. In the third quarter, the UK, Slovakia and France had the biggest absolute increase compared to the same period of 2015.

**FIGURE 3 - CHANGE OF EU GAS CONSUMPTION IN Q1, Q2 AND Q3 OF 2016, COMPARED TO THE SAME PERIOD OF 2015**

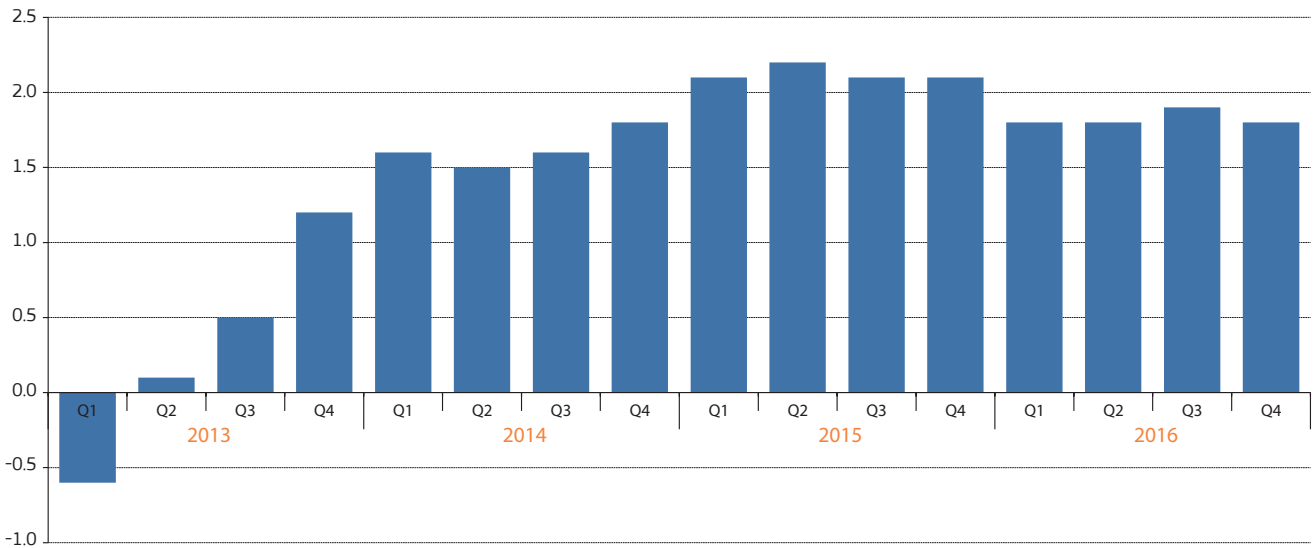


Source: Eurostat, data as of 17 February 2017 from data series nrg\_103m; for September 2016, German data is from data series nrg\_ind\_343m; calculations of DG Energy.

Note: Since the previous report, there have been significant revisions in the consumption data concerning Germany in Q1 and Q2 2016.

- Compared with the same quarter of the previous year, seasonally adjusted gross domestic product (GDP) rose by 1.8% in the EU in the fourth quarter of 2016, after a growth of 1.9% in the previous quarter. The gross value added in the manufacturing sector was 0.7% higher in the third quarter of 2016 than a year earlier; this is the slowest quarterly growth seen since 2013.

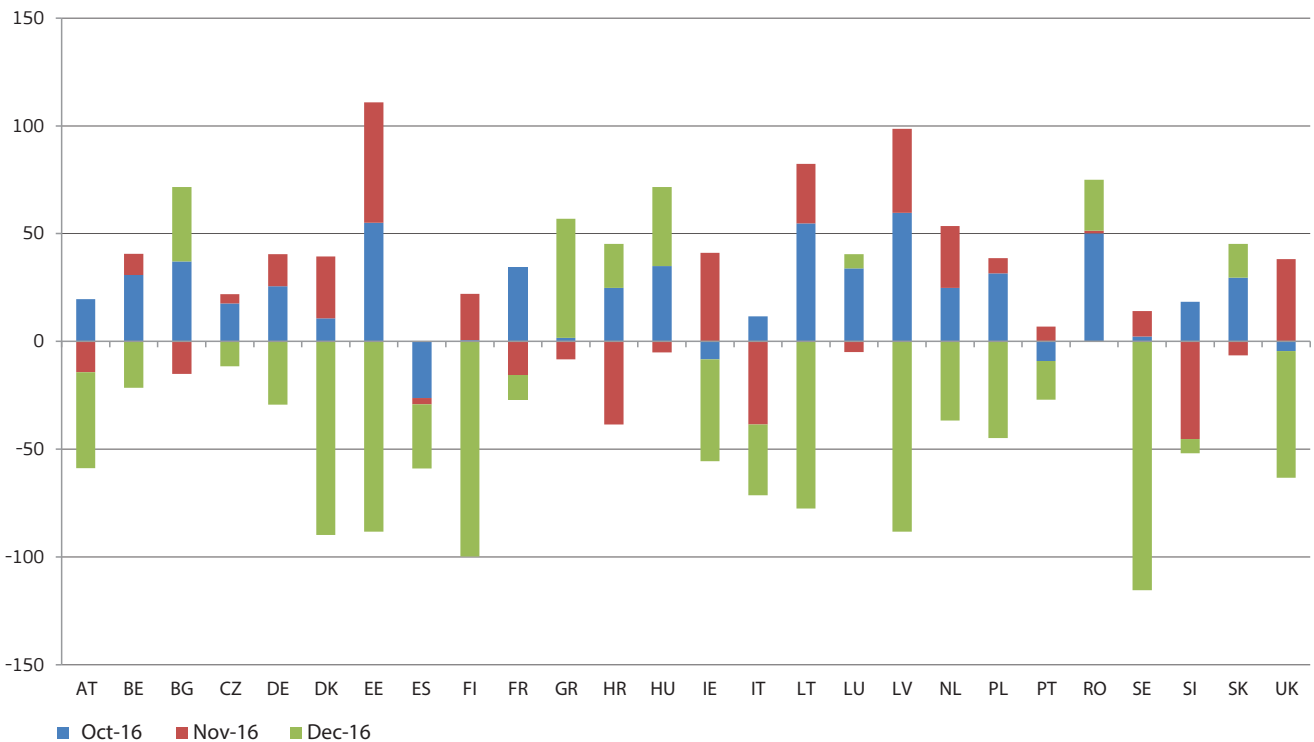
**FIGURE 4 - EU GDP Q/Q-4 CHANGE (%)**



Source: Eurostat, data as of 21 February 2017 from data series namq\_10\_gdp

- Figure 5 shows the deviation of actual heating degree days (HDDs) from the long-term average in individual EU Member States in the last quarter of 2016. On average, temperatures in October and November were below the seasonal norms, but December was warmer than usual. December was unusually mild in Scandinavian and Baltic countries, thereby reducing gas demand for space heating.
- Overall, the number of heating degree days in the fourth quarter of 2016 was roughly in line with the long-term average in the EU as a whole but, when comparing with the same period of 2015, the weather was significantly colder. Accordingly, the significant year-on-year increase of gas demand (shown by preliminary data) in this period is at least partly weather-driven.

**FIGURE 5 - DEVIATION OF ACTUAL HEATING DEGREE DAYS FROM THE LONG-TERM AVERAGE IN Q4 OF 2016**

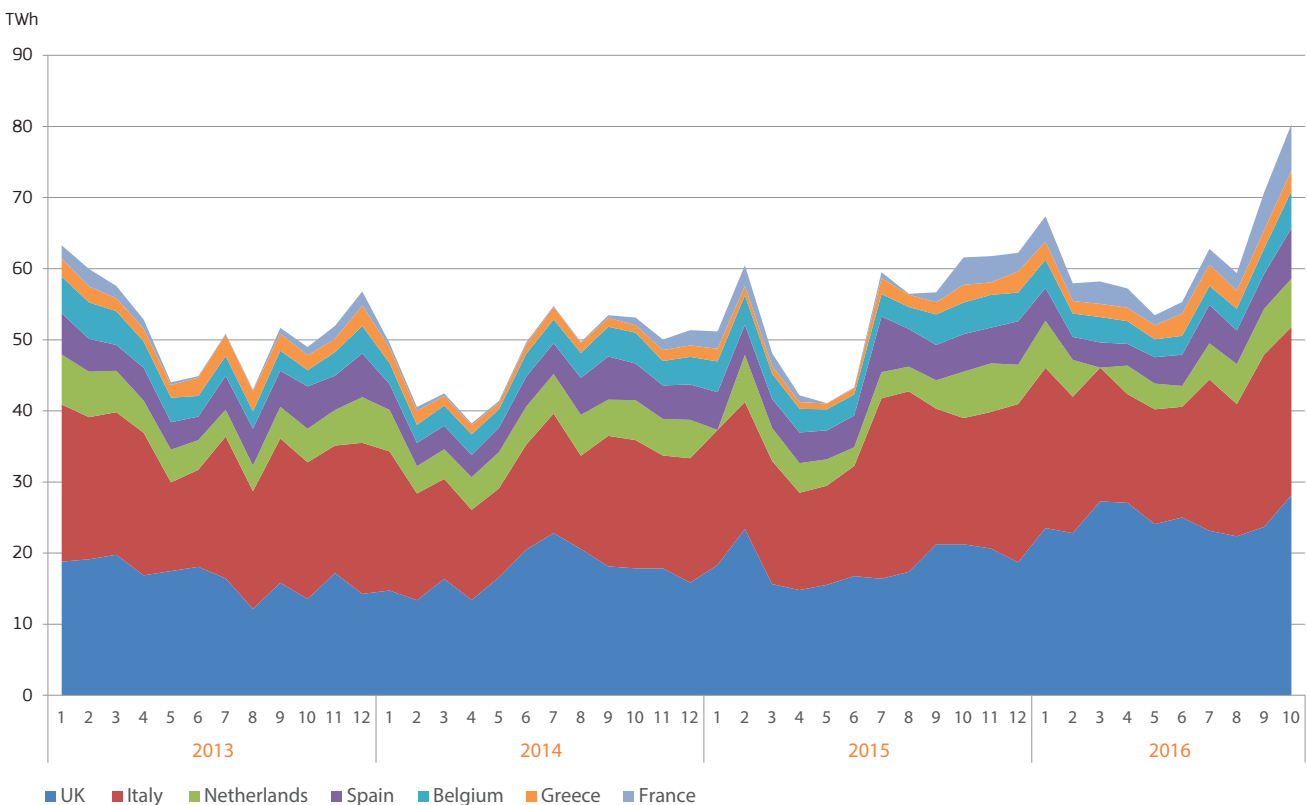


Source: Eurostat/JRC



- Since July 2015, gas deliveries to power generation have consistently shown a year-on-year increase. In the seven important markets depicted in Figure 6, gas deliveries to power generation increased by 20% in the first ten months of 2016 compared to the same period in 2015. The growth rate was 117% in France, 61% in Greece, 37% in the UK, 17% in the Netherlands and 6% in Italy. On the other hand, gas deliveries decreased in Spain (-10%) and Belgium (-7%).
- Looking at the August-October period (the last three month for which complete data is available), in these seven markets, gas deliveries to power generation increased by 20% compared to the same period of 2015. The growth rate was 166% in France, 35% in the Netherlands, 34% in Greece, 24% in the UK, 7% in Spain, 7% in Italy and 0% in Belgium.
- While EU electricity consumption is stagnating (in the first eleven months of 2016 it was basically flat compared to the same period of 2015) and gas has to face the continuing penetration of renewables in the power sector, it seems that the falling prices have improved the competitiveness of gas compared to other fuels, in particular coal. While gas prices started to increase in the fourth quarter of 2016, coal prices increased at a faster rate, suggesting an improvement in the relative competitiveness of gas. In addition, the closure of coal-fired plants and outages in French nuclear plants also allowed gas to increase its role in the electricity fuel mix.
- UK clean spark spreads – measuring the profitability of gas-fired generation – remained high, averaging nearly 30€/MWh in the last quarter of 2016. As a result of the improving economics and the closure or converting of some coal-powered plants, gas has gained ground in the electricity mix, mainly at the expense of coal.<sup>1</sup>
- Clean dark spreads are also on the rise in Germany: they averaged 5 €/MWh in the fourth quarter of 2016, the highest level since 2011.<sup>2</sup> As a result of the improving competitiveness of gas in Germany, the share of gas-fired power generation doubled in the third quarter of 2016, reaching 9.4% (compared to 4.6% in the same period of 2015).<sup>3</sup>

**FIGURE 6 - GAS DELIVERIES TO POWER GENERATION IN SELECTED MEMBER STATES**



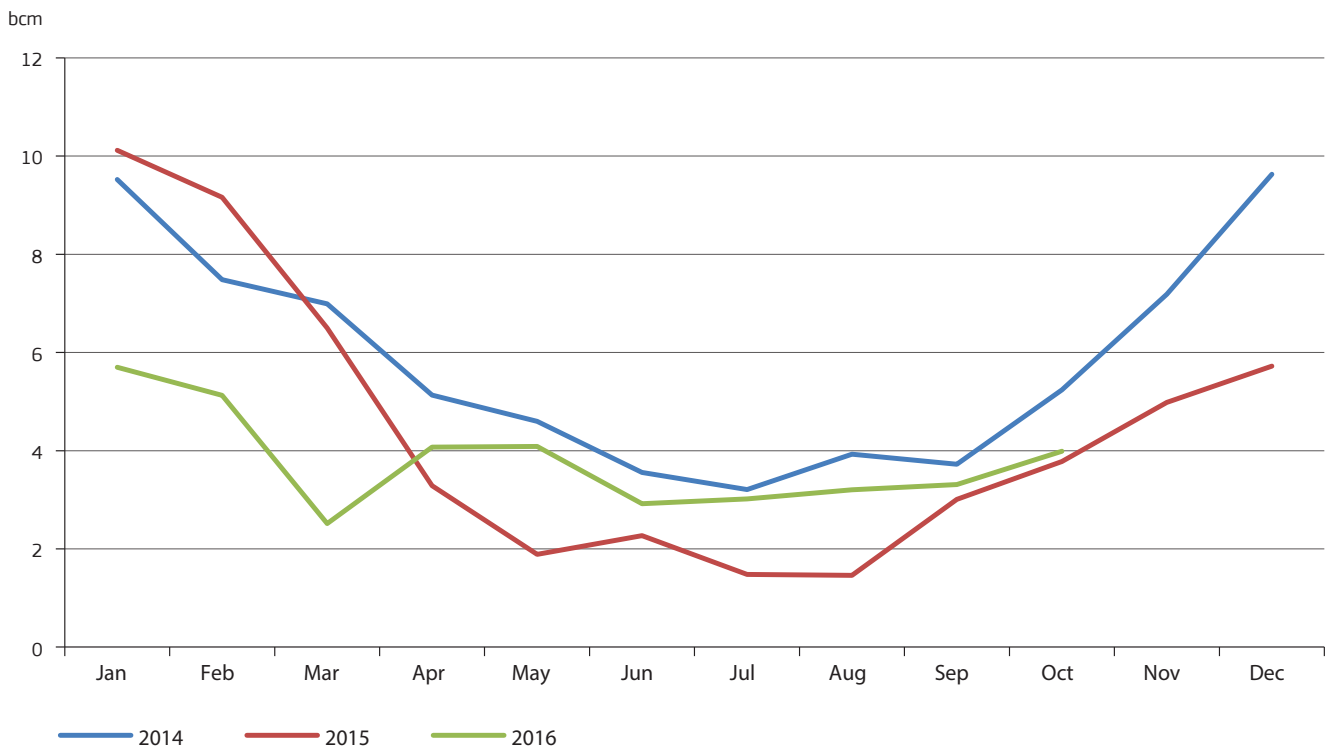
Source: Eurostat, data as of 21 November 2016 from data series nrg\_103m. Germany is not included because of gaps in reporting.

1. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/593413/Press\\_Notice\\_February\\_2017.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593413/Press_Notice_February_2017.pdf)  
 2. Charts of clean spark spreads in Germany and the UK can be found in the Quarterly Report of European Electricity Markets  
 3. <https://www.destatis.de/EN/FactsFigures/EconomicSectors/Energy/Production/Tables/ElectricityProductionSupply.html>

## 1.2 Production

- After a 24% decrease in the first quarter and an 8% increase in the second quarter, EU gas output increased by 17% in the third quarter of 2016, year-on-year. In the third quarter, Dutch production increased by 60%, UK output was up 13% while Ireland continued its robust growth (3370%) thanks to the commissioning of the Corrib field in late 2015. In turn, the production of all the other Member States combined was 10% less than in the same period of 2015.
- In the first nine months of 2016, EU gas production was 4% lower than in the same period of 2015. Looking at the six largest producers, gas output increased in the UK (5%) but decreased in the Netherlands (-13%), Romania (-12%), Germany (-12%), Italy (-18%) and Denmark (-5%).
- In order to avoid earthquakes in the area, the Dutch government aims to minimise fluctuations in the output of the Groningen field. These efforts had a tangible effect on the country's production profile in 2016. In previous years, Dutch gas production showed a very strong seasonal pattern, with output peaking in winter and plummeting in summer. While in 2015 the ratio of January and July volumes was about 7:1, in 2016 it was only 2:1. In the first quarter of 2016, production was well-below 2015 levels but in the second and third quarters it was consistently higher than in the same period of 2015. In the first ten months of 2016, production was 12% lower than a year earlier. As a downside of these developments, the ability of the Groningen field to provide seasonal flexibility has significantly decreased.

**FIGURE 7 - MONTHLY GAS PRODUCTION IN THE NETHERLANDS**



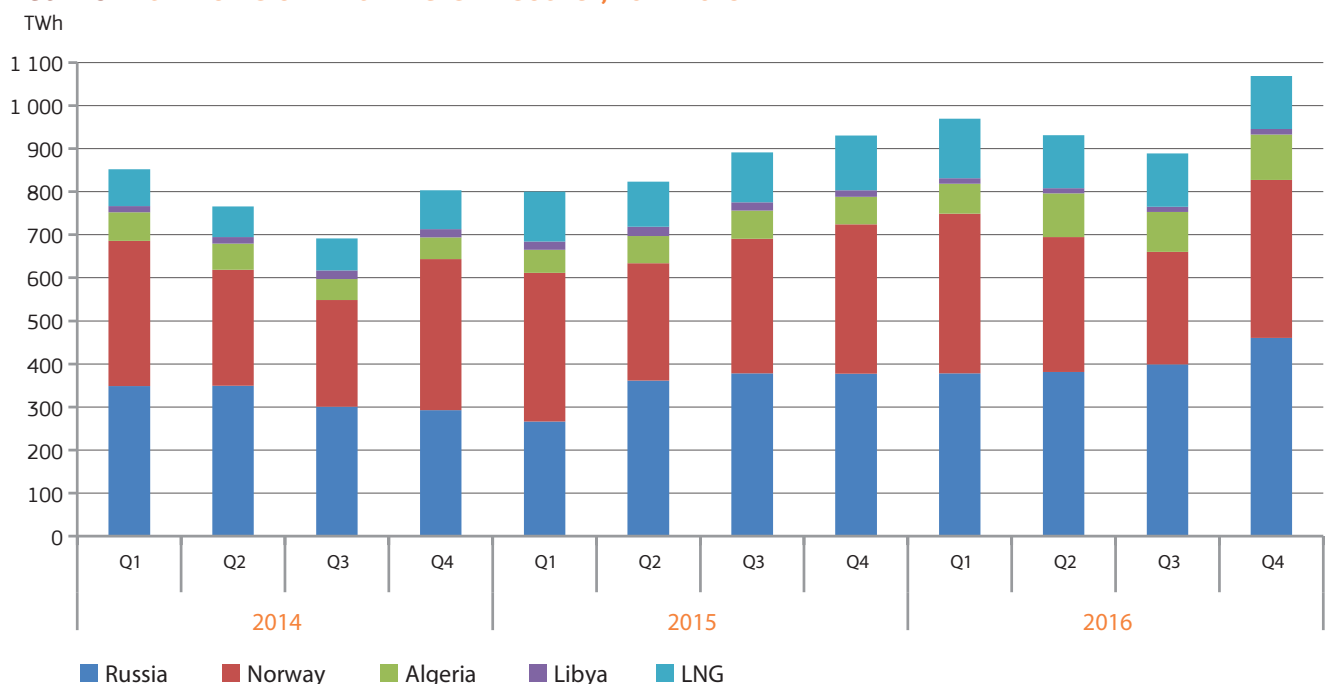
Source: Eurostat, data as of 17 February 2017 from data series nrg\_103m.

## 1.3 Imports

- According to Eurostat data, net imports increased year-on-year by 22% in the first quarter and 14% in the second quarter of 2016, followed by a 5% decrease in the third quarter. In the first nine months of 2016, net imports were 10% higher than in the same period of 2015. Growing consumption and falling indigenous production both contributed to the rise of imports.
- Among the biggest gas markets, in the first nine months of 2016 the net imports of Germany and the UK increased by 14% and 8%, respectively. Like in 2015, the Netherlands became a net importer in the second and third quarters of 2016. However, looking at the first nine months of 2016, it remained a net exporter although net exports were 12% lower than a year ago. In case of Ireland, the rapid ramp-up of production at the Corrib field allowed the country to reduce imports by 44%.
- ENTSO-G data show a similar, 11% year-on-year increase in the first nine months of 2016. In the last quarter, imports increased by 15% year-on-year, resulting in a 12% increase in 2016 as a whole.

- Imports from Russia have been rather stable since the third quarter of 2015 but increased substantially in the last quarter of 2016: in this period, Russian supplies were 22% higher than a year earlier. In addition to increasing gas consumption in the EU, low oil-indexed prices were instrumental in raising gas deliveries from Russia in this period. Oil prices bottomed out in January 2016 and gradually filtered through Russia's long-term contracts. For most of the last quarter, oil-indexed prices were actually lower than hub prices in Northwest Europe, thereby incentivising buyers to step up offtake nominations.
- In 2016 as a whole, imports from Russia increased by 17% compared to 2015. Russia remained the top supplier of the EU and falling oil-indexed prices allowed the country to increase its share from total extra-EU imports from 40% in 2015 to 42% in 2016.
- Imports from Norway increased by 6% year-on-year in the fourth quarter of 2016. Within Norwegian supplies, the share of the UK increased in this period as the outage of the Rough storage site and falling LNG imports forced the country to rely more on pipeline imports. France and Germany, on the other hand, reduced imports from Norway which was offset by rising LNG imports and rising Russian pipeline imports, respectively.
- In 2016 as a whole, Norwegian supplies increased by 3% but the country's market share decreased from 37% in 2015 to 34%. The country remained the EU's second gas supplier. (Note that Norway to UK flows reported by ENTSO-G include some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.)
- In the last quarter of 2016, pipeline imports from Algeria increased by 65% while those from Libya decreased by 15% year-on-year. Low oil-indexed prices, relatively cold weather and Eni renegotiating its long-term contract with Sonatrach<sup>4</sup> are likely to have contributed to the increasing flows from Algeria.
- Pipeline imports from North Africa continuously increased in 2016, helped by falling oil-indexed prices. The increase was driven by the growing volumes coming from Algeria: during the whole year, Algerian supplies were 50% higher than in 2015. While Algerian supplies to Spain remained practically unchanged, deliveries to Italy increased by 161%. Libyan oil exports started to recover lately but the trend for gas deliveries is less positive: volumes decreased by 32% in 2016. The combined share of the two countries from total extra-EU imports was 11% in 2016, up from 9% in 2015.
- Imports of LNG increased during the first three quarters of 2016 but decreased in the last quarter. In 2016 as a whole, LNG imports covered 13% of total extra-EU gas imports, the same as in 2015 (see further details below).
- The EU's estimated gas import bill was around 18 billion euros in the fourth quarter of 2016, about 5% more than a year earlier. While prices were lower than in the last quarter of 2015, this was more than offset by the increase in import volumes. In 2016 as a whole, the estimated gas import bill was about 59 billion euros, nearly 20% less than in 2015, despite the fact that the quantity of imports increased by 12% year-on-year.

**FIGURE 8 - EU IMPORTS OF NATURAL GAS BY SOURCE, 2014-2016**

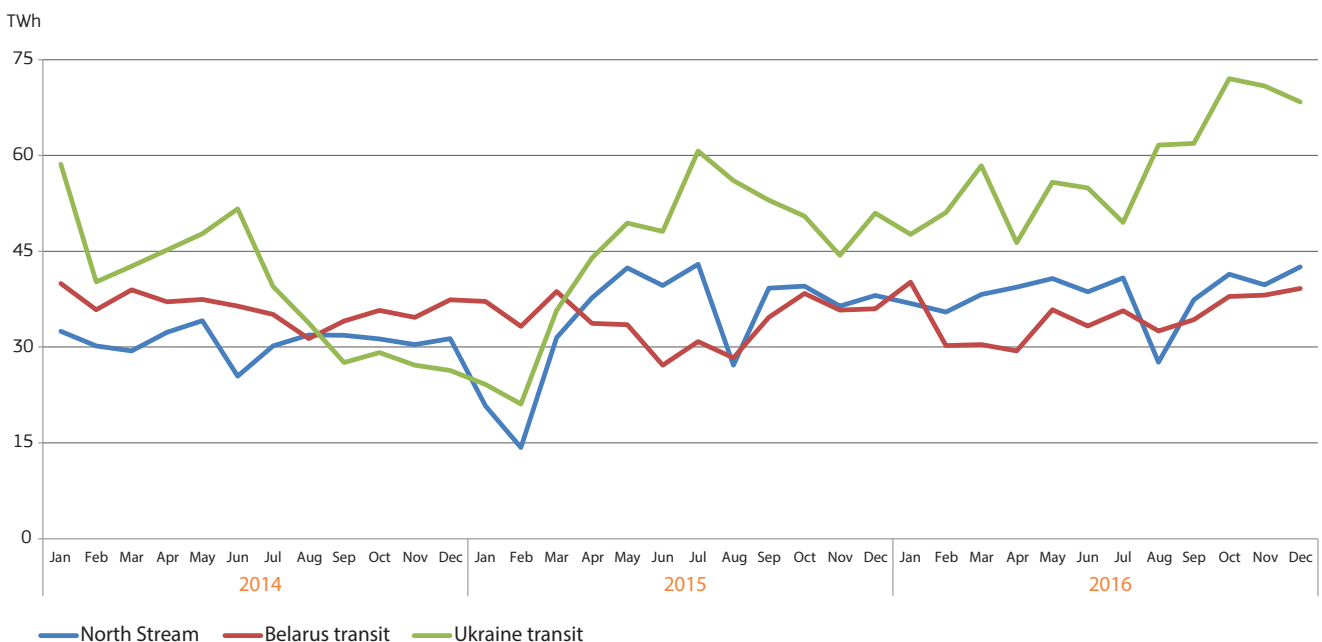


Source: Based on data from the ENTSO-G Transparency Platform  
 Russian deliveries to Finland are reported from 1 June 2014; deliveries to Estonia and Latvia are reported for a limited period (Narva from 15 June 2015 to 10 December 2015, Varska and Misso Izborsk from 26 May 2015)  
 Norway to UK flows reported by ENTSO-G include some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.

4. [https://www.eni.com/en\\_IT/media/2016/12/eni-and-sonatrach-reached-an-agreement-on-gas-supplies?lnkfrm=newssearch](https://www.eni.com/en_IT/media/2016/12/eni-and-sonatrach-reached-an-agreement-on-gas-supplies?lnkfrm=newssearch)

- In the first three quarters of 2016, the shares of the main supply routes of Russian gas imports have been relatively stable. In the fourth quarter, when Russian imports significantly increased, most of the additional volumes arrived through Ukraine. In this period, volumes transiting Ukraine were 45% higher than in the same period of 2015. As a result, Ukraine covered 46% of total EU imports from Russia, up from 39% a year earlier.
- Gas flows on the Nord Stream pipeline represented 27% of total EU imports from Russia in the fourth quarter of 2016. In absolute terms, volumes were 8% higher than in the same period of 2015.
- Gas supplies transiting Belarus increased by 5% in the last quarter of 2016 compared to the same period of 2015 and covered 25% of total EU imports from Russia.
- In 2016 as whole, the share of the main supply routes of Russian gas imports was as follows: Ukraine 43% (up from 39% in 2015), Nord Stream 28% (down from 30%) and Belarus 26% (down from 29%). Volumes arriving through Ukraine (which includes the Brotherhood Pipeline and the Balkan route), traditionally the main supply route of Russian gas to the EU, were 30% higher in 2016 than in 2015, with most of the increase on the Slovakian route. Nord Stream supplies increased by 12% while those transiting Belarus rose by 2%.
- The Commission's decision on the revised exemption conditions for the operation of the OPAL gas pipeline<sup>5</sup> had no significant impact on the utilisation of the Nord Stream pipeline in the last quarter of 2016 (utilisation was 77% in this period) but in January 2017 volumes were noticeably higher and utilisation was practically 100%. However, the European Court of Justice suspended the execution of the Commission's decision<sup>6</sup> and in February 2017 Nord Stream volumes returned to the levels seen in the fourth quarter of 2016.
- In March 2017, the Commission invited comments on commitments submitted by Gazprom to address the Commission's long-standing competition concerns as regards gas markets in Central and Eastern Europe. The commitments are expected to help to better integrate these markets, facilitating cross-border gas flows at competitive prices. Taking into account the comments received, the Commission may adopt a decision making the commitments legally binding on Gazprom.<sup>7</sup>
- While the gas transit through Ukraine reached record levels in the fourth quarter of 2016, Ukraine continued to rely on imports from Europe. Gas flows coming from Hungary, Poland and Slovakia reached about 4.3 bcm in this period. The country has not purchased gas from Russia since November 2015. Despite trilateral talks between Russia, Ukraine and the European Commission taking place on 9 December 2016, no agreement was reached between Russia and Ukraine on the terms for the purchase of Russian gas in the 2016-2017 winter.

**FIGURE 9 - EU IMPORTS OF NATURAL GAS FROM RUSSIA BY SUPPLY ROUTE, 2014-2016**



Source: Based on data from the ENTSO-G Transparency Platform - Deliveries to Estonia, Finland and Latvia are not included; transit volumes to the Former Yugoslav Republic of Macedonia, Serbia and Turkey are excluded

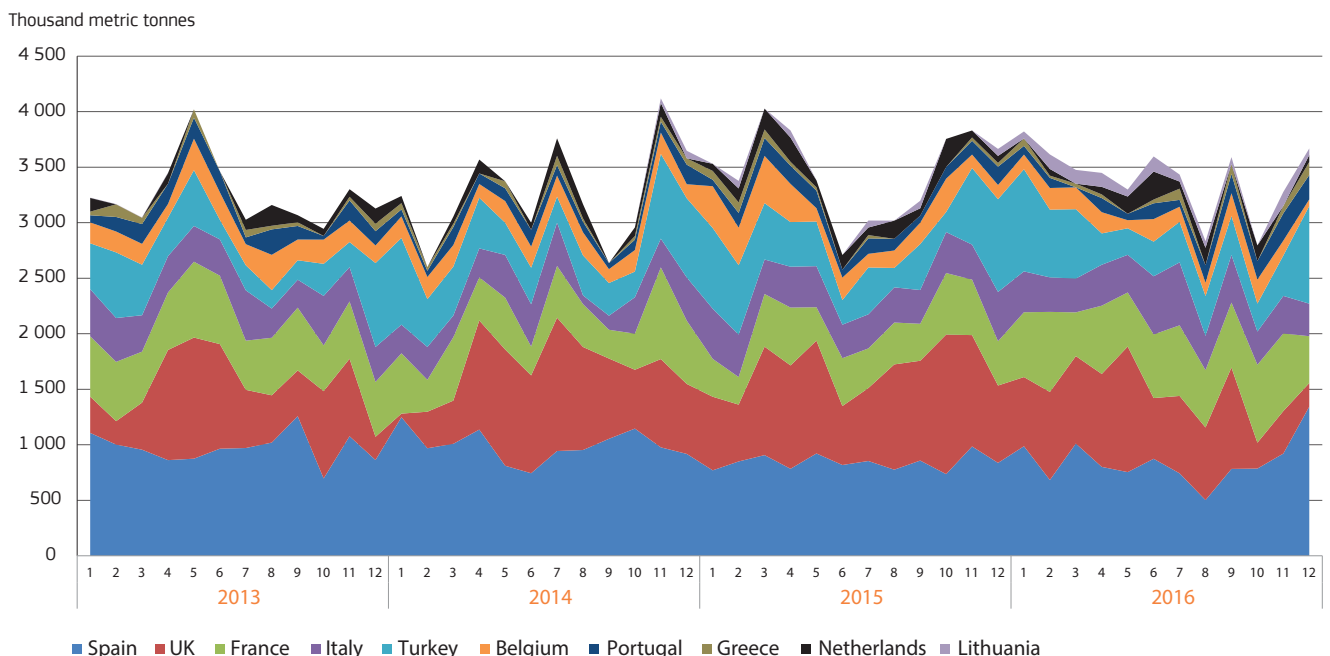
5. [http://europa.eu/rapid/press-release\\_IP-16-3562\\_en.htm](http://europa.eu/rapid/press-release_IP-16-3562_en.htm)

6. <http://en.pgnig.pl/news/-/news-list/id/eu-court-of-justice-recognises-the-legitimacy-of-the-polish-company-pgnig-s-complaint-and-suspends-the-execution-of-the-ec-s-decision-of-october-28-20/newsGroupId/18252?changeYear=2016&currentPage=1>

7. [http://europa.eu/rapid/press-release\\_IP-17-555\\_en.htm](http://europa.eu/rapid/press-release_IP-17-555_en.htm)

- After increasing by 3% in the first nine months of 2016, in the fourth quarter EU LNG imports decreased by 14% year-on-year, reaching the lowest Q4 level since 2013. In this period, deliveries significantly decreased in Northwest Europe where relatively high storage levels and ample pipeline imports reduced demand for LNG cargoes: imports to the UK, the Netherlands and Belgium fell by 72%, 46% and 25% respectively. On the other hand, imports to Lithuania (195%) and most Mediterranean countries increased: Spain (19%), France (25%), Portugal (60%) and Greece (188%) all increased their imports but supplies to Italy (-18%) fell.
- Because of the outage of the Rough storage facility, LNG was expected to play an increasing role in the UK gas supply during the 2016-2017 winter but in the fourth quarter of 2016 this has not materialised. Instead, the UK was relying more on pipeline imports from Norway and the continent.
- In 2016 as a whole, EU LNG imports were 1% lower than in 2015. Imports decreased in Northwest Europe: by 23% in the UK, by 34% in Belgium and by 35% in the Netherlands. In Spain, Europe's largest LNG importer, imports were basically unchanged but deliveries to France (43%), Greece (36%), Italy (5%) and Portugal (5%) increased. Lithuania experienced the biggest increase, with imports tripling compared to 2015.
- Although increasing global supply allowed LNG prices to decrease in 2016 to the lowest level since 2010, Europe's pipeline suppliers remained competitive vis-à-vis LNG imports. Rising demand and spot prices in Asia also meant that Europe became a less attractive destination for LNG cargoes, in spite of the growing premium of NBP price over Henry Hub in the last quarter of 2016.
- Commercial operations at the Dunkirk regasification terminal started on 1 January 2017. The terminal is the second largest in mainland Europe and is the only one in Europe to be directly connected to two consumption markets: France and Belgium.<sup>8</sup>
- In October 2016, the International Maritime Organisation (IMO) decided to impose the reduction of marine fuels' sulphur content to 0.5% (from the current 3.5%) from 2020.<sup>9</sup> The decision can potentially increase demand for LNG as one of the options for ship operators to comply with the decision is to switch to LNG, a fuel which contains almost no sulphur. A number of European port operators are already investing in the development of LNG bunkering vessels and facilities.

**FIGURE 10 - IMPORTS OF LNG INTO EUROPE BY COUNTRY**



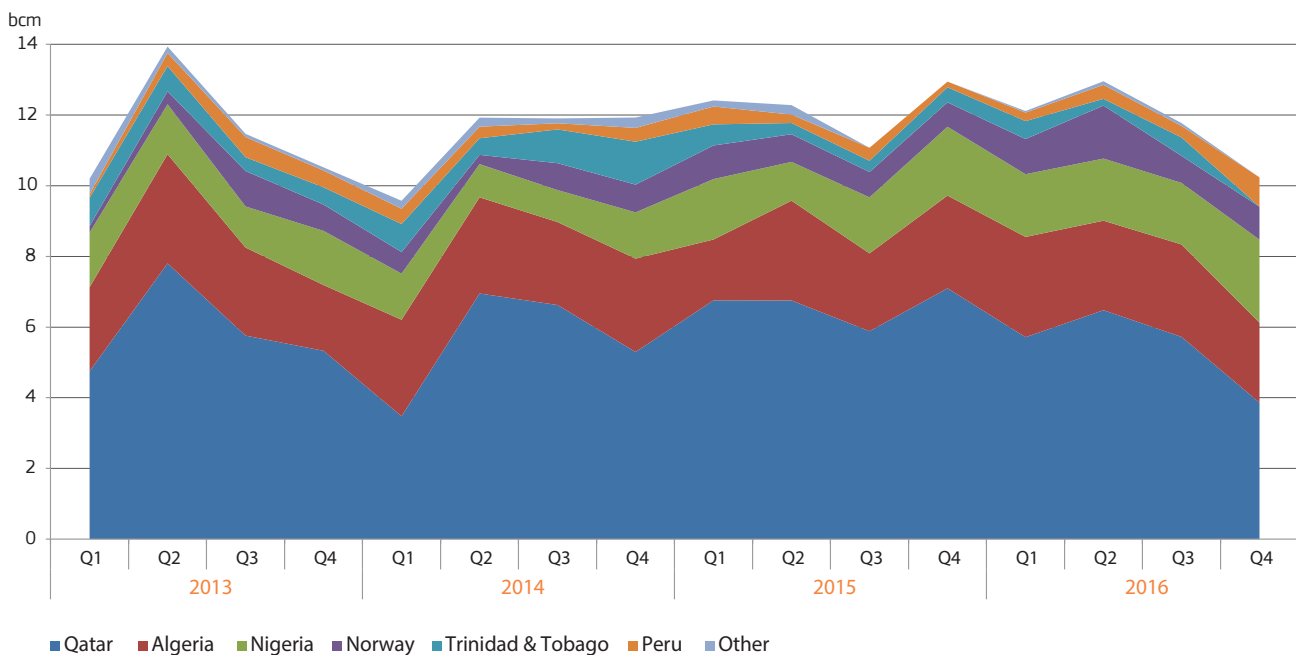
Source: Thomson-Reuters Waterborne - Poland is not included

8. <https://www.edf.fr/en/the-edf-group/our-energies/production-map/dunkerque-lng-terminal/news/commercial-commissioning-of-the-dunkirk-regasification-terminal>

9. <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/MEPC-70-2020sulphur.aspx>

- In the fourth quarter of 2016, Qatar remained the main LNG supplier of the EU but its market share decreased to 38%, well below the average 50% seen in the previous four years. Qatari LNG output decreased in the period and an increasing share of exports was directed to Asia and the Middle East. Nigeria was the main beneficiary of falling imports from Qatar: it increased its market share in the EU to 23%, up from 15% in the third quarter. Algeria maintained its 22% share but was pushed back to the third place, behind Nigeria. They were followed by Norway (9%) and Peru (8%).
- After one cargo arriving in the second quarter of 2016 to Portugal and another one in the third quarter to Spain, a further US-sourced LNG cargo was reported in the last quarter: the vessel arrived to Italy's OLT offshore regasification plant near Livorno in early December in order to provide reserve for winter peak-demand situations.<sup>10</sup> In the fourth quarter of 2016, no cargo arrived to the EU from one of the traditional suppliers, Trinidad & Tobago which is suffering from declining gas production.
- In the fourth quarter of 2016, Qatar had a dominant role in the Belgian (100%), Italian (96%) and UK (91%) markets. Algeria was the principal supplier of France (58%) and Greece (100%) while Portugal's main supplier was Nigeria (56%). Norway was the sole supplier of Lithuania and the Netherlands. Spain received LNG from five different suppliers and was the only country with no single supplier covering more than 50% of total LNG imports.
- In 2016 as a whole, Qatar was the EU's main supplier (46%), followed by Algeria (22%), Nigeria (16%), Norway (9%), Peru (4%) and Trinidad & Tobago (3%). The three US cargoes which arrived during the year covered about 0.6% of total EU LNG imports in 2016.

**FIGURE 11 - LNG IMPORTS TO THE EU BY SUPPLIER**



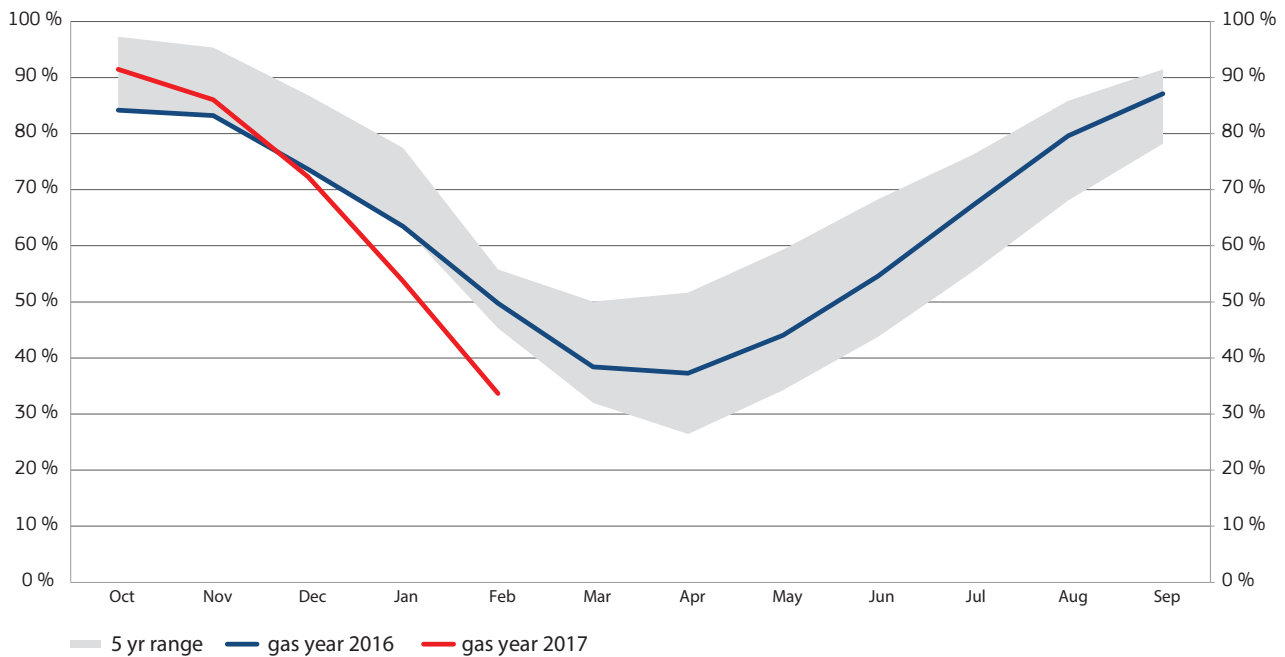
Source: Bloomberg/Poten & Partners  
Imports to Poland are not included

10. [https://www.uniper.energy/content/dam/uniper-corporate/documents/en/press/Pressemitteilung\\_OLT\\_Peak\\_Shaving\\_Award\\_161202\\_EN.pdf](https://www.uniper.energy/content/dam/uniper-corporate/documents/en/press/Pressemitteilung_OLT_Peak_Shaving_Award_161202_EN.pdf)

# 2. Gas Storage

- Throughout the 2016 injection season, the average filling rate in the EU remained consistently within the 5-year range. Low prompt prices incentivised injections for most of the period although in August and September maintenance of Norwegian and Russian infrastructure reduced supply, thereby limiting the volume of gas available for injection.
- At the beginning of the 2016-2017 winter season, storage levels were near to maximum capacity: the quantity of stored gas peaked on 9 October 2016 at 960 TWh, equivalent to 92% of storage capacity. In comparison, the maximum filling rate in October 2015 was 84%. At the start of the gas winter (1 October 2016), almost every Member State had a higher filling rate than a year earlier and 11 out of 18 Member States reported a filling rate of more than 90%, including Germany (94%), Italy (95%), the Netherlands (99%) and the UK<sup>11</sup> (95%).
- In the fourth quarter of 2016, withdrawals were much stronger than in the same period of 2015, driven by colder temperatures and an increased gas use in the power sector. As a result, in December the level of stocks went below the 5-year range. On 31 December 2016, the average filling rate was 64%, 6 percentage points lower than a year earlier. In many countries of Central and Eastern Europe filling rates were less than 60% (Austria, Croatia) or even less than 50% (Hungary, Romania). Withdrawals continued to be strong in the first months of 2017 and by 15 February the average filling rate fell to 34% while a year earlier it was 50%.

**FIGURE 12 - GAS STORAGE LEVELS AS PERCENTAGE OF MAXIMUM GAS STORAGE CAPACITY IN THE EU**



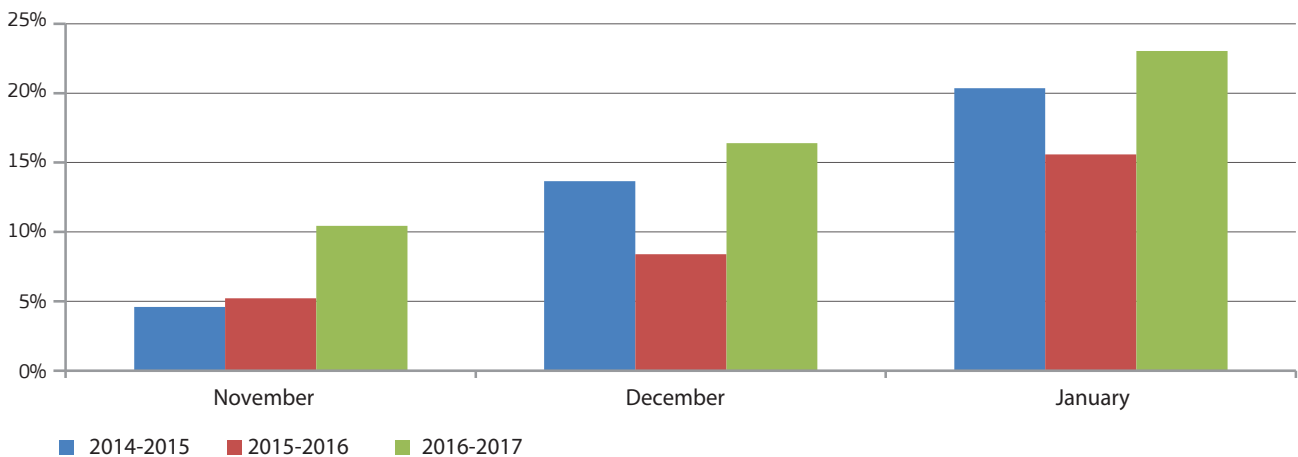
Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 20 February 2017. See explanations on data coverage at <https://agsi.gie.eu/#faq>.

The 5-year range reflects stock levels in gas years 2012-2016. The graph shows stock levels on the 15th day of the given month.

- During November 2016, December 2016 and January 2017, the average filling rate of EU storage facilities decreased by 50 percentage points (from 91% to 41%). In the same period of the 2015-2016 winter, withdrawals were equivalent to only 29% of storage capacity (the average filling rate decreased from 84% to 55%).

11. The UK figure does not include the Rough site which is not reported in the GIE database

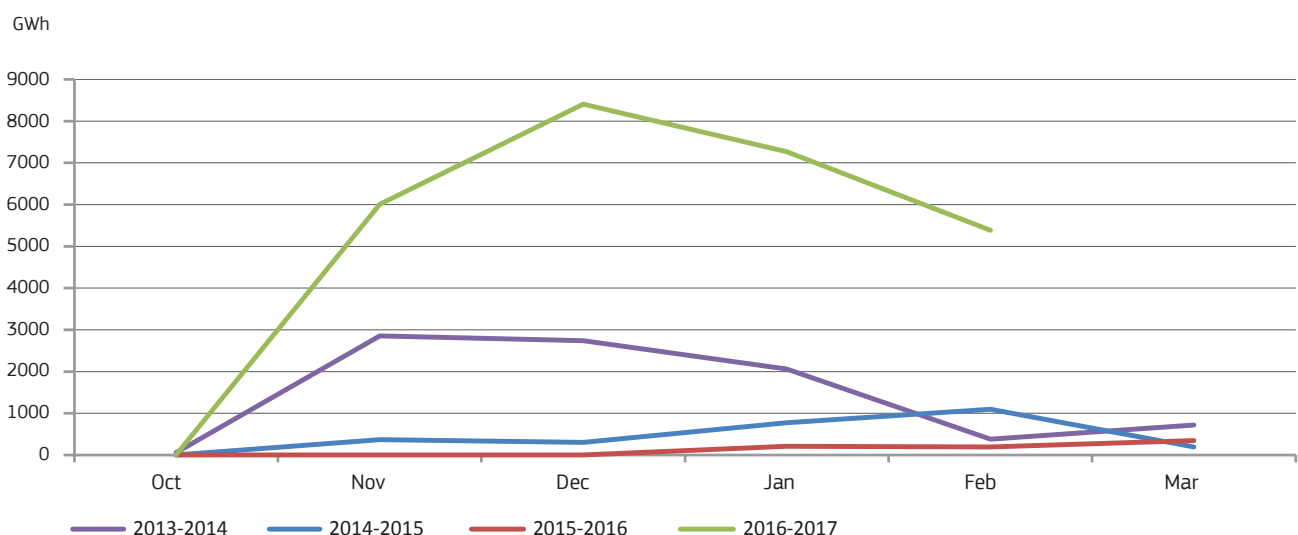
**FIGURE 13 - GAS WITHDRAWALS FROM EU STORAGE FACILITIES EXPRESSED AS PERCENTAGE OF STORAGE CAPACITY**



Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 20 February 2017; calculations of DG Energy. See explanations on data coverage at <https://agsi.gie.eu/#/faq>.

- In the UK, the technical issues with the Rough facility, the country's main gas storage site, continued. All injection and withdrawal activity was halted on 22 June 2016, thereby significantly reducing the country's storage levels compared to previous years. Withdrawals resumed on 9 December 2016<sup>12</sup> but the withdrawal capacity was cut from 19 December until 1 January 2017<sup>13</sup>. In the meantime, Centrica, the operator of the site launched a consultation about reducing the capacity it offers to the market, thereby increasing the uncertainty about the future of the facility.<sup>14</sup>
- As a result of the outage, during the 2016-2017 winter the UK has to rely more on pipeline imports from Norway and mainland Europe. In particular, gas flows increased on the Interconnector to unusually high levels. This pipeline typically carries gas from the UK to Belgium in summer and, in smaller volumes, from Belgium to the UK in winter. The outage of the Rough storage site has reinforced this seasonality. UK-bound flows were supported by an increasing premium of NBP over continental hub prices: in November-December 2016, the price at the UK hub was on average 1.0 Euro/MWh higher than at TTF, the Dutch hub, while in the same period of 2015 the difference was 0.3 Euro/MWh.

**FIGURE 14 - GAS FLOWS FROM BELGIUM TO THE UK ON THE INTERCONNECTOR**



Source: Based on data from the ENTSO-G Transparency Platform

12. <http://www.centrica-sl.co.uk/regulation/remit/2016-67>

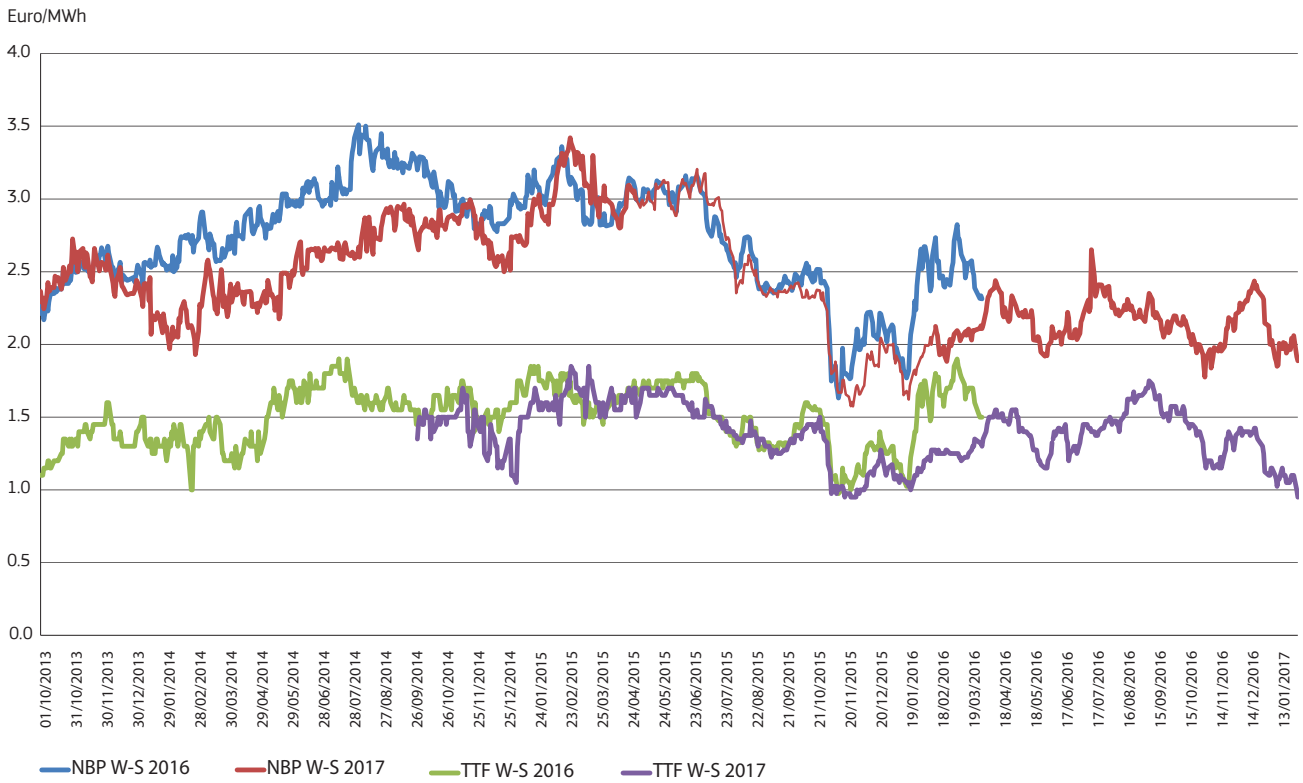
13. <http://www.centrica-sl.co.uk/regulation/remit/2016-74>

14. <http://www.centrica-sl.co.uk/news/centrica-storage-limited-%E2%80%9Ccs%E2%80%9D%E2%80%99s-consultation-its-application-reduce-minimum-rough-capacity-and>



- Figure 15 shows that seasonal spreads have been relatively high in 2014 and the first half of 2015 but started to fall in July 2015, dropping to as low as 1.6 Euro/MWh on the NBP and 1.0 Euro/MWh on the TTF. Among other factors, low seasonal price spreads probably contributed to the muted storage injections in 2015.
- From the second part of January 2016, spreads slightly recovered but remained below the 2014 levels. On the NBP, seasonal spreads averaged 2.1 Euro/MWh in the last quarter of 2016, more or less the same as in the same period of 2015. On the TTF, the average seasonal spread was 1.4 Euro/MWh in the last quarter, slightly more than a year earlier.

**FIGURE 15 - WINTER-SUMMER SPREADS IN THE DUTCH AND BRITISH GAS HUBS**



Source: Platts

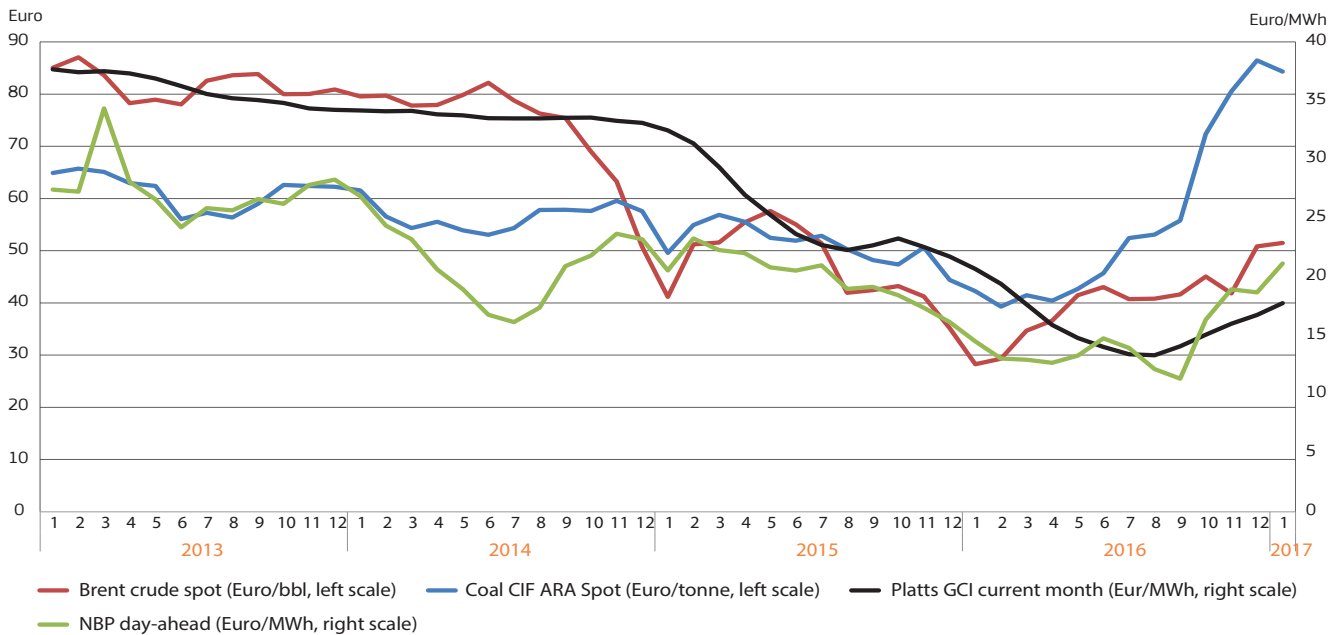
W-S 2016 refers to the difference between the winter 2016-17 price and the summer 2016 price; W-S 2017 refers to the difference between the winter 2017-18 price and the summer 2017 price

# 3. Wholesale Gas markets

## 3.1 The broader energy commodity picture: comparisons between oil, gas and coal prices in the EU

- After two years of attempting to maintain market shares and to squeeze out high-cost producers, OPEC returned to its traditional policy of adjusting supply to balance markets and stabilize prices: on 30 November 2016, the bloc agreed to cut output by around 1.2 million barrels per day (mb/d) in order to accelerate the rebalancing of the global oil market. A few days later, the deal was complemented by an agreement with key non-OPEC producers who pledged to cut output by nearly 0.6 mb/d. The OPEC agreement provided support to oil prices: since then, Brent has been trading in the 52-56 USD/bbl range, representing a roughly 8-10 USD/bbl (or 20%) increase compared to November 2016.
- For 2017, most analysts forecast an average Brent price of 50-60 USD/bbl. Even if producers comply with the agreement, the high level of stocks accumulated over the last two years, as well as a potential increase of US shale oil output triggered by a price increase, will limit the potential for a significant price rise.
- After a gradual decrease seen in 2015 and most of 2016, the NBP spot price started to grow in the last quarter of 2016: its value has increased by 67% from an average 11.3 Euro/MWh in September to 18.9 Euro/MWh in November – the highest monthly average price since September 2015. A number of factors contributed to the price increase, including the relatively cold weather, the outages of several French nuclear reactors, low LNG imports in Northwest Europe and uncertainty about the Rough storage site in the UK. In the fourth quarter of 2016, NBP averaged 18.0 Euro/MWh, 4% more than a year earlier.
- In spite of the recovery of oil prices from early 2016, oil-indexed prices continued to fall in 2016 because of the typical 6-9 month time lag used in the pricing formulas. Oil-indexed prices bottomed out in August but in the last quarter of 2016 they grew at a slower rate than hub prices and, as a result, oil-indexed prices were consistently lower than hub prices. Platt's North West Europe Gas Contract Indicator (GCI), a theoretical index showing what a gas price linked 100% to oil would be, averaged 15.9 Euro/MWh in the fourth quarter of 2016, 2 Euro/MWh less than the NBP. Oil-indexed prices became increasingly competitive with hub prices, contributing to the strong increase of Russian and Algerian imports.
- Coal prices have been on a declining trend since 2011, driven by global oversupply. However, from mid-2016 coal prices started to rise and in the last quarter of 2016 the CIF ARA spot price averaged 79.8 Euro/ton. This is the highest level since 2011 and represents a 68% increase from the same period of 2015. The price increase was largely driven by market tightness in Asia after China introduced measures restricting domestic coal output. As a result of increasing coal prices, the relative competitiveness of gas has noticeably improved in the second half of 2016, helping gas to gain ground in the EU electricity sector.

**FIGURE 16 - SPOT PRICES OF OIL, COAL AND GAS IN THE EU**

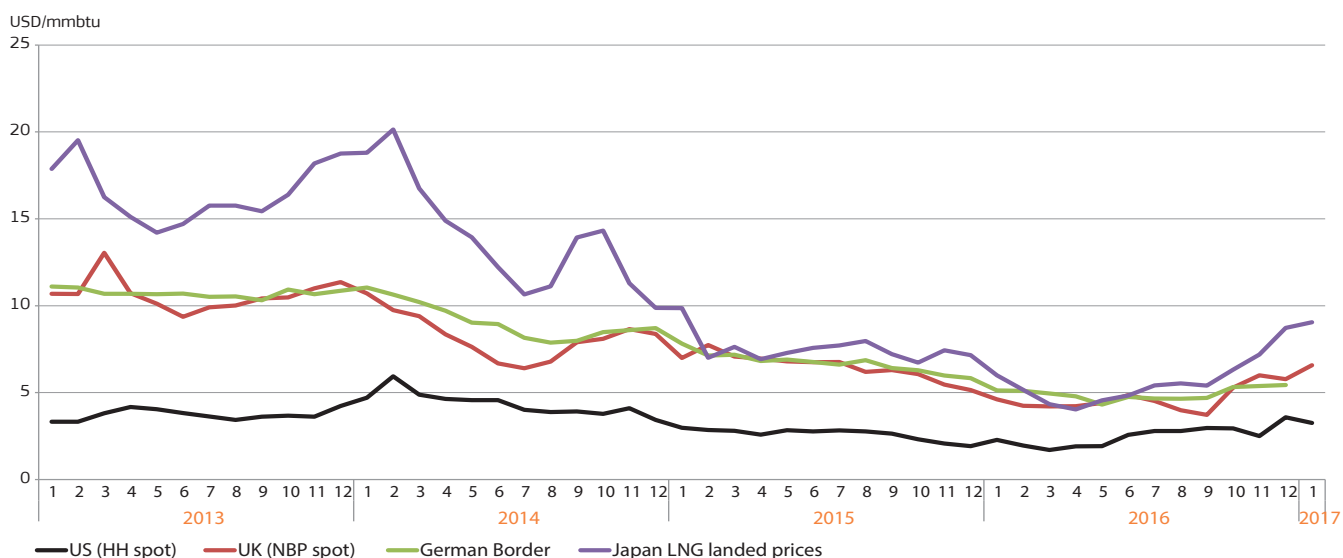


Sources: Platts

### 3.2 International gas markets

- Figure 17 displays an international comparison of wholesale gas prices. In the last few years, prices have been on a declining trajectory in all regions but this trend seems to have come to an end in the second part of 2016
- In 2015-2016, Asian LNG prices traded on average 1.0 USD/mmbtu higher than NBP, the UK gas hub but in certain periods the premium has disappeared. In the fourth quarter of 2016, Japanese landed prices averaged 7.4 USD/mmbtu so the premium over NBP increased to 1.7 USD/mmbtu. In December, the premium was almost 3.0 USD/mmbtu, the highest level since 2014 as strong demand in Asia ahead of the winter and a number of production outages supported prices.
- After years of gradual decrease, European gas prices started to grow from October 2016 and the NBP averaged 5.7 USD/mmbtu (18.0 Euro/MWh) in the last quarter of 2016. The average German border price was slightly lower: 5.4 USD/mmbtu (17.0 Euro/MWh) which shows that part of German gas imports is still based on oil-indexed pricing (in this period, oil-indexed prices were lower than hub prices).
- After two years of steady decrease driven by record production, high stocks and warmer than average winters, the Henry Hub price started to increase from April 2016. In the fourth quarter, the average price was 3.0 USD/mmbtu, 0.9 USD/mmbtu (43%) more than in the same period of 2015. The price increase seen in 2016 was helped by rising demand in the power generation sector (driven by high temperatures, the retirement of coal plants and nuclear outages), increasing exports (to Mexico and by LNG), as well as relatively low storage injections during summer.
- There has been a convergence of international gas prices in most of 2016 but this trend has reversed in the last quarter of the year when both European and Asian prices grew substantially. The ratio of the Japanese LNG price and US Henry Hub increased to 2.9 in November 2016 while it was 1.8 in September 2016.
- The average NBP/Henry Hub ratio increased to 2.4 in November 2016 while it was only 1.3 in September 2016. In absolute terms, the differential reached 3.5 USD/mmbtu in November 2016, up from 0.8 USD/mmbtu in September 2016. This is the highest level of the premium since October 2015. The euro significantly weakened compared to the US dollar over 2014 and the first quarter of 2015 (thereby lowering European prices expressed in dollars) but the exchange rate has been relatively stable since then.

**FIGURE 17 - INTERNATIONAL COMPARISON OF WHOLESALE GAS PRICES**



Sources: Platts, Thomson Reuters, BAFA

### 3.2.1 LNG markets

- Spot LNG prices decreased significantly in 2014 and early 2015 in both Asia and Europe, driven by weak demand in Asia and increasing global supplies, and compounded by the fall of oil prices. The decrease was steeper in Asia and, as a result, the premium of Asian LNG prices over European ones, which regularly exceeded 5 USD/mmbtu in previous years, practically disappeared.
- For most of 2015 and early 2016, spot prices in Asia were higher than those in Europe and this difference increased in the fourth quarter of 2016. In this period, prices averaged 5.9 USD/mmbtu in the UK, 6.4 USD/mmbtu in Spain, 7.4 USD/mmbtu in Japan and 7.3 USD/mmbtu in China. As a result of strong demand, Japanese spot prices exceeded oil-indexed prices: JCC, the Japanese benchmark of oil-indexed LNG prices averaged around 7 USD/mmbtu in the last quarter.
- In December 2016, UK prices dropped while those in Asia continued to increase, supported by increasing demand and a number of production outages, including at Australia's Gorgon facility. As a result, the difference between the Japanese and UK price exceeded 3.0 USD/mmbtu, the highest level since 2014.
- After a slight annual decrease in 2015, Asian LNG demand picked up in 2016: imports increased by 36% in China, by 27% in India and by 1% in Korea, while imports decreased by 2% in Japan. In spite of the decrease, Japan remained by far the largest LNG importer of the world, covering nearly one third of global LNG demand. Latin American imports decreased by 26% in 2016. In the fourth quarter of 2016, imports increased by 64% in China, by 7% in India and by 16% in Korea but decreased in Japan (-2%) and Latin America (-24%) year-on-year.<sup>15</sup>
- In Korea, four nuclear reactors were closed as a precaution following an earthquake on 12 September 2016 and a number of other reactors were closed for maintenance.<sup>16</sup> These shutdowns have significantly increased LNG demand in the power sector of the country in the last quarter of 2016. Japan's nuclear restart proves to be slow, with still only three out of 42 operable reactors operating at the end of 2016. The restart of nuclear reactors is expected to replace crude oil and fuel oil first as the most expensive commodities.<sup>17</sup>
- Cheniere's Sabine Pass facility completed its second production train in September 2016, thereby doubling the plant's capacity. As a result, US LNG exports have noticeably increased in the last two months of the year. In the fourth quarter, half of US exports went to Asia. Asian LNG prices rose sharply in this period, making exports to the region more profitable.

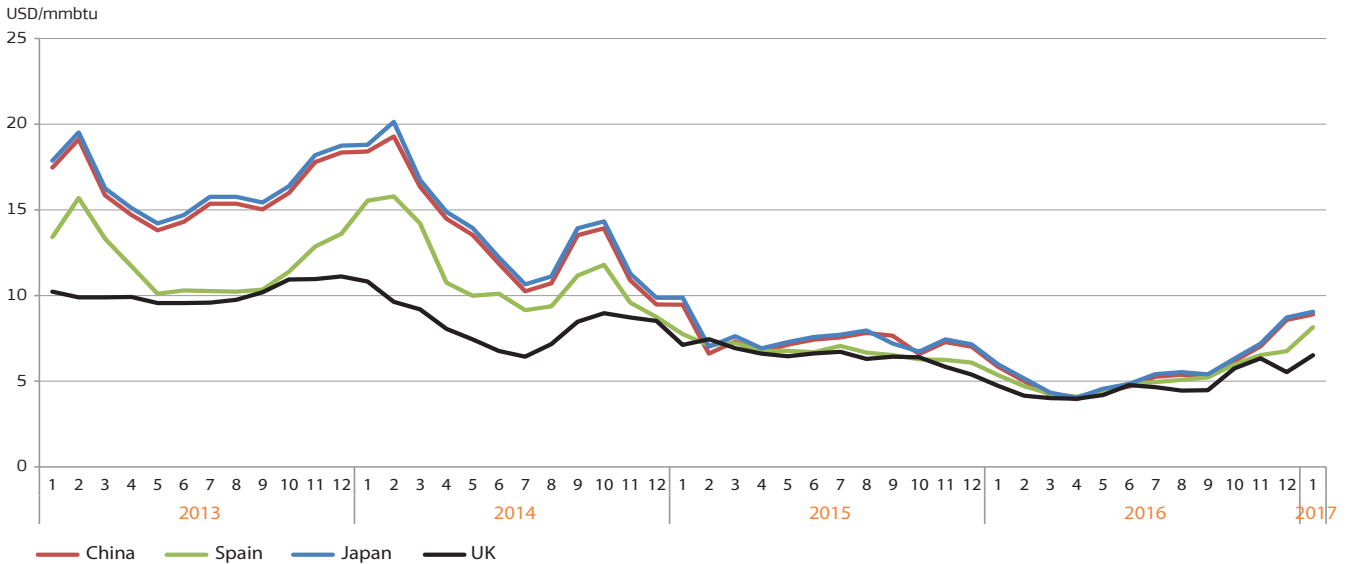
15. Source: Thomson Reuters Eikon for Commodities

16. <http://af.reuters.com/article/energyOilNews/idAFL4N1DA1EJ>

17. Platts Energy Economist, January 2017

- LNG exports from the mainland US started in February 2016. In 2016, the country exported 5.2 bcm of LNG. The main destination was Latin America (47%), followed by Asia (30%) and the Middle East (13%). 3 cargoes, 5% of US LNG exports was destined to the EU and another 5% to Turkey in 2016. Looking at individual countries, the three largest buyers were Chile, Mexico and China.<sup>18</sup>
- Global LNG supply increased by 17 million tons (7%) in 2016, driven by new projects in Australia, and was absorbed by greater than expected demand in Asia (mainly China and India) and the Middle East. In the last two years, six new importing countries emerged, bringing the number of LNG buyers to 35.<sup>19</sup>

**FIGURE 18 – SPOT LNG PRICES IN THE EU AND ASIA**



Note: Landed prices for LNG

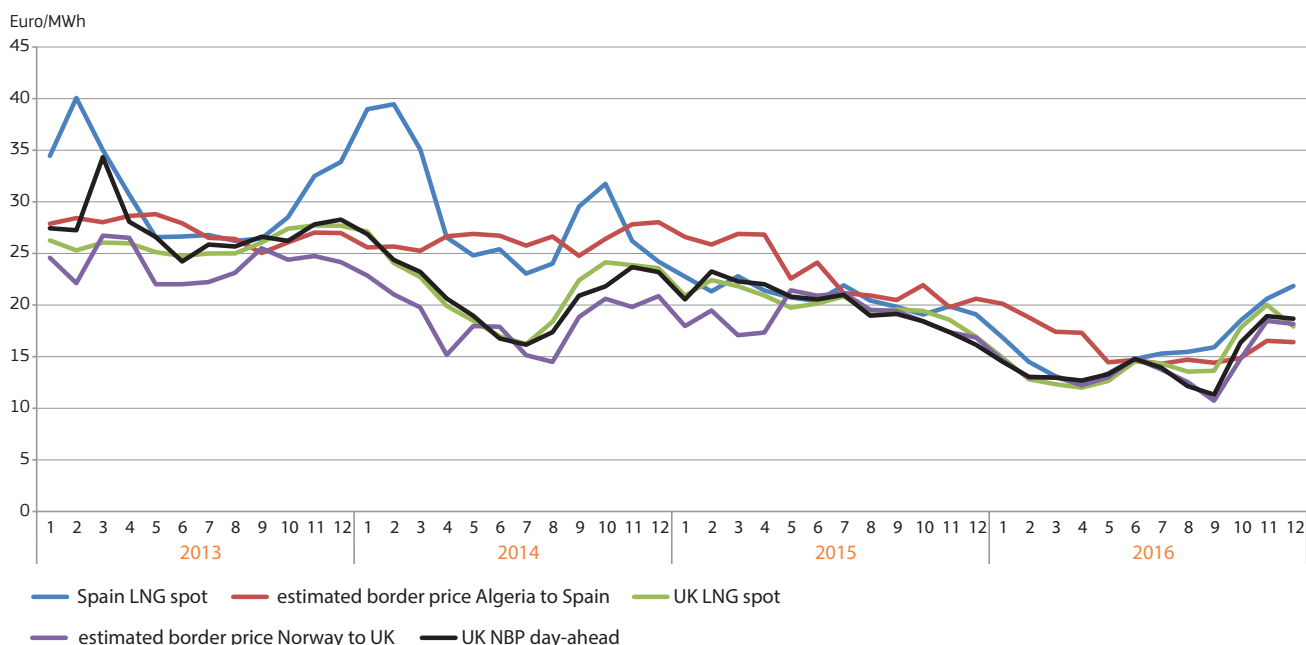
Source: Thomson-Reuters Waterborne

- Figure 19 displays the evolution of spot LNG prices paid in the UK and Spain and estimated border prices for pipeline imports from Norway and Algeria, which account for the major part of pipeline imports in the UK and Spain, respectively. The evolution of the day-ahead prices on the UK NBP hub is also presented. The fall in LNG prices has helped to narrow the gap between the prices of pipeline and LNG imports in the EU, the significant differences seen in previous years having disappeared in mid-2015.
- In the UK, spot LNG prices closely follow the NBP price but, unusually, in September 2016 the average LNG price was 2.3 Euro/MWh above the average NBP price. In the last quarter, the gap narrowed to an average 0.6 Euro/MWh. For a long time, the estimated price of Norwegian imports was below the NBP price but the difference largely vanished from May 2015, indicating that Norwegian export prices are now clearly linked to European hub prices. In the last quarter of 2016, the estimated price of Norwegian imports was on average 0.8 Euro/MWh below the NBP price.
- In previous years, there have been seasonal differences in the price development of Algerian pipeline imports and spot LNG in Spain: LNG had a high premium during the winter months but was cheaper than Algerian pipeline gas in the summer. In the 2014-2015 winter, however, LNG prices plummeted and, until mid-2016, remained below the price of Algerian pipeline imports. In the second half of 2016, however, LNG was more expensive than the pipeline gas coming from Algeria as the price of the latter was pushed down by the lagged effect of plummeting oil prices. In the third quarter, these price developments had a tangible impact on LNG imports which decreased by 18% year-on-year. In the last quarter, however, LNG imports were 19% higher than in the same period of 2015, despite the relatively high price compared to pipeline gas.

18. [http://www.eia.gov/dnav/ng/ng\\_move\\_expc\\_s1\\_m.htm](http://www.eia.gov/dnav/ng/ng_move_expc_s1_m.htm)

19. Shell LNG Outlook, [www.shell.com/lngoutlook](http://www.shell.com/lngoutlook)

**FIGURE 19 – PRICE DEVELOPMENTS OF LNG AND PIPELINE GAS IN THE UK AND SPAIN**



Note: Landed prices for LNG.

Source: Platts, Thomson Reuters, European Commission estimates based on Eurostat COMEXT data

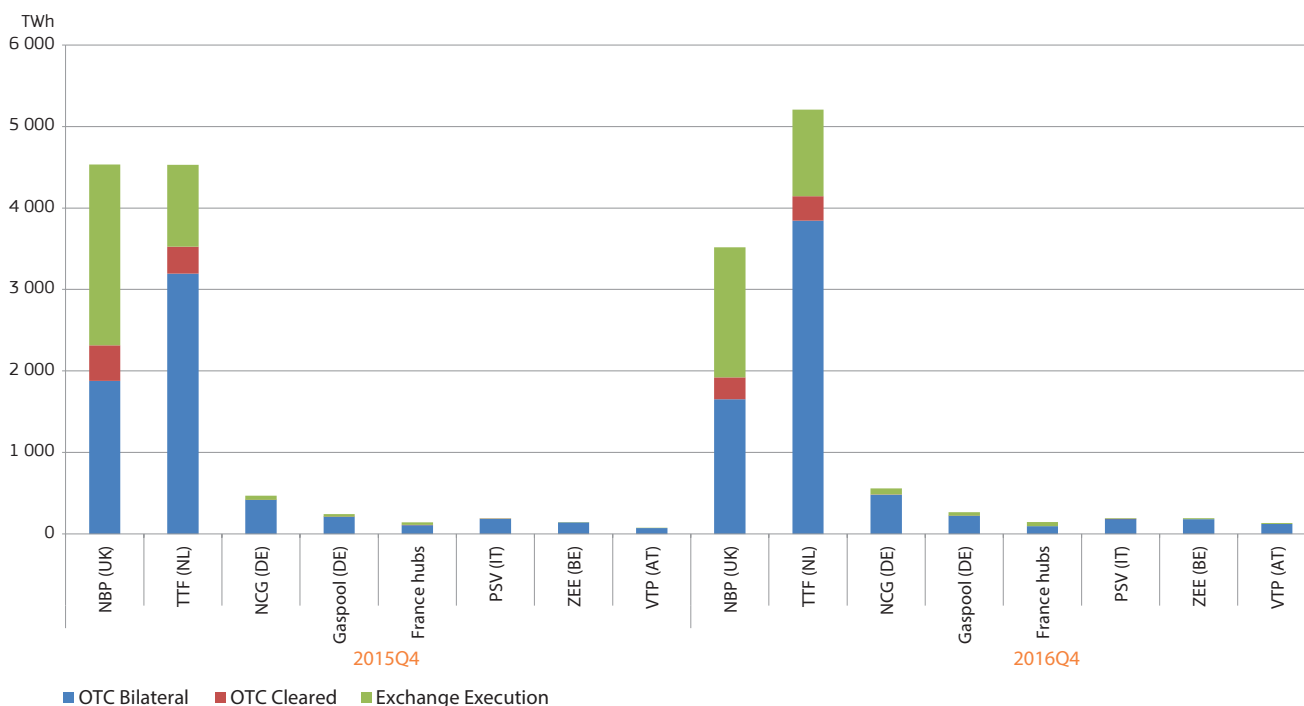
## 3.3 European gas markets

### 3.3.1 Wholesale markets in the EU

- In the fourth quarter of 2016, liquidity on the main European gas hubs slightly decreased: total traded volumes amounted to around 10,200 TWh, 1% less than in the same period of 2015. The decrease is clearly attributed to NBP, the UK hub; in all other markets, traded volumes increased year-on-year.
- Volumes at the TTF, the Dutch virtual trading point increased by 15% year-on-year whereas volumes at NBP, the UK hub dropped by 22%. The uncertainty triggered by the Brexit vote, in particular the volatility of the EUR/GBP exchange rate, is seen as an important factor limiting liquidity at NBP.<sup>20</sup> From the smaller markets, the Austrian VTP showed the biggest year-on-year increase (73%).
- While in the last quarter of 2015, TTF and NBP volumes were of similar magnitude, both covering 44% of hub traded volumes, in the last quarter of 2016 TTF alone covered more than half (51%) of hub traded volumes while the share of NBP decreased to 34%.
- On the UK NBP hub, 45% of total traded volumes were executed directly on an exchange in the fourth quarter of 2016. This share was 20% on the Dutch TTF hub, 34% at the French hubs, 14% at the German hubs and less than 10% in the other hubs covered by the analysis.
- The NBP has the highest share of exchange-traded volumes and, accordingly, the declining liquidity of the UK hub meant that at EU level OTC markets gained ground: their share increased from 68% in the fourth quarter of 2015 to 72% in the same period of 2016. 8% of OTC volumes was cleared at a clearinghouse, down from 11% in the previous year.

<sup>20</sup> ICIS Heren European Gas Markets, 21 December 2016

**FIGURE 20 – TRADED VOLUMES ON THE MAIN EUROPEAN GAS HUBS IN THE FOURTH QUARTER OF 2015 AND 2016**



The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (Net-Connect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point (VTP).

Source: Trayport Euro Commodities Market Dynamics Report

- In 2016 as a whole, total volumes traded on the main European gas hubs were nearly 46,400 TWh, 13% more than in the same period of 2015. This is about twelve times more than the annual gas consumption of the seven Member States covered by the analysis. The growth was primarily driven by TTF where volumes increased by 31% year-on-year. In turn, in the UK hub volumes were 3% lower than in 2015 and in the Zeebrugge Beach hub volumes decreased at the same rate. The Austrian hub showed the biggest year-on-year increase (56%) in this period.
- The share of exchange-executed trade was 28% in the fourth quarter of 2016, down from 33% in the same period of 2015. At the French hubs this share increased from 21% to 34%.
- In 2014-2015, exchanges gradually gained ground: while in the first quarter of 2014 their share from total traded volumes was 23%, by the first quarter of 2016 it increased to 32%. However, this trend seems to have turned from the second quarter of 2016: the share decreased to 31% in the second quarter and to 28% in both the third and fourth quarters. The share of cleared OTC volumes also decreased recently, from 7% of total traded volumes in the first quarter of 2016 to less than 6% in the fourth quarter.

**FIGURE 21 – THE SHARE OF TRADED VOLUMES ON THE MAIN EUROPEAN GAS HUBS**



The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (Net-Connect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach.  
Source: Trayport Euro Commodities Market Dynamics Report

### 3.3.2 Wholesale price developments in the EU

- Between February 2015 and April 2016, day-ahead hub prices showed a continuous decreasing trend as low oil prices and steady LNG supply put downward pressure on European hub prices. During the 2015/2016 winter, higher-than-average temperatures also weighed on demand and thus on prices, compounded by robust pipeline imports from Russia, Norway and Algeria, and relatively high storage levels at the end of the withdrawal season.
- From the second half of April 2016, hub prices started to increase, helped by a combination of factors: a late cold spell in Northwest Europe, increased storage injections, growing oil prices, the decision on the Groningen output cap and a number of outages affecting Norwegian infrastructure. In France, a strike affecting the country's LNG terminals in late May and early June also contributed to tighter supplies and higher prices. In August, day-ahead prices returned to the downward trend, helped by falling seasonal demand, high stocks, lower oil prices and increasing Norwegian imports
- The last quarter of 2016 was characterized by an increasing price trend. A number of factors contributed to the price increase, including the relatively cold weather (especially when compared to the previous year), strong demand in the power sector, the outages of several French nuclear reactors, low LNG imports in Northwest Europe, uncertainty about the Rough storage site in the UK and rising oil prices.
- On 3 November 2016, EDF announced an extended shutdown at 5 of its 58 nuclear reactors to allow certain safety checks to be carried out.<sup>21</sup> The announcement sent European electricity prices higher, with a knock-on effect on gas prices. The low availability of the French nuclear fleet supported gas demand in the power sector: average daily gas demand from French and UK power plants increased by 6% and 5%, respectively, in the first half of November, compared to the previous month.<sup>22</sup>
- Gas at the UK hub typically trades at a small premium to the Dutch hub (in 2015, the price at the NBP was on average 0.2 Euro/MWh higher than the price at TTF) but the differential increased well above this level in the end of 2016: it was 0.9 Euro/MWh in November and 1.1 Euro/MWh in December. Low stock levels after the outage of the Rough site, the UK's largest storage facility and low LNG imports caused supply tightness in the UK and the country had to rely more on pipeline imports from Norway and mainland Europe. Increased import flows were fostered by the relatively high prices in the UK.

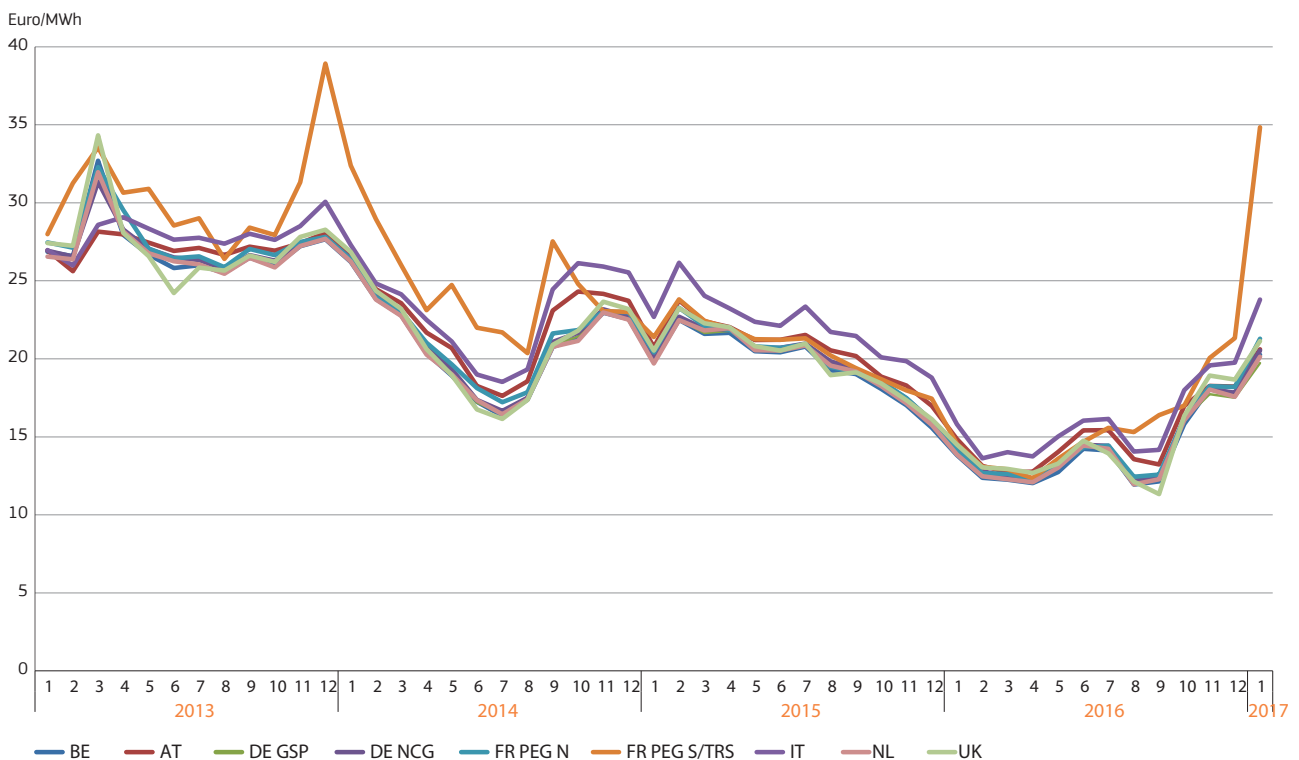
21. [https://www.edf.fr/sites/default/files/contrib/en-en/groupe-edf/espaces-dedies/medias-data/pr/2016/cp\\_edf\\_20161103\\_obj2016\\_va.pdf](https://www.edf.fr/sites/default/files/contrib/en-en/groupe-edf/espaces-dedies/medias-data/pr/2016/cp_edf_20161103_obj2016_va.pdf)

22. ICIS Heren European Gas Markets, 15 November 2016



- In the last quarter of 2016, European hub prices moved in the 16-21 Euro/MWh range and average day-ahead prices were practically the same as in the same period of 2015 but the price trajectory was different: falling in 2015 and increasing in 2016. In November and December 2016, average day-ahead prices were around 18-19 Euro/MWh, the highest level since October 2015.
- Prices at the Italian PSV hub remained relatively high in the fourth quarter of 2016, with an average premium of 1.9 Euro/MWh above TTF, the Dutch hub. In France, the average premium of TRS over PEG Nord was also 1.9 Euro/MWh in the last quarter of 2016 because of restrictions on north-south gas flows and lower LNG supplies in Southern France.
- In November-December 2016, Germany's Gaspool became the cheapest hub in Europe; the Commission's decision about the OPAL pipeline has reportedly contributed to this weakness.<sup>23</sup> In December, the difference between the lowest (Gaspool) and the highest priced hub (France's TRS) in North-West Europe increased to nearly 4 Euro/MWh.

**FIGURE 22 – WHOLESALE DAY-AHEAD GAS PRICES ON GAS HUBS IN THE EU**



Source: Platts

- Figure 23 looks at the development of forward prices one, two and three years ahead in comparison to the development of the day-ahead price on the Dutch TTF. For most of 2014, there has been a situation of contango<sup>24</sup>, whereby closer to the present date prices are lower than prices for future deliveries. With seasonally high stock levels and ample physical supply, spot prices significantly decreased in the first half of the year, while higher forward prices reflected the general uncertainty about future developments, in particular the Russia-Ukraine conflict.
- Day-ahead and forward prices have been more or less at parity in 2015 but in 2016 the forward curve moved higher. In the first nine months of 2016, the year-ahead price was on average 1.00 Euro/MWh more expensive than the day-ahead price but in certain days of August the difference exceeded 2 Euro/MWh. In this period, the oil price rise which started in late January 2016 provided support to forward prices.
- In the last quarter of 2016, this premium of forward prices over day-ahead prices have practically disappeared. In fact, from mid-October, day-ahead prices have been consistently higher than year-ahead prices. The difference was highest in November (on average 0.57 Euro/MWh) when day-ahead prices sharply increased, mainly because of below-average temperatures.

23. ICIS Heren European Gas Markets, 15 September 2016

24. See the glossary for a definition of contango

**FIGURE 23 – FORWARD GAS PRICES ON THE DUTCH GAS HUB**

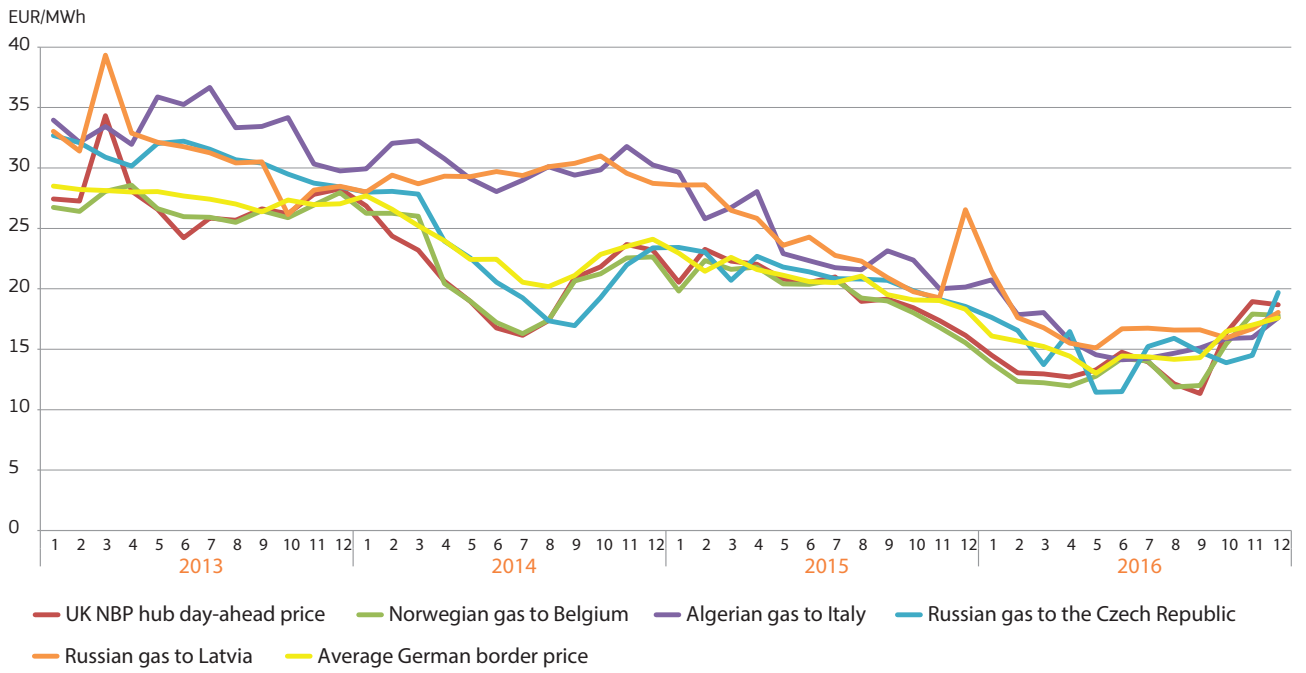


Source: Platts

### 3.3.3 Comparing the prices of different contracts for gas in the EU

- Figure 24 compares a selection of estimated border prices of gas deliveries from the main exporters to the EU – Russia, Norway, and Algeria.
- Estimated border prices showed a clear declining trend over 2015 and the first half of 2016. Driven by the oil price drop observed in the second half of 2014, oil-indexed prices fell faster than hub-based prices, leading to a significant price convergence in the third quarter of 2015. From the last quarter of 2015, however, the difference between the prices of various contracts increased again, although not to levels seen in previous years.
- In 2016, the different prices have been rather volatile, often moving in the opposite direction. The oil price rise starting in the end of January 2016 is reflected in oil-indexed prices from the summer of 2016 while hub prices continued to fall. As a result, in the third quarter of the year oil-indexed prices became noticeably more expensive than hub prices. In the last quarter, however, hub prices sharply increased and other contracts have grown to a lesser extent. As a result, unusually, the UK NBP price was the highest in this period among those depicted on Figure 24, exceeding even the typically oil-indexed prices of Russian gas to Latvia and Algerian gas to Italy.
- Prices have clearly converged in December 2016 when the difference between the highest and lowest price decreased to 2.1 Euro/MWh, the lowest level in the last 4 years.

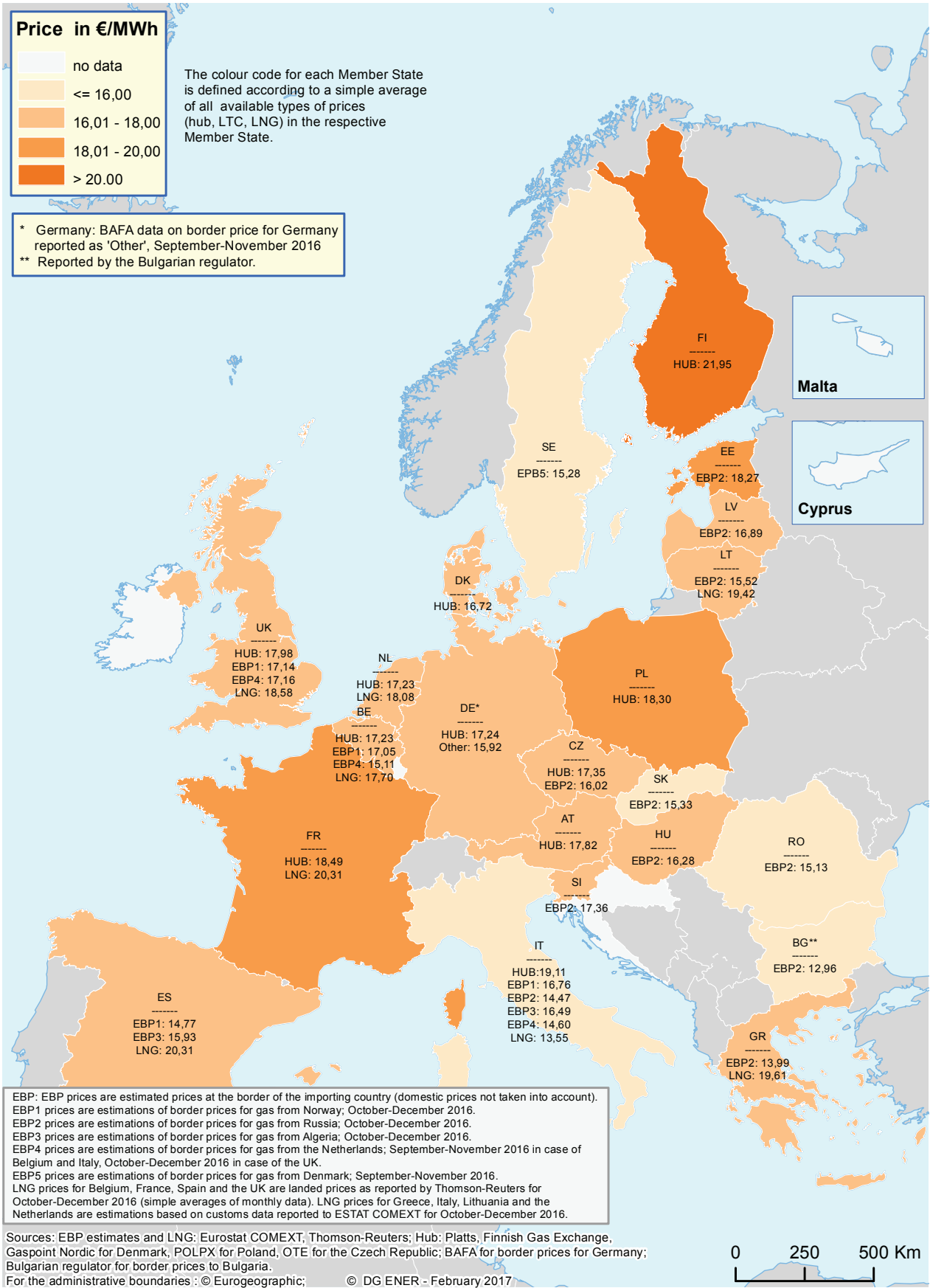
**FIGURE 24 – COMPARISON OF EU WHOLESALE GAS PRICE ESTIMATIONS**



Source: Eurostat COMEXT and European Commission estimations, BAFA, Platts

Note: Border prices are estimations of prices of piped gas imports paid at the border of the importing country, based on information collected by customs agencies, and are deemed to be representative of long-term contracts.

**MAP 1 – COMPARISON OF EU WHOLESALE GAS PRICES IN THE SECOND QUARTER OF 2016**

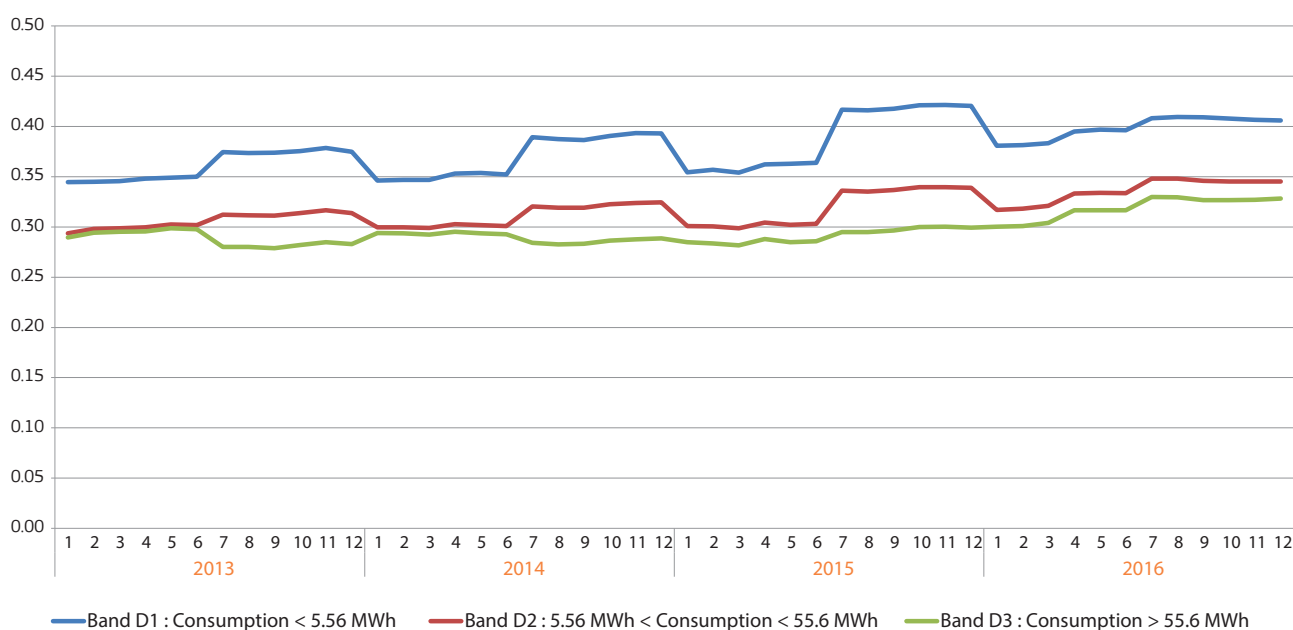


Note: Border prices are estimations of prices of piped gas imports paid at the border of the importing country, based on information collected by customs agencies, and are deemed to be representative of long-term gas contracts.

# 4. Retail gas prices in the EU

- Figures 25 and 26 show the convergence of retail gas prices for household and industrial consumers, using as a metric the relative standard deviation<sup>25</sup> of the prices in individual Member States. Monthly retail prices are estimated by using half-yearly prices from Eurostat (with the latest available figures relating to the first half of 2016) and Harmonised Consumer Price Indices (HICP) for the household prices and Producer Price Indices (PPI) for industrial consumers.
- For household consumers, the estimated average retail price (including all taxes) showed an increasing trend since 2010 but peaked in 2014, with a slight decrease in 2015 which accelerated in 2016. In the most typical consumption band, D2, the estimated average price (all taxes included) in December 2016 was 6.0 Eurocents/kWh, 15% lower than a year earlier. In this period, the estimated price decreased in all Member States except Denmark and Estonia.
- In contrast to converging wholesale prices, retail prices for households show a slightly diverging trend, as shown by the increase of the relative standard deviation over the last four years. Moreover, observed price differences are higher for the consumers with lower annual consumption.
- There are still significant differences in retail gas prices across the EU: in December 2016, the estimated household price in consumption band D2 varied between 3.2 Eurocent/kWh in Bulgaria and Romania and 11.3 Eurocent/kWh in Sweden, resulting in a price differential ratio of 3.5 between the cheapest and the most expensive Member State. While this ratio is rather high, it shows a declining trend since March 2012 when it was 4.8.

**FIGURE 25 - RELATIVE STANDARD DEVIATION OF GAS PRICES PAID BY HOUSEHOLD CONSUMERS IN EU MEMBER STATES**



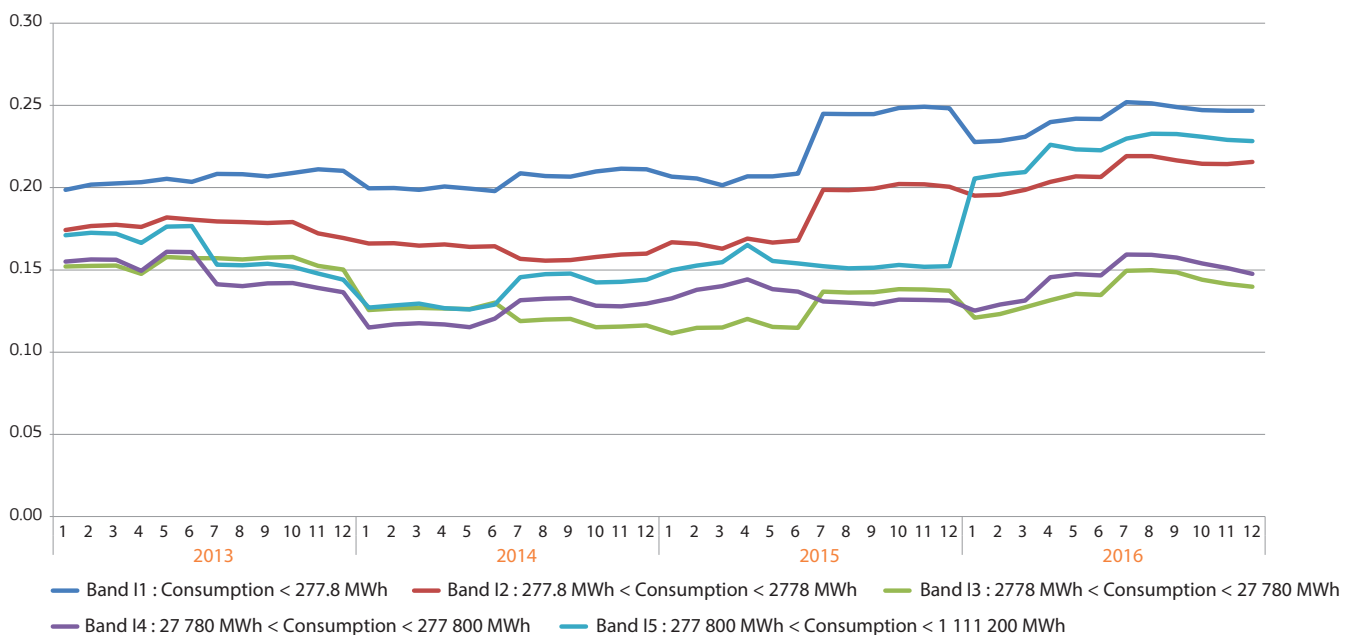
Note: all taxes included.

Source: European Commission estimates based on Eurostat data on consumer prices adjusted by the HICP

25. The relative standard deviation is calculated by dividing the standard deviation with the average. It shows the extent of variability in relation to the mean of the sample.

- Estimated industrial prices started to decrease already in 2014, and the trend continued in 2015 and 2016. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.42 Eurocent/kWh in December 2016, 15% lower than a year earlier. Prices decreased in this period in all Member States except Estonia and Lithuania. Bulgaria (-26%) and Poland (-23%) experienced the biggest decreases. Compared to December 2013, the average estimated price decreased by 30%.
- For industrial customers, the relative standard deviation has been significantly lower than in the case of households, indicating smaller price differences across Member States. However, in most consumption bands the standard deviation grew since mid-2015, implying that price differences increased in this period.
- In case of consumption band I5, the relative standard deviation increased significantly from the beginning of 2016. While several Member States with under-average prices had seen a relatively big drop of prices (including France, Poland and the UK), in a couple of countries with high prices (e.g. Austria, Greece, Slovakia) there was no or only minimal decrease in prices. As a result, price differences increased.
- In December 2016, Bulgaria had the lowest estimated industrial price in consumption band I4 (1.65 Eurocent/kWh), while the highest price was observed in Sweden (3.41 Eurocent/kWh), resulting in a price differential ratio of 2.1 between the cheapest and the most expensive Member State of the EU. This represents an increase from the beginning of 2016 when this ratio was only 1.7.

**FIGURE 26 - RELATIVE STANDARD DEVIATION OF GAS PRICES PAID BY INDUSTRIAL CONSUMERS IN EU MEMBER STATES**



Note: Excluding VAT and other recoverable taxes.

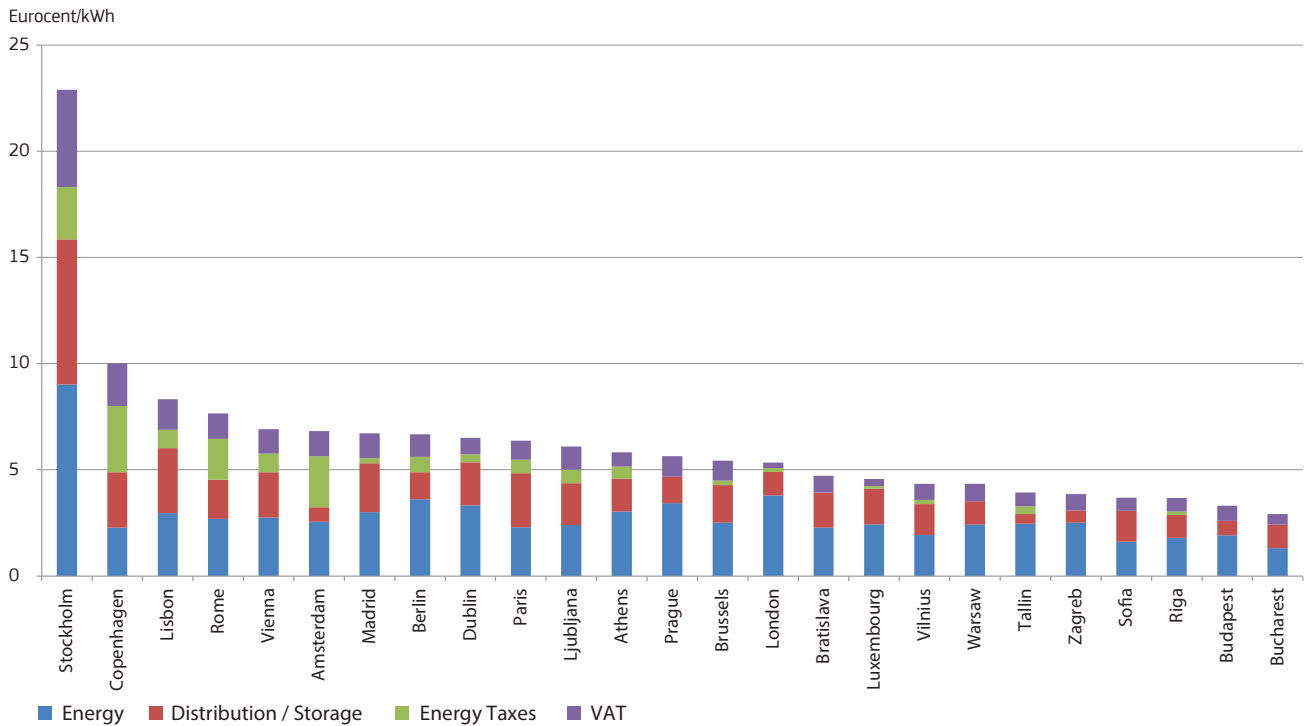
Source of data: European Commission estimates based on Eurostat data on industrial prices adjusted by the PPI

- Figure 27 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in December 2016. On average, 48% of the price covers the gas itself, while the rest covers distribution/storage costs (28%), energy taxes (8%) and VAT (16%).<sup>26</sup>

26. Note that these are arithmetic averages..

- There are significant differences across Member States, with the share of energy cost ranging from 23 to 71%, the share of distribution/storage costs ranging from 10 to 40% and the share of taxes ranging from 8 to 53%. In Amsterdam and Copenhagen, taxes make up more than half of the price while in London and Luxembourg their share is less than 10%. For 7 of the 25 capitals covered, the price does not include an energy tax component.
- Apart from Amsterdam, Copenhagen and Stockholm, prices in all capitals were lower in December 2016 than a year earlier, with the biggest decreases in Zagreb (-23%) and London (-22%).

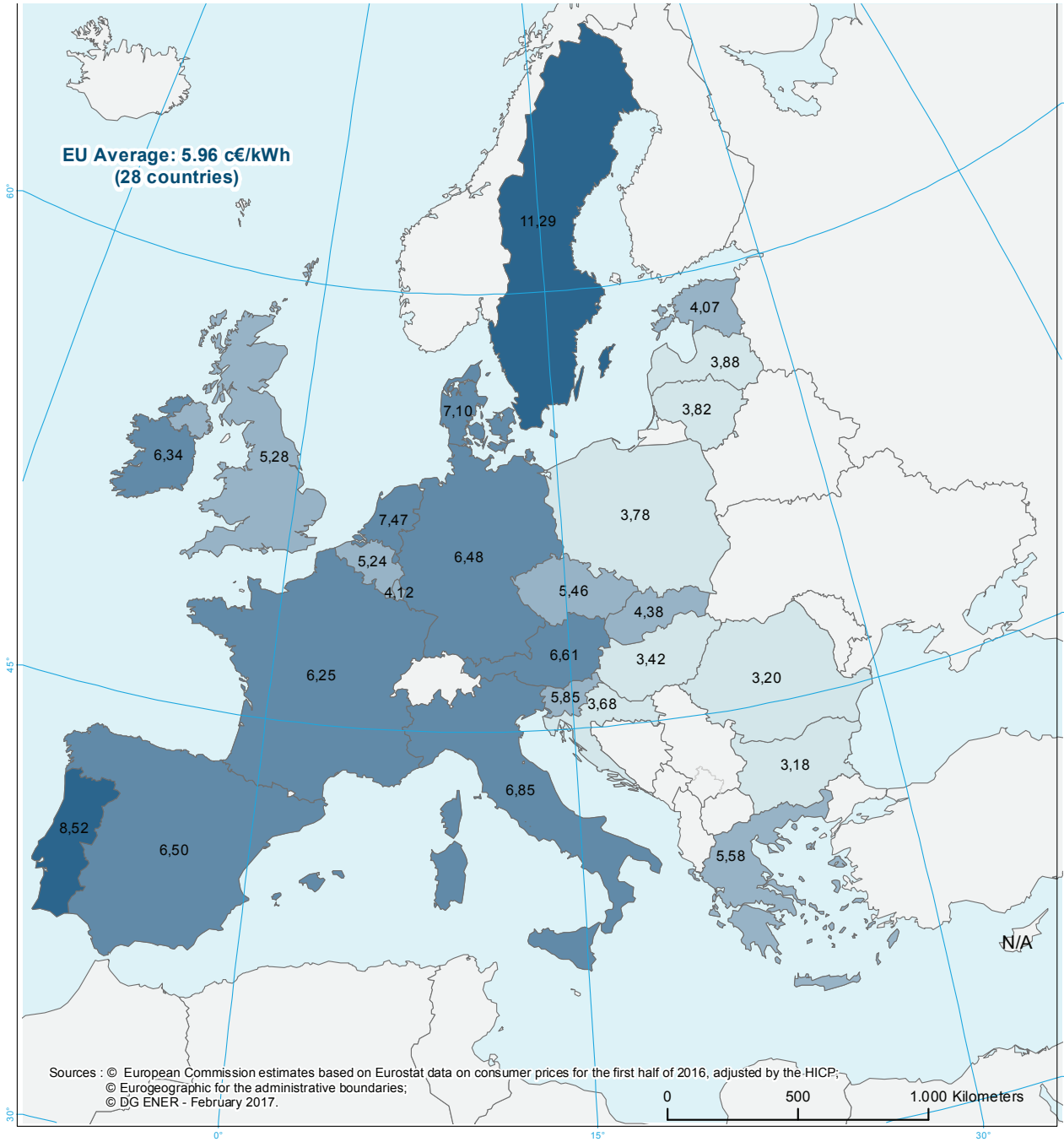
**FIGURE 27 - THE BREAKDOWN OF GAS PRICE PAID BY TYPICAL HOUSEHOLD CUSTOMERS IN EUROPEAN CAPITALS, DECEMBER 2016**



Source: VaasaETT

- Maps 2 and 3 show the estimated retail gas prices paid by households and industrial consumers in the fourth quarter of 2016.

**MAP 2 - RETAIL GAS PRICE ESTIMATES FOR HOUSEHOLDS IN THE EU - FOURTH QUARTER OF 2016**



Prices in Eurocents/kWh

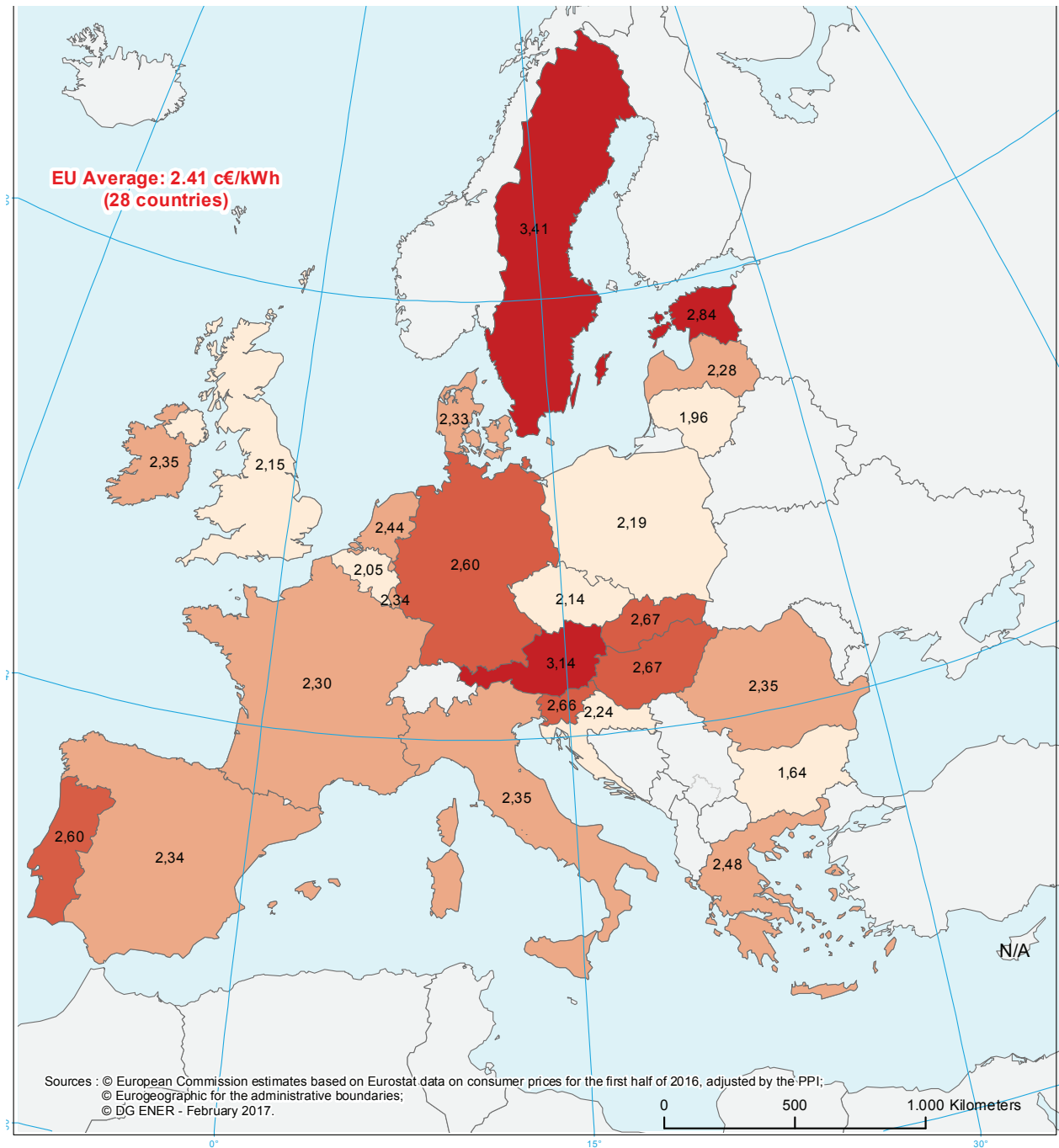
- no data
- < 4.00
- 4.01 - 6.00
- 6.01 - 8.00
- > 8.00

**Including all taxes and levies**

**Band D2: 5.56 MWh < Consumption < 55.6 MWh**



**MAP 3 - RETAIL GAS PRICE ESTIMATES FOR INDUSTRIAL CONSUMERS IN THE EU – FOURTH QUARTER OF 2016**



**Prices in Eurocents/kWh**

- no data
- ≤ 2.25
- 2.26 - 2.50
- 2.51 - 2.75
- > 2.75

**Excluding VAT (value added tax) and other recoverable taxes**

**Band I4: 27 780 MWh < Consumption < 277 800 MWh**

# 5. 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. 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 for UK and Germany, with the coal and power reference price as reported by Platts.

**Clean spark spreads** are defined as the average difference between the cost of gas and emissions, and the equivalent price of electricity. Spark spreads are indicative prices showing the average difference between the cost of gas delivered on the gas transmission system and the power price. As such, they do not include operation, maintenance or transport costs. The spark spreads are calculated for gas-fired plants with standard efficiencies of 50% and 60%. This report uses the 50% efficiency. Spreads are quoted for the UK, German and Benelux markets.

**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.

**Flow against price differentials (FAPDs):** By combining daily price and flow data, Flow Against Price Differentials (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 natural gas systems. With the closure of the day-ahead markets (D-1), the price for delivering gas in a given hub on day D is known by market participants. Based on price information for adjacent areas, market participants can establish price differentials. Later in D-1, market participants also nominate commercial schedules for day D. An event labelled as an FAPD occurs when commercial nominations for cross border capacities are such that gas is set to flow from a higher price area to a lower price area. The FAPD event is defined by the minimum threshold of price difference under which no FAPD is recorded. The minimum threshold for gas is set at 0.5 €/MWh. After the day ahead market closes, market participants still have the opportunity to level off their positions on the balancing market. That is why a high level of FAPD does not necessarily equate to irrational behaviour. In addition, it should be noted that close-to real time transactions represent only a fractional amount of the total trade on gas contracts. The FAPD chart provides detailed information on adverse flows. It has two panels: The first panel estimates the ratio of the number of days with adverse flows to the total number of trading days in a given period. It also estimates the monetary value of energy exchanged under adverse flow conditions (mark-up) compared to the total value of energy exchanged across the border. The mark-up is also referred to as «welfare loss». A colour code informs about the relative size of FAPD events in the observed sample, going from green if less than 10% of traded days in a given period are FAPDs to red if more than 50% of the days are FAPDs. The second panel gives the split of FAPDs by sub-category of pre-established intervals of price differentials. It represents the average exchanged energy and relative importance of each sub-category on two vertical axes.

**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.

**LNG sendout** expresses the amount of gas flowing out of LNG terminals into pipelines.

