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Quarterly Report on European Gas Markets

Market Observatory for Energy

DG Energy

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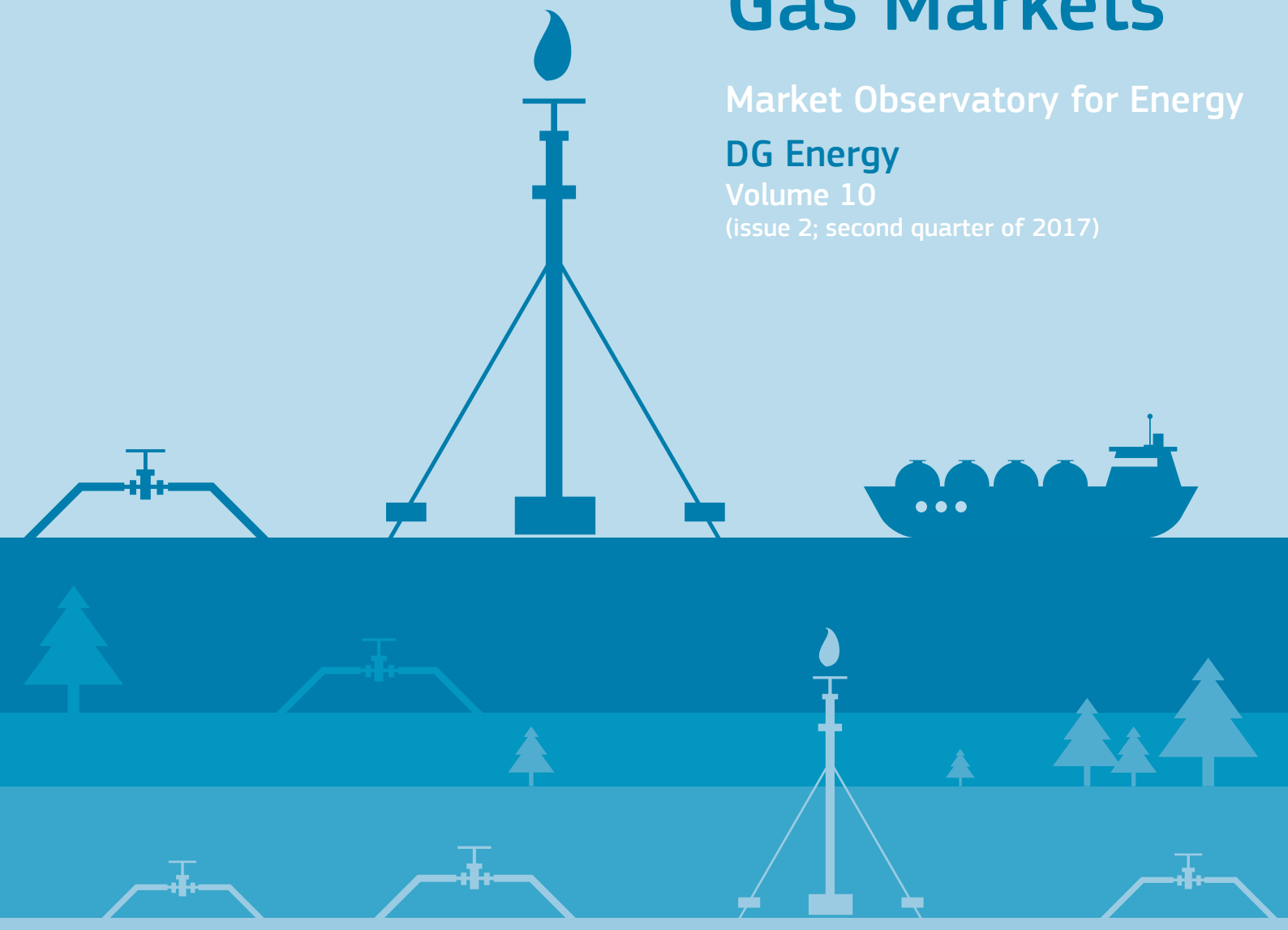

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CONTENT

HIGHLIGHTS OF THE REPORT

- **EU gas demand has shown a year-on-year increase for the sixth quarter in a row, helped by a continuous growth of gas use in the power sector.**

- **The share of LNG from total imports reached 16%, the highest level in the last four years. This was facilitated by a strong convergence between global prices.**

- **For the first time, LNG imports from the US reached Northern Europe: the Netherlands, Poland and the UK.**

- **The closure of the Rough facility in the UK and the reduction of the Groningen production cap by a further 10% mean that Northwest Europe will have to rely on other sources of seasonal flexibility.**

EXECUTIVE SUMMARY

- Preliminary Eurostat data shows that **EU gas consumption increased by 11%** year-on-year **in the second quarter of 2017**. This means consumption has increased for the sixth consecutive quarter, driven by the cold 2016-2017 winter and the growing gas use in the power sector, and also supported by the gradual economic recovery.

- EU gas **production decreased by an estimated 5%** year-on-year **in the second quarter of 2017** but in the first half of the year EU output was 2% higher than in the same period of 2016.

- **In the second quarter of 2017, EU gas imports were 8% higher than a year earlier** according to ENTSO-G data. The growth was driven by increasing flows from Russia and rising LNG imports while pipeline imports from North Africa decreased compared to the same period in 2016.
- In the second quarter of 2017, **Russia remained the EU's top supplier**, covering 43% of extra-EU imports, followed by Norway (33%); LNG imports made up 16%, the highest share in the last four years. Ukraine remained the main supply route of Russian gas coming to the EU.
- **EU LNG imports increased by 10%** year-on-year in the second quarter of 2017. Deliveries decreased in Northern Europe but this was more than offset by rising flows to the Mediterranean countries. The Qatari diplomatic crisis had no impact on LNG flows and the country remained the main supplier of the EU. **Imports from the US reached Northern Europe** (the Netherlands, Poland and the UK) for the first time but volumes were slightly lower than in the first quarter. The decision of Qatar to lift the moratorium on its North Field suggests that the country intends to maintain its market share in the growing global LNG market.

- The EU's **estimated gas import bill was around 16 billion euros** in the second quarter of 2017, about 25% more than a year earlier. Both import volumes and the average import price were higher than in the second quarter of 2016.
- After a colder-than-average winter, filling rates of European gas storage facilities decreased to unusually low levels. Although net injections started earlier than usual, **throughout the injection period, the average filling rate was 8-10 percentage points lower than a year earlier**. On 30 June 2017, the average filling rate was 51%, compared to 61% a year earlier.

- The **decision of Centrica to close the Rough facility in the UK** and **the Dutch government's intention to cut the Groningen production cap by a further 10%** mean that Northwest Europe will have to rely on other sources of seasonal flexibility.
- In the second quarter of 2016, **spot prices at European gas hubs decreased from winter highs** but were about 18% higher than year-ago levels. **Oil-indexed prices**, on the other hand, **increased** by 38% compared to the same period of 2016 and exceeded hub prices in Northwest Europe.

- **International gas prices** converged in the second quarter of 2017, showing the **greatest level of convergence since 2011**.

- As a result of low volatility, **trading activity on European gas hubs decreased** by 16% year-on-year. Germany decided to merge its two gas hubs from 2022.

- After decreasing in the last 2-3 years, **retail prices**, in particular those for households, **seem to be on the rise again**. On the other hand, the trend of diverging prices across the EU has come to an end in case of both household and industry prices.

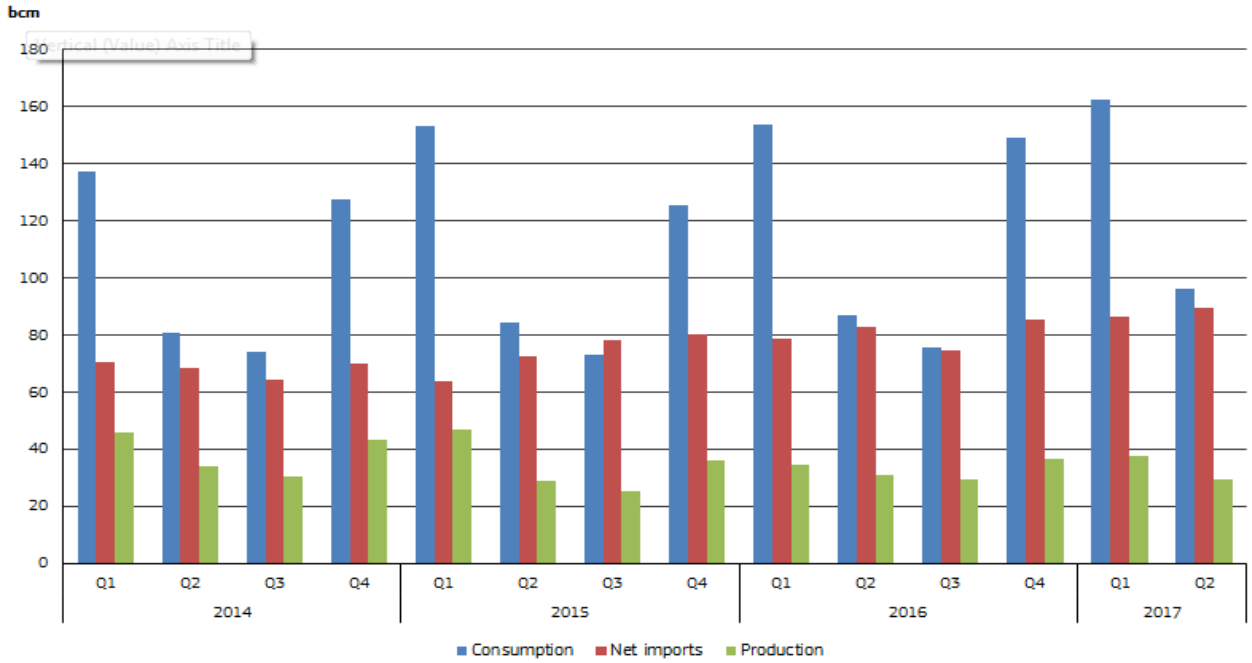
1. Gas balances

1.1 Consumption

- After the 7% growth seen in 2016, EU gas consumption continued to be on the rise in the first quarter of 2017: consumption was 6% higher than in the same period of 2016. The increase was largely driven by low temperatures in January and increasing use of gas in power generation. The biggest growth rates were observed in Greece (45%), Portugal (43%) and the Netherlands (27%) while some of the northern Member States, including Sweden (-33%), Estonia (-12%) and Finland (-10%), experienced double-digit decreases as a result of a relatively mild winter in the region. Gas consumption fell in Germany (-4%) but the country remained Europe's largest gas market.

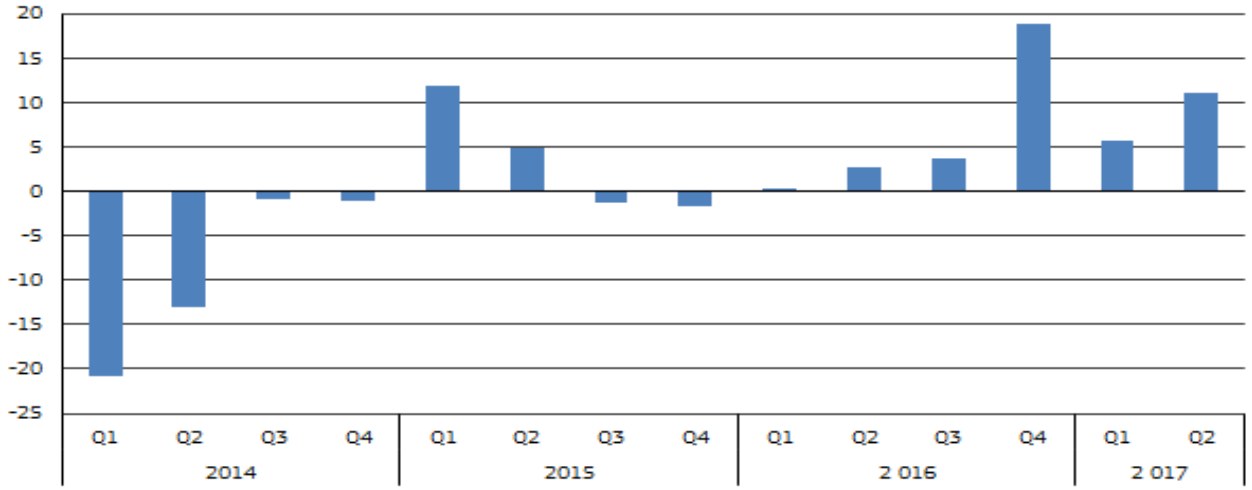
- EU gas consumption has shown a consistent year-on-year growth since the first quarter of 2016. In absolute level, the consumption in the first quarter of 2017 amounted to 162 bcm which is the highest quarterly level since the first quarter of 2013.

Figure 1. EU gas consumption, imports and production



Source: Eurostat, data as of 28 September 2017 from data series nrg_103m. Net imports refer to imports minus exports. In case of 2017Q2, short-term monthly data (data series nrg_ind_343m) was used to fill in the gaps.

Figure 2. EU gas consumption Q/Q-4 change (%)

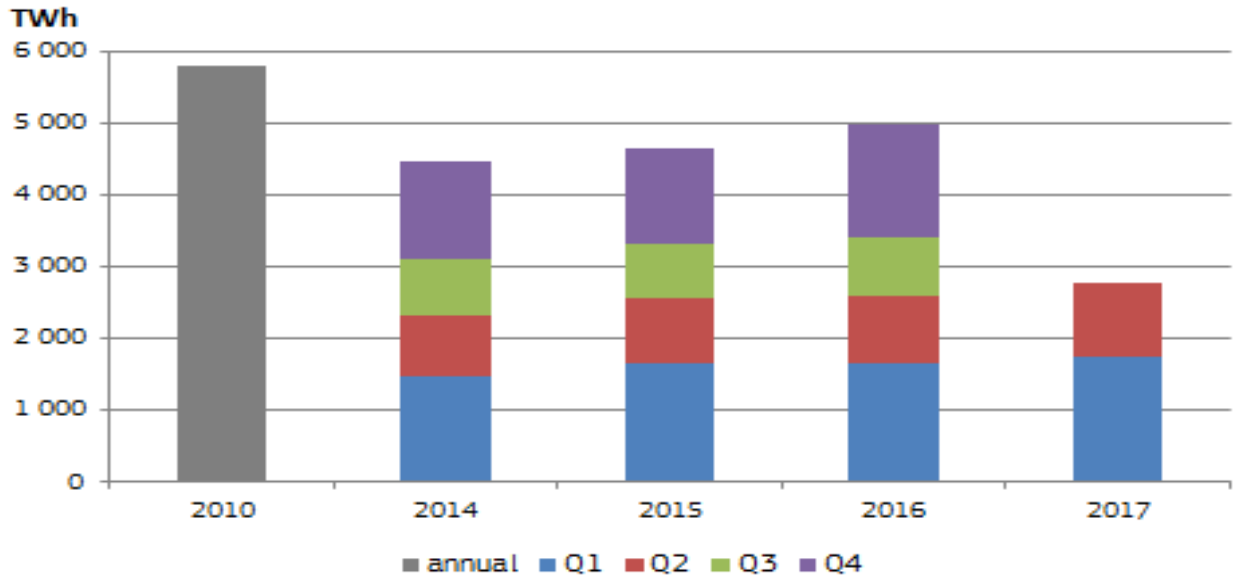


Source: Eurostat, data as of 28 September 2017 from data series nrg_103m; calculations of DG Energy (based on consumption measured in bcm). In case of 2017Q2, short-term monthly data (data series nrg_ind_343m) was used to fill in the gaps.

- According to preliminary Eurostat data, the increasing trend continued in the second quarter: consumption was about 11% higher than in the same period of 2016, with particularly strong growth in the Netherlands and Portugal. If confirmed, this would mean a year-on-year increase of 8% in the first half of 2017.

- EU gas consumption grew for two consecutive years, by 4% in 2015 and by 7% in 2016. Based on the data for the first half of 2017, a third consecutive year of growing consumption seems increasingly likely. To put this into context, despite the significant growth compared to 2014, the consumption in 2016 was 14% less than in 2010 when it reached a record high of nearly 5800 TWh.

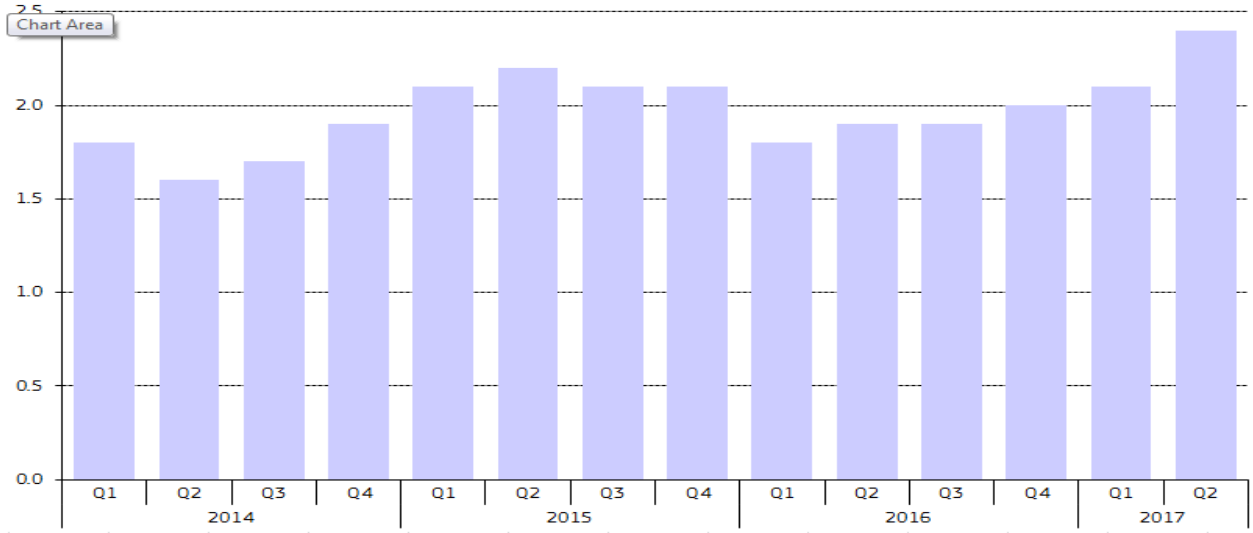
Figure 3. Quarterly EU gas consumption in 2014-2017



Source: Eurostat, data as of 28 September 2017 from data series nrg_103m; in case of 2017Q2, short-term monthly data (data series nrg_ind_343m) was used to fill in the gaps. The 2010 data is from Eurostat's annual data series nrg_103a.

- GDP growth is picking up in the EU: compared with the same quarter of the previous year, seasonally adjusted gross domestic product (GDP) rose by 2.4% in the second quarter of 2017. This is the biggest growth rate seen since the first quarter of 2011. Furthermore, the growth rate is gradually increasing since early 2016 which probably contributed to the increase of gas consumption over the same period. Industrial activity is also on the rise: the gross value added in the manufacturing sector was 3.2% higher in the second quarter of 2017 than a year earlier which is the fastest growth since 2015.[1]

Figure 4. EU GDP Q/Q-4 change (%)

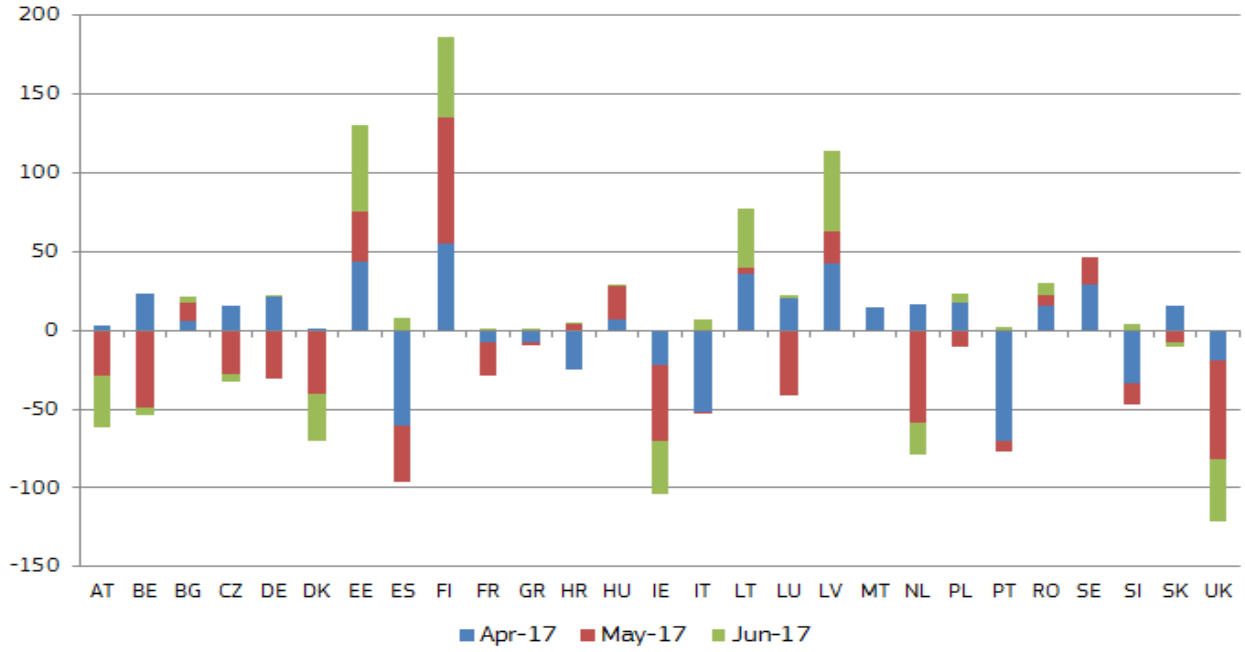


Source: Eurostat, data as of 19 September 2017 from data series namq_10_gdp
Seasonally and calendar adjusted data

[1] Source: Eurostat, data as of 19 September 2017 from data series namq_10_a10; seasonally and calendar adjusted data

- Figure 5 shows the deviation of actual heating degree days (HDDs) from the long-term average in individual EU Member States in the second quarter of 2017. Overall, the number of heating degree days in the second quarter of 2017 was more or less in line with the long-term average but with some regional variations. Weather in Scandinavia and the Baltic states was relatively cold in this period, thereby increasing gas demand for space heating. On the other hand, temperatures were higher than usual in countries like the UK, Ireland, Spain and Portugal. Compared to the long-term average, Finland had the highest number of additional heating degree days (186) which means that in this period the average temperature was about 2^{0}C lower than the long-term average.

Figure 5. Deviation of actual heating degree days from the long-term average in Q2 of 2017



Source: Joint Research Centre (JRC), European Commission

- Since mid-2015, gas deliveries to power generation in the EU as a whole have consistently shown a year-on-year increase. In the seven important markets[2] depicted in Figure 6, gas deliveries to power generation increased by 21% in the first quarter of 2017. The growth rate was 97% in France, 76% in the Netherlands, 44% in Greece, 23% in Belgium, 19% in Spain, 15% in Italy and 4% in the UK. In France, the reduced availability of nuclear capacity was the main driver for increased gas-fired generation.

- Gas continued to gain ground in the second quarter: in these seven markets, gas deliveries to power generation increased by 13% compared to the same period of 2016. The growth rate was 62% in the Netherlands, 43% in France, 24% in Belgium and Italy, 23% in Spain and 10% in Greece. On the other hand, volumes decreased by 7% in the UK.

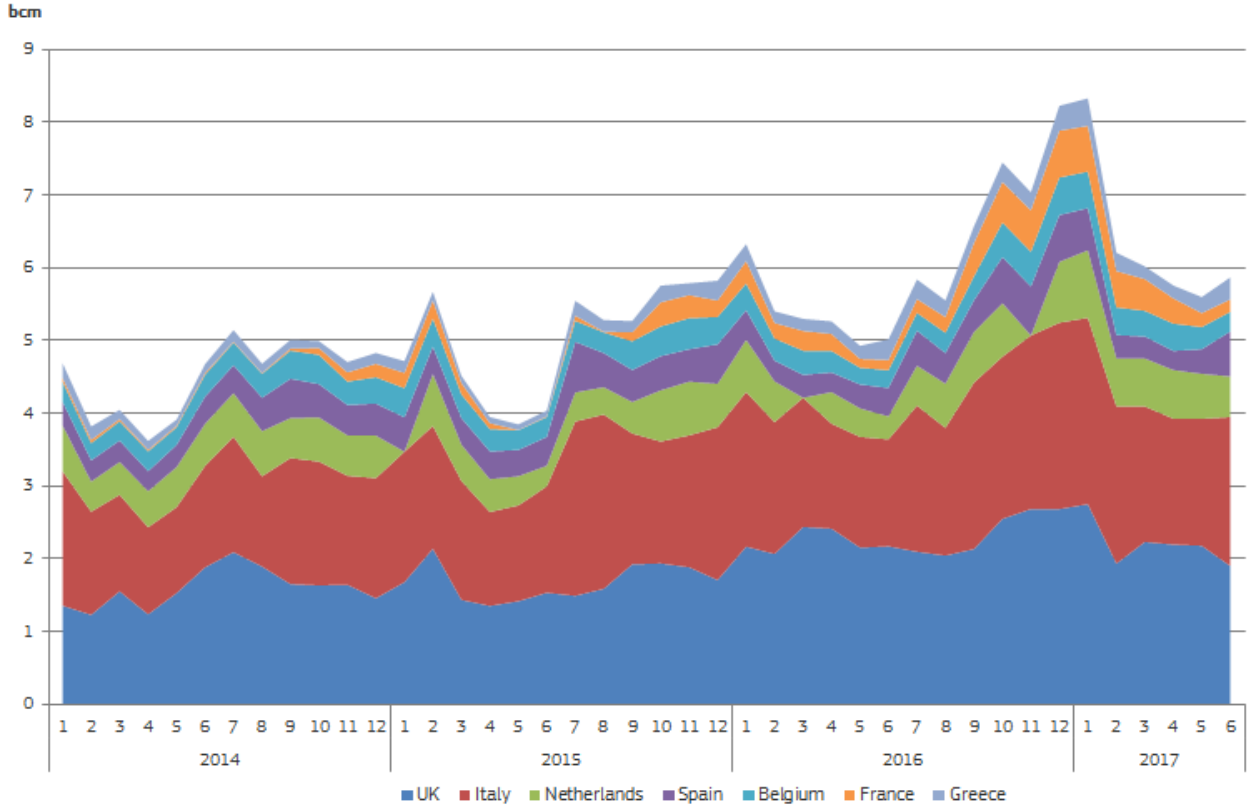
- Over the last two years, falling prices have improved the competitiveness of gas compared to other fuels, in particular coal. After peaking during the 2016/2017 winter, gas prices at European hubs started to decrease again while coal prices remained at an elevated level, suggesting that the favourable economics of gas-fired generation persists. (See more details about the price development of different fuels in chapter 2.1.)

- UK clean spark spreads – measuring the profitability of gas-fired generation – averaged 8 Euro/MWh in the second quarter of 2017. They were lower than during the winter but gas-fired generation remained competitive compared to coal. In the first quarter of 2017, gas continued to gain ground in power generation although not at the fast pace observed in 2016: the share of gas in the power mix increased from 37.0% in the first quarter of 2016 to 39.9% in the same period of 2017.[3] At the same time, the share of coal fell from 15.9% to 11.3% which means that the potential for further coal-to-gas switching is limited. According to the National Grid, 21 April 2017 was the first working day since the industrial revolution without coal in the UK's electricity mix.[4]

- Clean dark spreads in Germany averaged just above 0 Euro/MWh in the second quarter of 2017; this is lower than in the previous three quarters.[5] As a result, the share of gas-fired power generation decreased in the second quarter of 2017: it was 10.6%, compared to 15.3% in the first quarter of the year but still above the level seen in the second quarter of 2016 (8.2%).[6]

[2] Germany is not included because of gaps in reporting.
[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639098/Energy_Trends_June_2017.pdf
[4] https://twitter.com/Grid_Media/status/855324680076484608
[5] Charts of clean spark spreads in Germany and the UK can be found in the Quarterly Report of European Electricity Markets
[6] https://www.destatis.de/EN/FactsFigures/EconomicSectors/Energy/Production/Tables/ElectricityProductionSupply.html

Figure 6. Gas deliveries to power generation in selected Member States



Source: Eurostat, data as of 28 September 2017 from data series nrg_103m. Germany is not included because of gaps in reporting.

1.2 Production

- In the first quarter of 2017, EU gas production was 8% higher than in the same period of 2016. Looking at the largest producers, gas output increased in the Netherlands (15%), the UK (5%) and Denmark (8%) but decreased in Romania (-2%), Germany (-7%) and Italy (-3%). Ireland continued its robust growth (80%) thanks to the commissioning of the Corrib field in late 2015.

- According to preliminary Eurostat data, in the second quarter of 2017 production decreased by 5% year-on-year as Dutch output returned to its downward trend. If confirmed, this would mean that in the first half of 2017 EU output was 2% higher than in the same period of 2016.

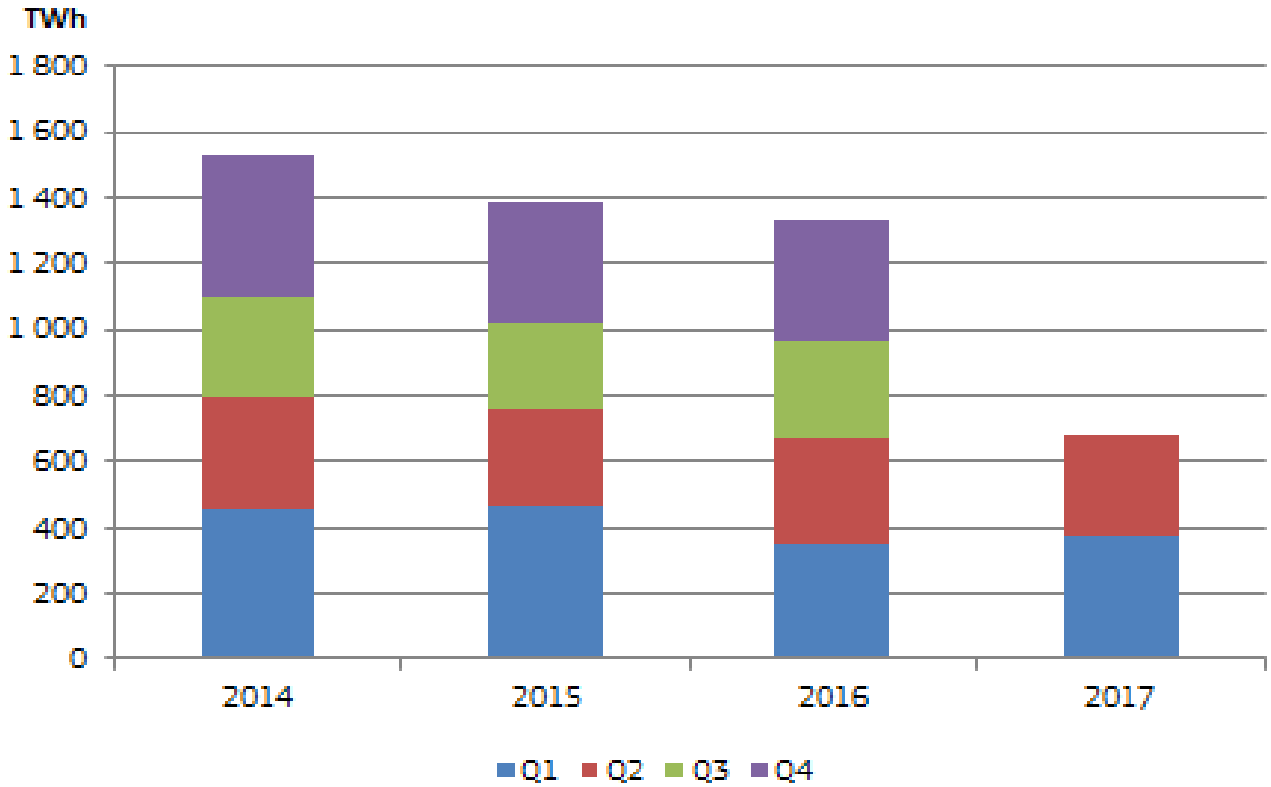
- In the Netherlands, cold weather provided support to production during the first quarter of 2017 with output showing a 15% year-on-year increase. In view of the declining production cap of the Groningen field (24 bcm for the 2016 gas year), output is likely to be constrained during the rest of the gas year. This was already visible in the second quarter when Dutch production decreased by 26% year-on-year. In May, the government announced its intention to cut the Groningen production cap by a further 10% (to 21.6 bcm) for gas year 2017.[7] This will further reduce the ability of the field to provide seasonal flexibility.

- In June, the UK Oil and Gas Authority published a strategy to maximise the economic recovery of tight gas from the Southern North Sea. The Authority conservatively estimates that there are more than 100 bcm of remaining gas accessible in the area. Tapping this potential would help to extend the life of existing fields and infrastructure.[8]

[7] https://www.rvo.nl/subsidies-regelingen/bureau-energieprojecten/lopende-projecten/gaswinning/gaswinning-groningen/wijzigingsbesluit-24-mei-2017

[8] https://www.ogauthority.co.uk/news-publications/news/2017/strategy-to-maximise-recovery-of-tight-gas-from-the-southern-north-sea/

Figure 7. Quarterly EU gas production in 2014-2017



Source: Eurostat, data as of 28 September 2017 from data series nrg_103m; in case of 2017Q2, short-term monthly data (data series nrg_ind_343m) was used to fill in the gaps.

1.3 Imports

- While indigenous production increased in the first quarter of 2017, strong consumption provided support to a year-on-year increase in imports: according to Eurostat data, net imports in this period were 10% higher than a year earlier. Among the biggest EU gas markets, the net imports of Italy, France and the UK increased by 17%, 11%, and 7%, respectively while net imports of Germany fell by 12%. In spite of the growing output, the next exports of the Netherlands were 35% lower than in the same period of 2016. After the rapid ramp-up of production at the Corrib field, indigenous production in Ireland covered 68% of the country's consumption in the first quarter of 2017, up from 3% in 2015.

- ENTSO-G data show that the trend of rising imports continued in the second quarter of 2017: in this period, total extra-EU imports increased by 8% year-on-year. In absolute terms, this was the highest second-quarter volume observed in the last four years. The increase was driven by growing consumption and strong injection demand. Increasing supply from Russia and a rapid rise of LNG imports were partly offset by lower imports from North Africa compared to the same period in 2016.

- In the second quarter of 2017, imports from Russia increased by 13% year-on-year and were only 5% less than the record-high level reached in the last quarter of 2016. Purely oil-indexed prices clearly exceeded hub prices in Northwest Europe in this period, but moving towards more competitive pricing allowed Russia to increase its sales and market share. Gazprom claims it now has a balanced portfolio in Europe, with half of their exports oil-indexed and the other half hub-indexed.[9] Russia remained the top supplier of the EU in the second quarter of 2017, covering 43% of total extra-EU imports, up from 41% in the same period of 2016.

- In May and June, Norwegian exports were restricted by planned maintenance activities in some fields and processing plants. Nevertheless, gas flows from Norway increased by 5% year-on-year in the second quarter of 2017. The country's share from total extra-EU imports decreased from 34% to 33%.[10] In view of the unavailability of the Rough storage facility for injections, the share of the UK from total Norwegian exports gradually decreased with the arrival of the summer.

[9] ICIS European Gas Markets, 15 May 2017
[10] 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 second quarter of 2017, Norwegian gas production amounted to 28.2 bcm, practically the same as in the second quarter of the previous year. For 2017 as a whole, the Norwegian Petroleum Directorate forecasts a gas production of 114.5 bcm, which is 2% less than in 2016.[11] In June, Norway announced the 24th licensing round covering 102 blocks, most of which are in the Barents Sea. The new production licenses are expected to be awarded in the first half of 2018.[12]

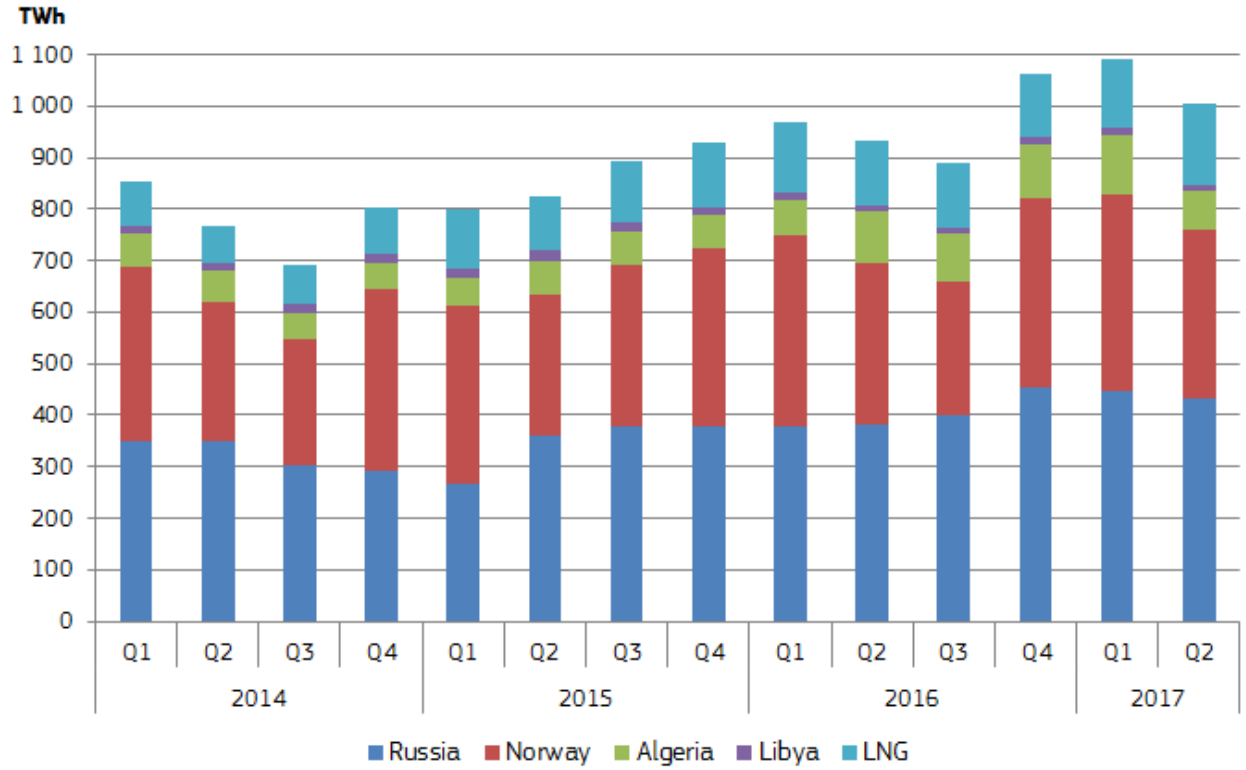
- After 2 years of consistent year-on-year growth, pipeline imports from Algeria decreased by 27% in the second quarter of 2017 compared to the same period of the previous year. Supplies to both Italy and Spain decreased, by 32% and 20%, respectively. Falling production and growing domestic consumption, as well as increasing oil-indexed prices probably all contributed to the lower supplies from the North African country.

- In Libya, a force majeure on the Wafa field was lifted in mid-April after a 2-week interruption[13] which helped to increase exports to Europe. However, volumes decreased by 3% year-on-year in the second quarter of 2017. The combined share of Algeria and Libya from total extra-EU imports was 9% in the second quarter of 2017, down from 12% in the same period of 2016.

- Imports of LNG significantly increased in the second quarter of 2017 and covered 16% of total extra-EU gas imports, the highest share in the last four years (see further details below).

- The EU's estimated gas import bill was around 16 billion euros in the second quarter of 2017, about 25% more than a year earlier. Both import volumes (1005 TWh) and the estimated average import price (around 16.2 Euro/MWh) were higher than in the second quarter of 2016.

Figure 8. EU imports of natural gas by source, 2014-2017



Source: Based on data from the ENTSO-G Transparency Platform, data as of 19 July 2017
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.

- In the second quarter of 2017, the volume of Russian imports transiting Ukraine (which includes the Brotherhood Pipeline and the Balkan route) was 24% higher than in the same period of 2016. Ukraine remained the main supply route of Russian gas to the EU, covering 45% of the total.

[11] http://www.npd.no/Global/Norsk/1-Aktuelt/Produksjonstall/P2017/Aug-2017/Data-aug-2017.xlsx
[12] https://www.regjeringen.no/en/aktuelt/announcement-of-the-24th-licensing-round/id2558309/
[13] https://af.reuters.com/article/africaTech/idAFL8N1HK3OF

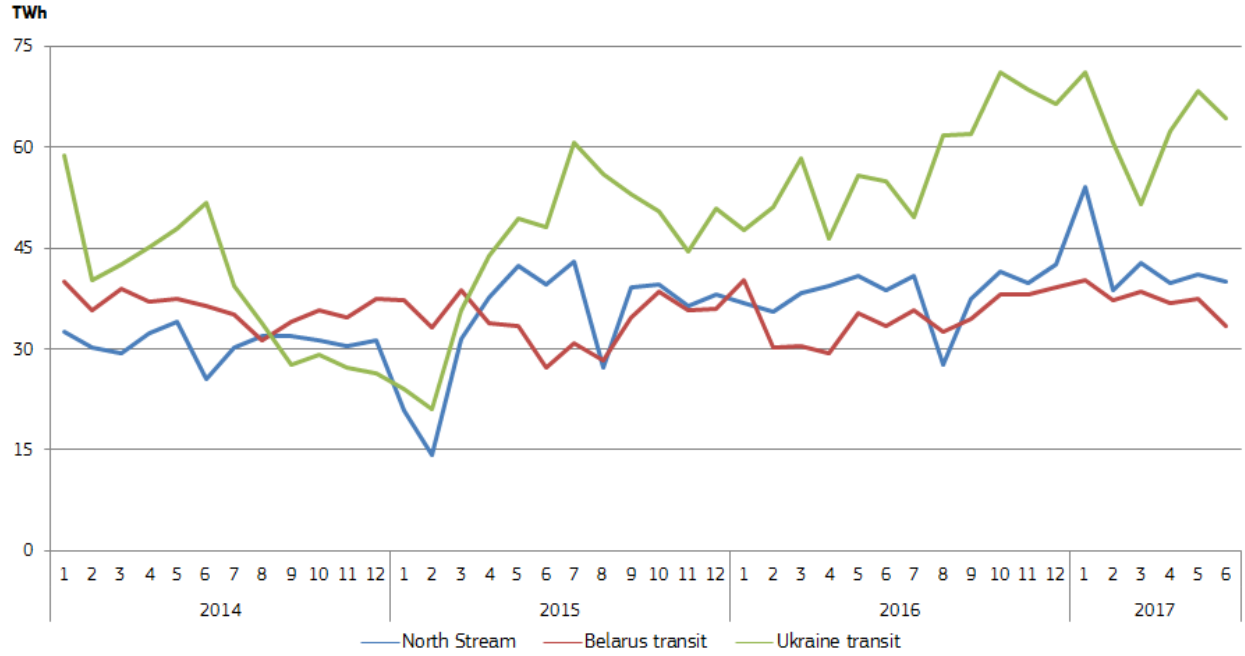
- Gas flows on the Nord Stream pipeline represented 28% of total EU imports from Russia in the second quarter of 2017. In absolute terms, volumes were 2% higher than in the same period of 2016.

- Gas supplies transiting Belarus increased by 10% in the second quarter of 2017 compared to the same period of 2016 and covered 25% of total EU imports from Russia. Deliveries on this route were limited by technical issues in the second half of June, with daily flows decreasing by up to 25%.[14]

- In the second quarter of 2017, Ukraine continued to rely on imports from Europe. Gas flows coming from Hungary, Poland and Slovakia reached about 2.7 bcm in this period, about 7.5 times more than in the same period of 2016 when deliveries dwindled to unusually low levels. The country has not purchased gas from Russia since November 2015.

- In April, Ukraine's Naftogaz and Ukrtransgaz, Italy's Snam and Slovakia's Eustream have signed a Memorandum of Understanding aimed at jointly evaluating opportunities for collaboration in the operation and enhancement of the gas transmission system in Ukraine.[15] On 31 May, the Stockholm Court of Arbitration made a preliminary decision in the dispute between Naftogaz and Gazprom related to their gas supply contract signed in 2009. According to Naftogaz, the court has rejected Gazprom's take-or-pay requirement and accepted Naftogaz's claim to make the contract price market-reflective. Furthermore, the court has lifted the ban on gas re-export.[16]

Figure 9. EU imports of natural gas from Russia by supply route, 2014-2017



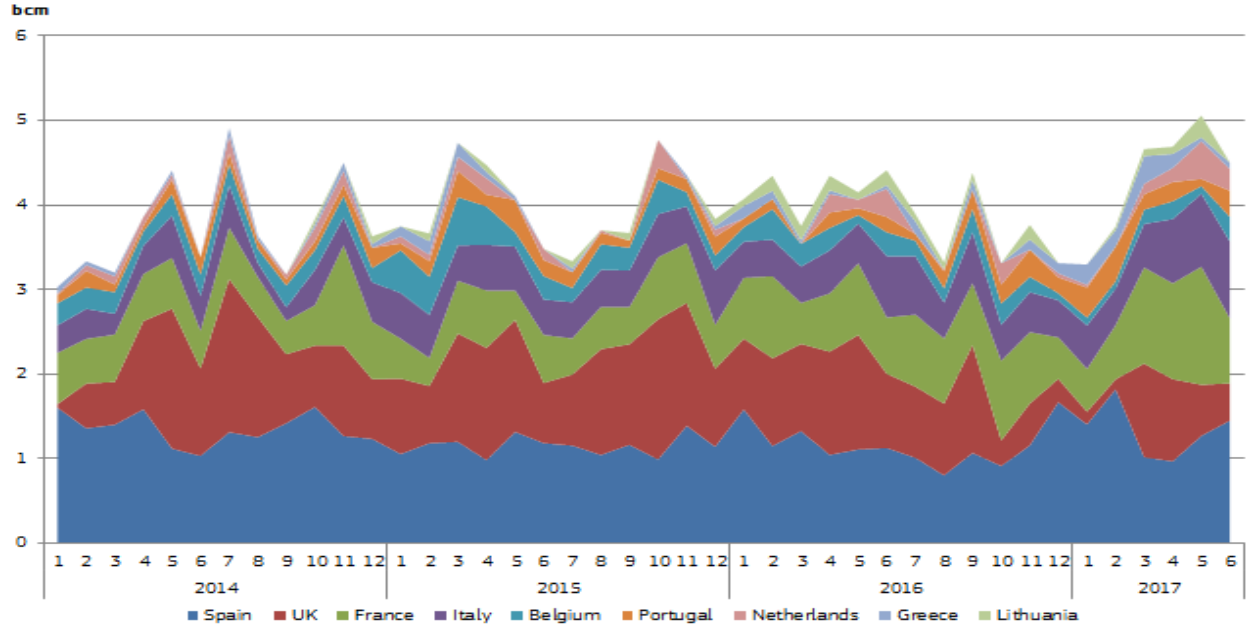
Source: Based on data from the ENTSO-G Transparency Platform, data as of 19 July 2017
Deliveries to Estonia, Finland and Latvia are not included; transit volumes to the Former Yugoslav Republic of Macedonia, Serbia and Turkey are excluded

- After a slight decrease in the first quarter of 2017, in the second quarter EU LNG imports increased by 10% year-on-year, facilitated by a decrease of seasonal demand in Asia and the convergence of international LNG prices. In May, LNG imports exceeded 5 bcm, the highest monthly level observed in the last four years. Similarly to the first quarter, the trend was markedly different in Northern Europe and the Mediterranean: imports decreased in the UK (-42%), Belgium (-9%) and Lithuania (-22%) which was more than offset by increases in Spain (13%), France (50%), Italy (49%), Portugal (40%) and Greece (222%).

- High spot prices in Asia (see Figure 17) meant that Europe was a less attractive destination for LNG cargoes for most of the 2016-2017 winter. In the liquid and well-connected Northwest European market, LNG was struggling to compete with the Russian and Norwegian pipeline supplies, leading to a decrease of LNG imports. From March, as global LNG prices converged, imports to Northwest Europe rebounded but UK imports decreased again in May and June as the country had to cope with the lack of injection demand at the Rough facility.

[14] http://en.gaz-system.pl/press-centre/news/information-for-the-media/artykul/202518/
[15] http://naftogaz-europe.com/article/en/naftogazukrtransgazsnamandeustreamsignamemorandum
[16] http://naftogaz-europe.com/article/en/thestockholmarbitrationtribunalrejects

Figure 10. LNG Imports to the EU by Member State



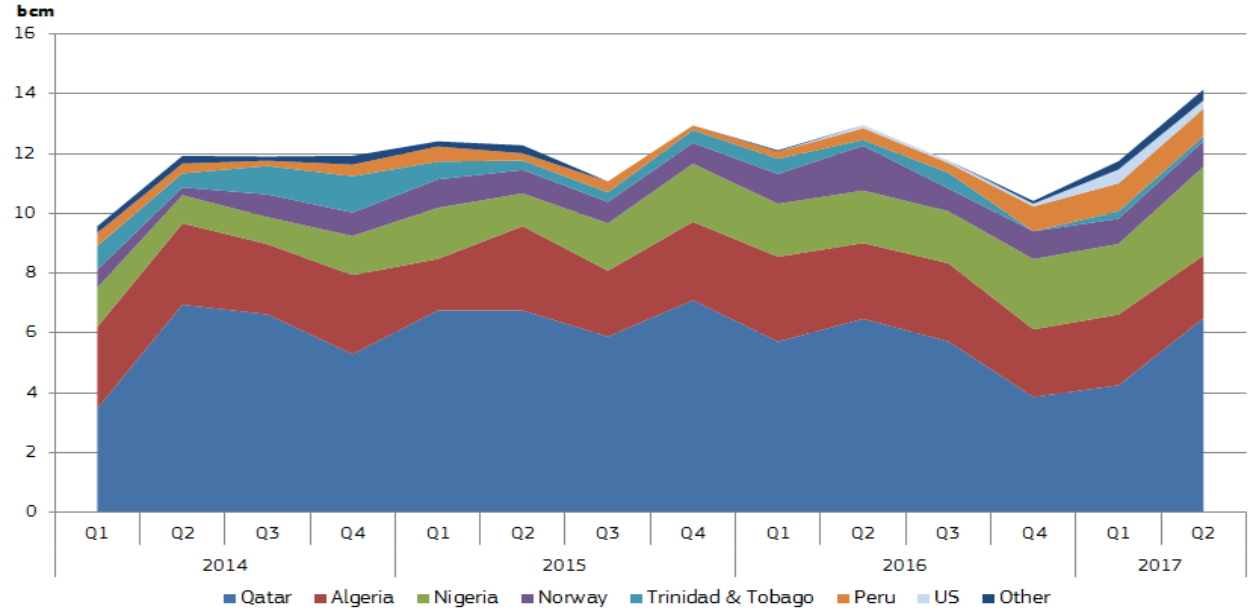
Source: Bloomberg/Poten & Partners
Imports to Malta and Poland are not included

- In the second quarter of 2017, Qatar remained the main LNG supplier of the EU. After relatively low volumes in the last quarter of 2016 and the first quarter of 2017, imports returned to the usual level seen in previous years, with the country's market share rebounding to 46% (from 36-37% in the previous two quarters). The Qatari diplomatic crises which broke out in early June raised uncertainty about LNG supplies but had no discernible impact on the country's exports.

- Qatar was followed by Nigeria (21%), Algeria (15%), Peru (7%) and Norway (6%). For Algeria, this is the lowest market share since early 2015. The US remained the sixth LNG supplier of the EU, although volumes fell short of those observed in the first quarter. The market share of the US was 2% in the second quarter of 2017.

- In the second quarter of 2017, Qatar had a dominant role in the Belgian (83%), Dutch (56%), Italian (74%) and UK (98%) markets. Nigeria was the largest supplier of Portugal (57%) while Greece's main supplier was Algeria (59%). Norway was the dominant supplier of Lithuania (75%). France and Spain had the most diversified portfolio: they received LNG from seven and six suppliers, respectively. Nigeria had the biggest market share in both France (32%) and Spain (40%).

Figure 11. LNG Imports to the EU by supplier



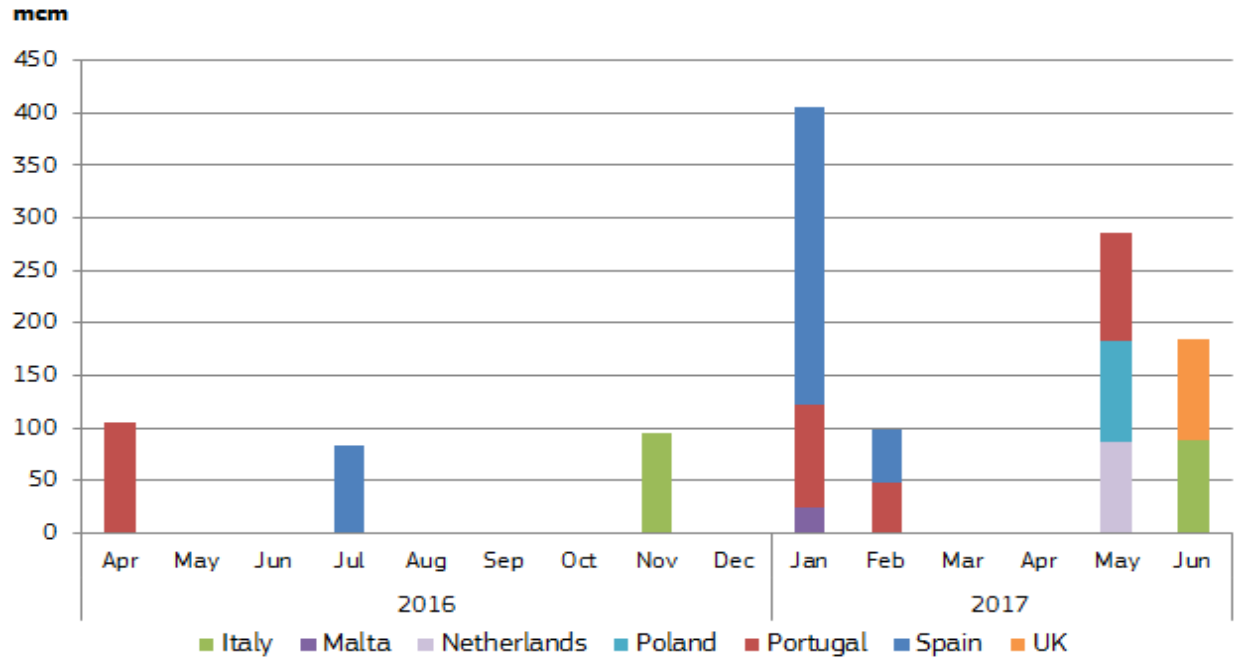
Source: Bloomberg/Poten & Partners
Imports to Malta and Poland are not included; imports coming from other EU Member States (reexports) are excluded

- In the second quarter of 2017, three additional EU Member States were added to the list of countries receiving LNG deliveries from the US: the Netherlands, Poland and the UK.[17] This also means that, for the first time, US LNG supplies arrived to liquid markets of Northwest Europe; previously only countries in Southern Europe received cargoes from the US.

- In the second quarter of 2017, five LNG vessels were sent from the US to EU ports: one each to Italy, the Netherlands, Poland, Portugal and the UK. US exports to the EU totalled 470 million cubic meters, representing 10% of total US LNG exports in this period. Mexico (30%) was the single largest destination of US LNG exports.

- The Cove Point LNG project and the fourth train of the Sabine Pass terminal are expected to be online by the end of 2017, increasing the likelihood of growing LNG exports to Europe.

Figure 12. US LNG exports to the EU from April 2016 to June 2017



Source: US Energy Information Administration

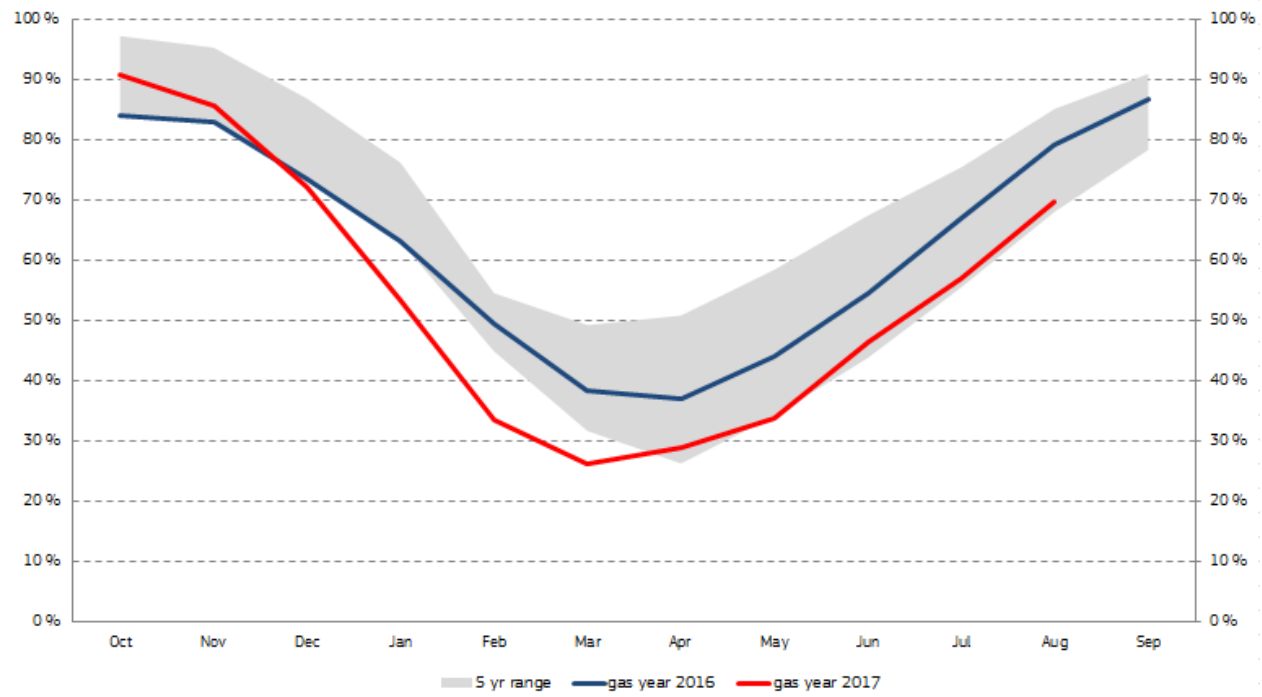
1.4 Storage

- 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 nearly 980 TWh, equivalent to 91% of storage capacity. During the winter, however, withdrawals were much stronger than a year earlier, driven by cold temperatures, an increased gas use in the power sector and relatively low LNG imports. By 31 March 2017, the stock level fell below 280 TWh. This was equivalent to an average filling rate of 26%, 10 percentage points lower than a year earlier and below the 5-year range.

- The injection season started earlier than usual: EU stock levels bottomed out already on 28 March. After the strong injection observed in April, the pace of injections was similar to 2016 but it started from a lower base which means that, throughout the injection period, the average filling rate was 8-10 percentage points lower than a year earlier. On 30 June 2017, the average filling rate was 51%, compared to 61% a year earlier.

[17] The cargo destined to the UK was loaded in June but arrived in early July.

Figure 13. Gas storage levels as percentage of maximum gas storage capacity in the EU



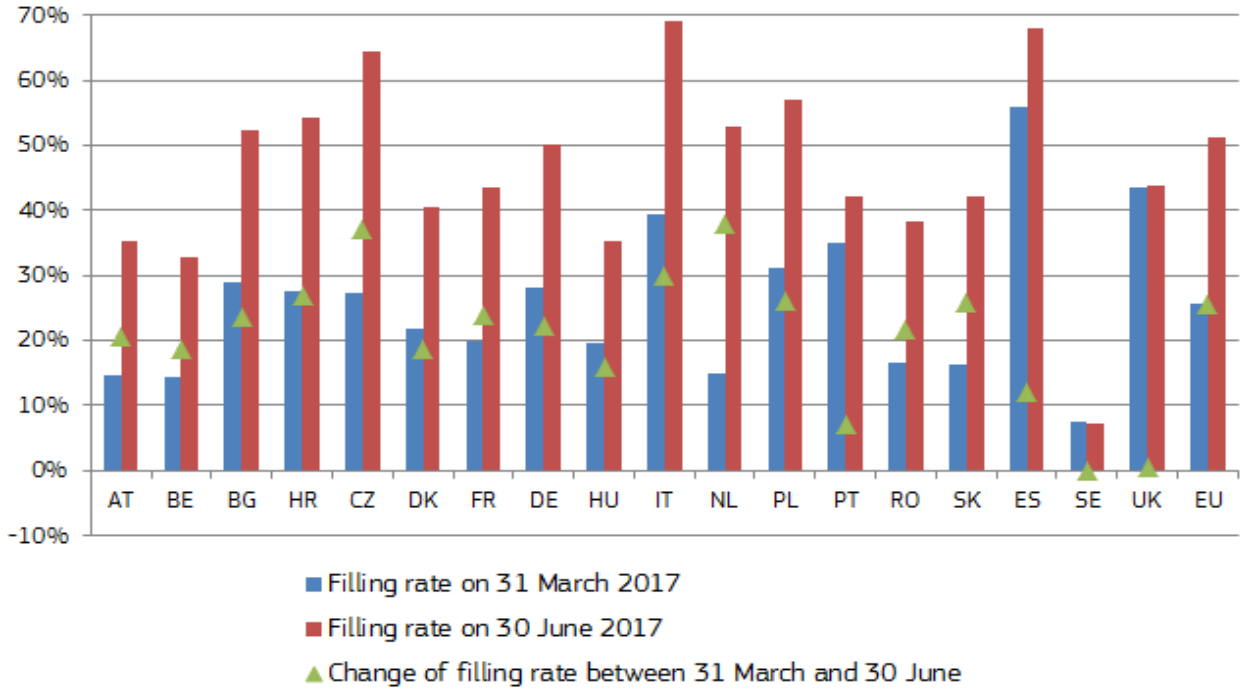
Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 4 September 2017. See explanations on data coverage at https://agsi.gie.eu/#/faq.
The 5-year range reflects stock levels in gas years 2012-2016. The graph shows stock levels on the 15th day of the given month.

- On average, injections made during the second quarter of 2017 were equivalent to 25% of storage capacity: the average filling rate increased from 26% on 31 March to 51% on 30 June. However, as Figure 14 shows, there was significant variation among Member States in terms of both the staring position (the filling rate at the end of the first quarter) and the pace of injections. For example, in Italy, where withdrawals are capped by the government, the filling rate on 31 March was well above the EU average (39%) and injections were also faster than in most other Member States. The Czech Republic and the Netherlands also saw a high rate of injections. On the other hand, a couple of Member States (Austria, Belgium, Hungary, Romania) had a filling rate of less than 40% at the end of June; these countries will probably have to accelerate injections before the start of the 2017 gas year.

- The fate of the Rough facility, the UK's main gas storage site, was sealed on 20 June when Centrica announced it would cease storage operations at the site.[18] For two years, both injections and withdrawals have been restricted at the facility, thereby creating in the UK market a deficit in winter (requiring increased imports from mainland Europe, Norway and/or LNG suppliers) and a surplus in summer (requiring increased exports to mainland Europe), with corresponding price differences between NBP and the continental hubs. The closure of the site is likely to exacerbate this situation and the country will have to rely even more on mainland Europe, Norway and LNG imports during peak winter periods.

[18] https://www.centrica.com/news/cessation-storage-operations-rough

Figure 14. Gas storage levels as percentage of maximum gas storage capacity by Member State

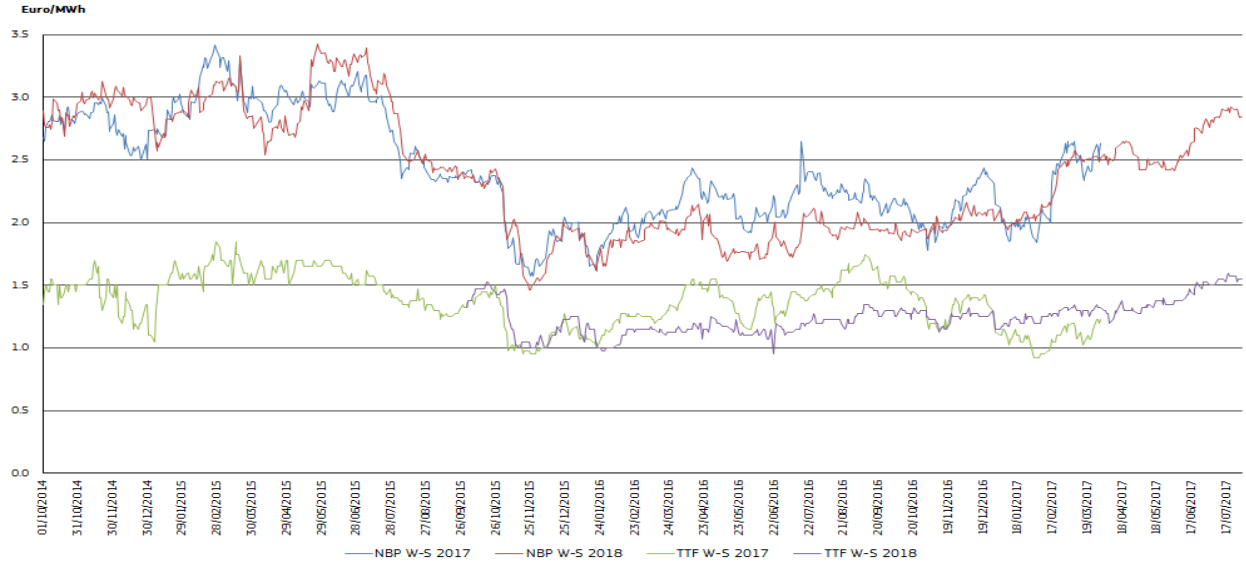


Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 12 September 2017; calculations of DG Energy. See explanations on data coverage at https://agsi.gie.eu/#/faq.

- 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 1.5 Euro/MWh on the NBP and 1.0 Euro/MWh on the TTF. From early 2016, spreads slightly recovered but remained below the 2014 levels. On the NBP, seasonal spreads averaged 2.6 Euro/MWh in the second quarter of 2017, 0.4 Euro/MWh more than in the same period of 2016. On the TTF, the average seasonal spread was 1.4 Euro/MWh in the second quarter, more or less the same as a year earlier.

- In the UK, seasonal spreads have been clearly on the rise in 2017, reaching levels not seen since 2015. This is probably related to the woes of the Rough storage facility which mean low injection demand and oversupply in summer and a tighter market in winter, thereby increasing the seasonal spread. After Centrica's announcement on 20 May that the Rough site would be closed, the difference between the winter 2017-18 price and the summer 2017 price increased further, reaching up to 2.9 Euro/MWh during the summer.

Figure 15. Winter-summer spreads in the Dutch and British gas hubs



Source: Platts

W-S 2017 refers to the difference between the winter 2017-18 price and the summer 2017 price; W-S 2018 refers to the difference between the winter 2018-19 price and the summer 2018 price

2. Wholesale gas markets

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

- The decision of OPEC and non-OPEC producers to reduce output provided some support to oil prices at the end of 2016. However, from March 2017, despite high levels of compliance of OPEC with the agreed cuts, oil prices decreased as increasing drilling and production in the US, as well as growing output in Libya and Nigeria (which are exempted from the OPEC cut) raised doubts about the rebalancing of the global oil market. On 25 May 2017, OPEC and non-OPEC producers decided to extend the production cut until March 2018 but this failed to reverse the trend: in the second half of June, the price of Brent dropped below 45 USD/bbl, the lowest level since November 2016.

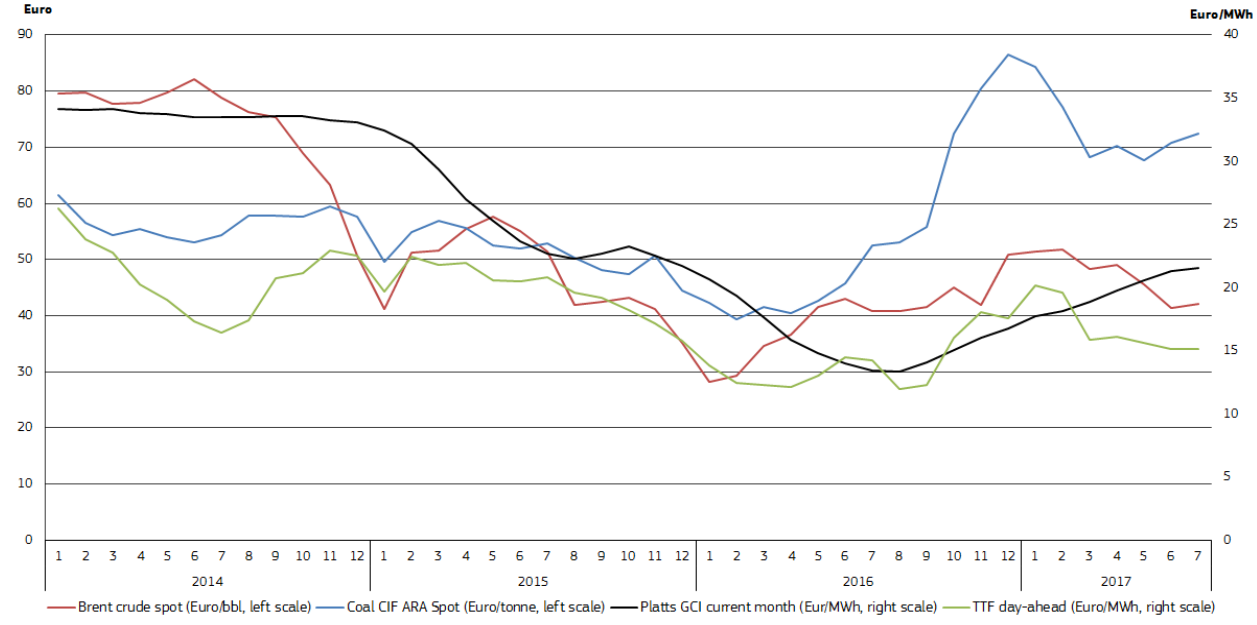
- After a gradual decrease seen in 2015 and most of 2016, the TTF spot price started to grow in the last quarter of 2016. After a peak in January, as the winter receded, hub prices returned to the declining trajectory. An uptick in LNG imports also put pressure on prices. In the second quarter of 2017, the average TTF price was 15.6 Euro/MWh, 19% higher than in the same period of 2016 but 16% less than in the first quarter of 2017. In addition to the milder weather, recovering LNG imports and the partial restart of French nuclear reactors also contributed to the falling prices.

- Due to the typical 6-9 month time lag structure used in the pricing formulas, oil-indexed prices bottomed out in August 2016 and started to grow gradually afterwards. By the second quarter of 2017, oil-indexed prices clearly exceeded 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, reached 21.3 Euro/MWh in June, 6.2 Euro/MWh more than the TTF. This is the biggest difference since early 2016. In the second quarter of 2017, the average GCI price was 20.6 Euro/MWh, 38% more than in the same period of 2016.

- According to the International Gas Union, oil-indexation accounted for 30% of European gas consumption in 2016, basically unchanged from the previous year. There are considerable regional differences: the share was 9% in Northwest Europe, 28% in Central Europe, 68% in the Mediterranean, 32% in Southeast Europe and 28% in Scandinavia and the Baltics.[19] While over the years we see a clear trend of a decline of oil-indexation in long-term contracts, there is a strong correlation between oil prices and European hub prices, reflecting the close relationship between the gas market and the wider energy complex.[20]

- Driven by market tightness in Asia after China introduced measures restricting domestic coal output, coal prices increased significantly in the second half of 2016. In December, the CIF ARA spot price averaged 86.5 Euro/ton, the highest level since 2011. Prices eased in the first quarter of 2017 as temperatures warmed and Chinese production increased, but remained rather high: the CIF ARA spot price averaged 69.6 Euro/ton in the second quarter of 2017. As a result, the relative competitiveness of gas versus coal remained favourable.

Figure 16. Spot prices of oil, coal and gas in the EU



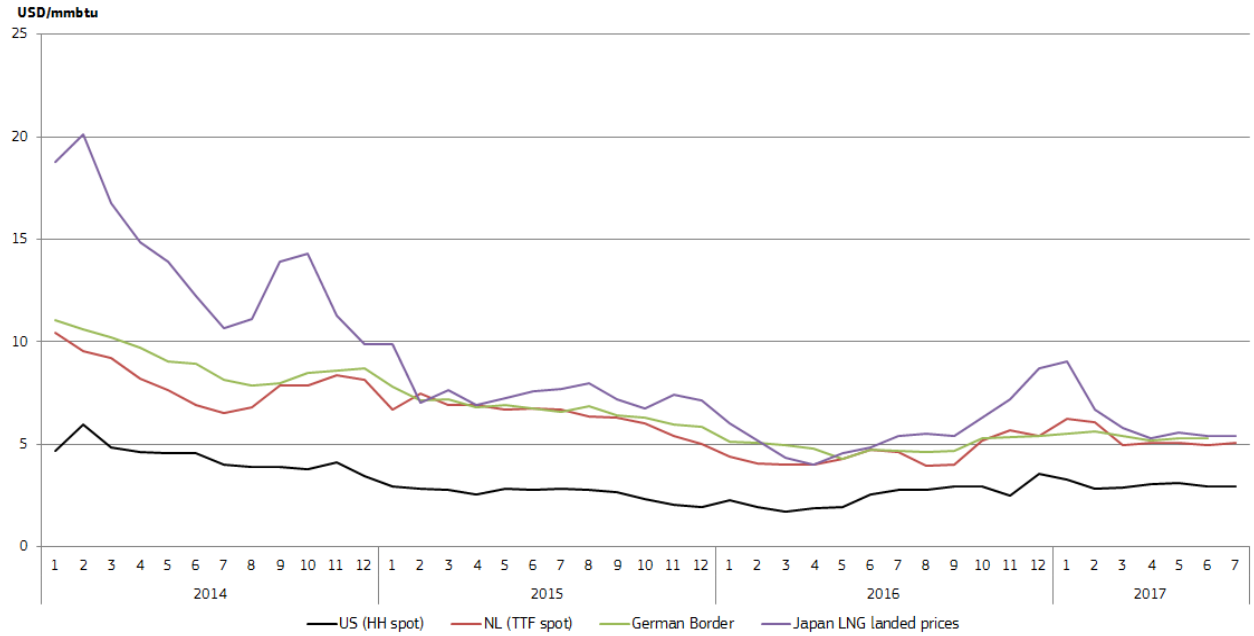
Source: Platts

[19] IGU Wholesale Gas Price Report 2017, http://www.igu.org/publications-page
[20] ICIS European Gas Markets, 15 June 2017

2.2 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 was interrupted by an increase in practically all regions during the 2016-2017 winter. During the second quarter of 2017, international gas prices have been remarkably stable.
- In 2015-2016, Japanese LNG prices traded on average 1.1 USD/mmbtu higher than TTF, the Dutch gas hub but in certain periods the premium has practically disappeared. During the past winter, strong demand in Asia and a number of production outages supported Japanese prices and, as a result, the difference significantly increased and in December 2016 reached 3.3 USD/mmbtu, a level not seen since 2014. Prices eased from February as demand weakened while Australian and US output continued to grow. In the second quarter of 2017, Japanese landed prices averaged 5.4 USD/mmbtu which means that the average premium over TTF dropped to 0.4 USD/mmbtu.
- After years of gradual decrease, European gas prices started to grow from October 2016 and the TTF averaged 6.3 USD/mmbtu (20.1 Euro/MWh) in January 2017. Prices decreased afterwards and in the second quarter TTF averaged 5.0 USD/mmbtu (15.6 Euro/MWh). The average German border price was slightly higher: 5.3 USD/mmbtu (16.3 Euro/MWh), supported by growing low oil-indexed prices.
- The Henry Hub price has been on the rise since April 2016, supported by rising demand in the power generation sector, increasing exports, as well as relatively low storage injections during summer. In early 2017, the price slightly decreased from a peak reached in the end of December 2016 as gas output increased and temperatures were above average, thereby reducing demand from heating and power generation. In the second quarter of 2017, the average price was 3.0 USD/mmbtu, 0.9 USD/mmbtu (51%) more than in the same period of 2016 and unchanged from the first quarter 2017.
- 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. Prices started to converge again from February 2017 and in the second quarter the convergence among key international gas prices reached the greatest level since the Fukushima accident in 2011.[21]
- The ratio of the Japanese LNG price and US Henry Hub decreased to 1.8 in the second quarter of 2017 while it was 2.9 in November 2016. The average TTF/Henry Hub ratio decreased to 1.7 in the second quarter of 2017 from 2.3 in November 2016. In absolute terms, the differential decreased to 2.0 USD/mmbtu, down from 3.3 USD/mmbtu in February 2017.

Figure 17. International comparison of wholesale gas prices



Sources: Platts, Thomson-Reuters, BAFA

[21] ICIS European Gas Markets, 30 June 2017

2.2.1 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 significantly in December 2016 and January 2017, driven by high winter demand and supply outages in Asia. From February, however, prices in both Asia and Europe decreased, returning to the levels observed in July-September 2016. In the second quarter of 2017, there has been a clear convergence of international LNG prices: spot prices averaged 4.8 USD/mmbtu in the UK, 5.1 USD/mmbtu in Spain, 5.4 USD/mmbtu in Japan and 5.3 USD/mmbtu in China. JCC, the Japanese benchmark of oil-indexed LNG prices was much higher, averaging around 8 USD/mmbtu in the second quarter.

- Asian LNG demand continued to pick up: in the second quarter of 2017, imports increased by 46% in China, by 15% in Korea, by 7% in Japan, while imports decreased by 1% in India, all compared to the same period in 2016. Latin American imports increased by 14 year-on-year.[22]

- In Japan, the Takahama 3 and 4 nuclear reactors were restarted in May and June 2017, respectively, thereby increasing the number of operating reactors to five.[23] Furthermore, a court cleared the way for the restart of two additional nuclear reactors at the Genkai plant by March 2018.[24] These developments are likely to moderate the country's LNG demand. In Korea, ten old coal-fired power plants were ordered to shut down for 30 days starting from 1 June 2017 in order to address air pollution, a move likely to increase the country's LNG demand. The presidential office said it wants to close all of the old coal plants within President Moon's presidency which ends in May 2022.[25]

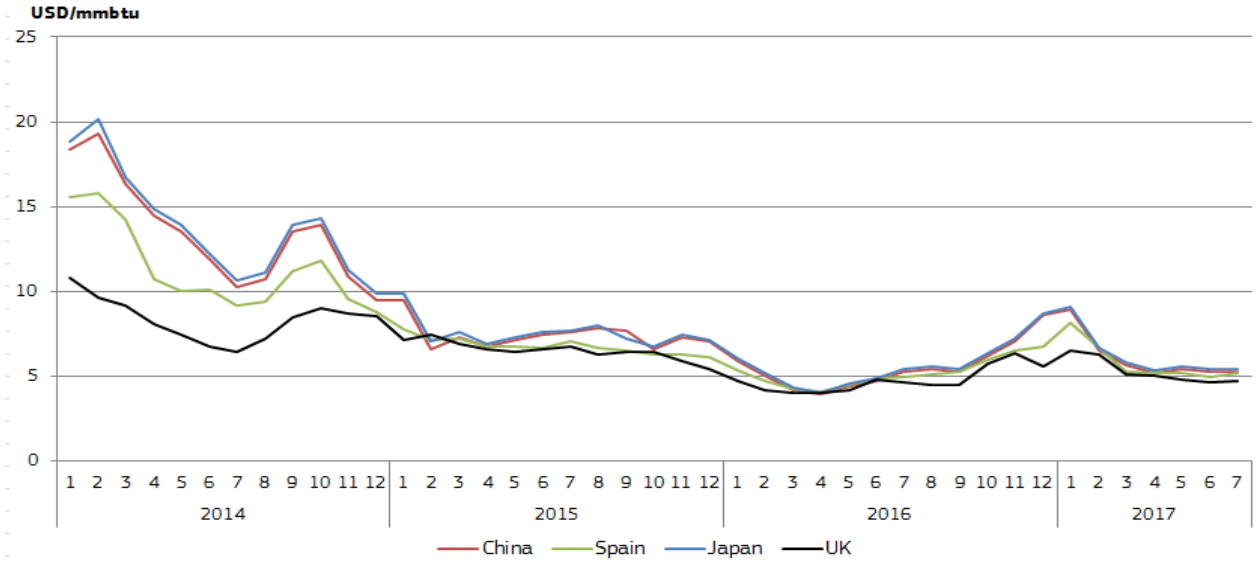
- In April, Qatar lifted the moratorium on its North Field, the world's largest conventional gas field, potentially adding 21 bcm of gas production within five to seven years. The lifting of the moratorium, which was imposed in 2005, could help the country to maintain its market share in the global LNG market (30% in 2016). By 2018, Qatar is expected to lose its top position to Australia once new projects are completed there.[26] In June, a diplomatic crisis broke out between Qatar on the one hand and Saudi Arabia, the United Arab Emirates (UAE), Bahrain and Egypt on the other but had no significant impact on Qatari LNG supplies and on LNG prices. While Qatari LNG cargoes destined to the UAE stopped, deliveries to Egypt continued. About 20-25% of Qatari LNG exports come to Europe. There were some concerns that Egypt may block the Suez Canal to Qatari LNG vessels but the use of this route is governed by international treaties which do not allow such restrictions.

- US LNG exports continued to ramp up in the second quarter of 2017, reaching 4.6 bcm, 12% more than in the first three months of the year. Almost half of US exports were destined to Latin America (48%), followed by Asia (26%) and the Middle East (16%). 10% of US LNG exports was destined to the EU, compared to 12% in the previous quarter. Looking at individual countries, the three largest buyers of US LNG were Mexico, Korea and Argentina.[27]

- On 11 July, Climate Action and Energy Commissioner Miguel Arias Cañete and Japan's Minister of Economy, Trade and Industry Hiroshige Seko signed a joint Memorandum of Cooperation on LNG. As the EU and Japan together account for nearly 50% of global LNG consumption, reinforced cooperation between the EU and Japan is expected to promote the liquidity, flexibility and transparency of the global LNG market.[28]

[22] Source: Commission calculations based on tanker movements reported by Thomson Reuters
[23] http://www.world-nuclear-news.org/C-Japan-puts-fifth-reactor-back-into-operation-0606174.html
[24] http://www.reuters.com/article/us-japan-nuclear-court-idUSKBN19404S
[25] https://www.reuters.com/article/southkorea-politics-energy/s-korea-to-temporarily-close-10-old-coal-fired-power-plants-in-june-idUSL4N1IH13D
[26] Platts Energy Economist, May 2017
[27] http://www.eia.gov/dnav/ng/ng_move_expc_s1_m.htm
[28] http://europa.eu/rapid/press-release_MEX-17-1964_en.htm

Figure 18. Spot LNG prices in the EU and Asia



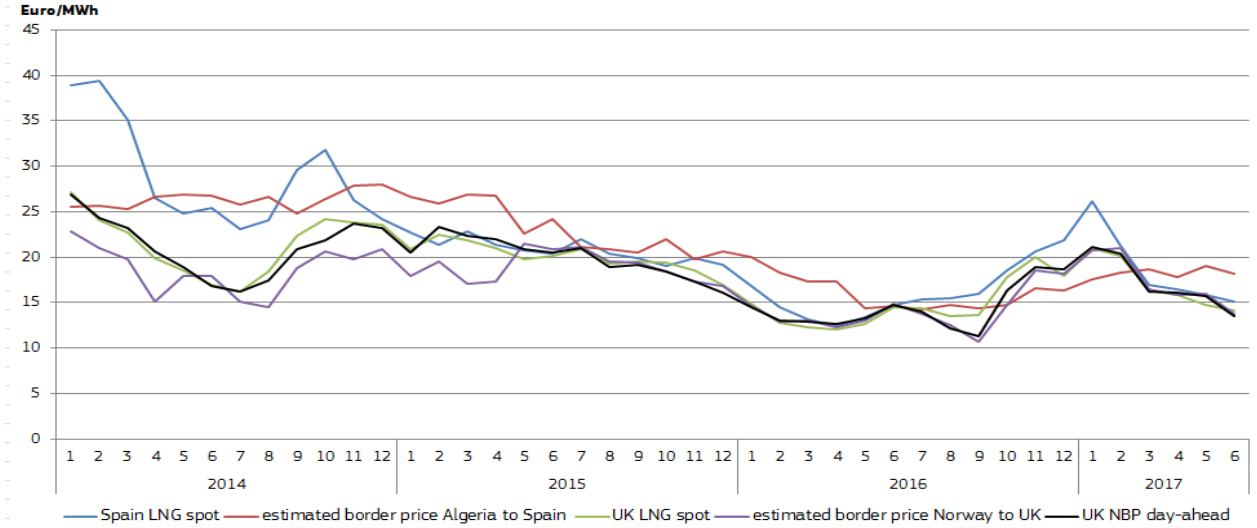
Note: Landed prices for LNG
Source: Thomson-Reuters Waterborne

- 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.

- In the UK, spot LNG prices closely follow the NBP price although, unusually, in September 2016 the average LNG price was 2.3 Euro/MWh above the average NBP price. 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 second quarter of 2017, the estimated price of Norwegian imports was on average 0.1 Euro/MWh above the NBP price while the spot LNG price was on average 0.1 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. From 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 falling oil prices while LNG prices were supported by strong Asian demand during the 2016-2017 winter. By the second quarter of 2017, however, LNG prices decreased while the price of Algerian pipeline gas recovered. In the second quarter, the estimated price of Algerian imports was on average 2.6 Euro/MWh more expensive than spot LNG prices. Gas flows reflected this price development: Spanish LNG imports gradually increased over the second quarter, while pipeline supplies from Algeria significantly decreased.

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

2.3 European gas markets

2.3.1. Wholesale markets in the EU

- Similarly to the first quarter of the year, liquidity on the main European gas hubs decreased in the second quarter of 2017: total traded volumes amounted to around 10,400 TWh, 16% less than in the same period of 2016. This is still about 18 times more than the gas consumption of the seven Member States covered by the analysis in this period. Traded volumes decreased year-on-year in the Austrian (-13%), Belgian (-25%), Dutch (-17%), German (-14%), Italian (-11%) and UK (-15%) hubs; only the French hubs showcased an increase (20%). Analysts suggested that the smaller liquidity is explained by lower volatility and a lack of trade on seasonal products.[29]

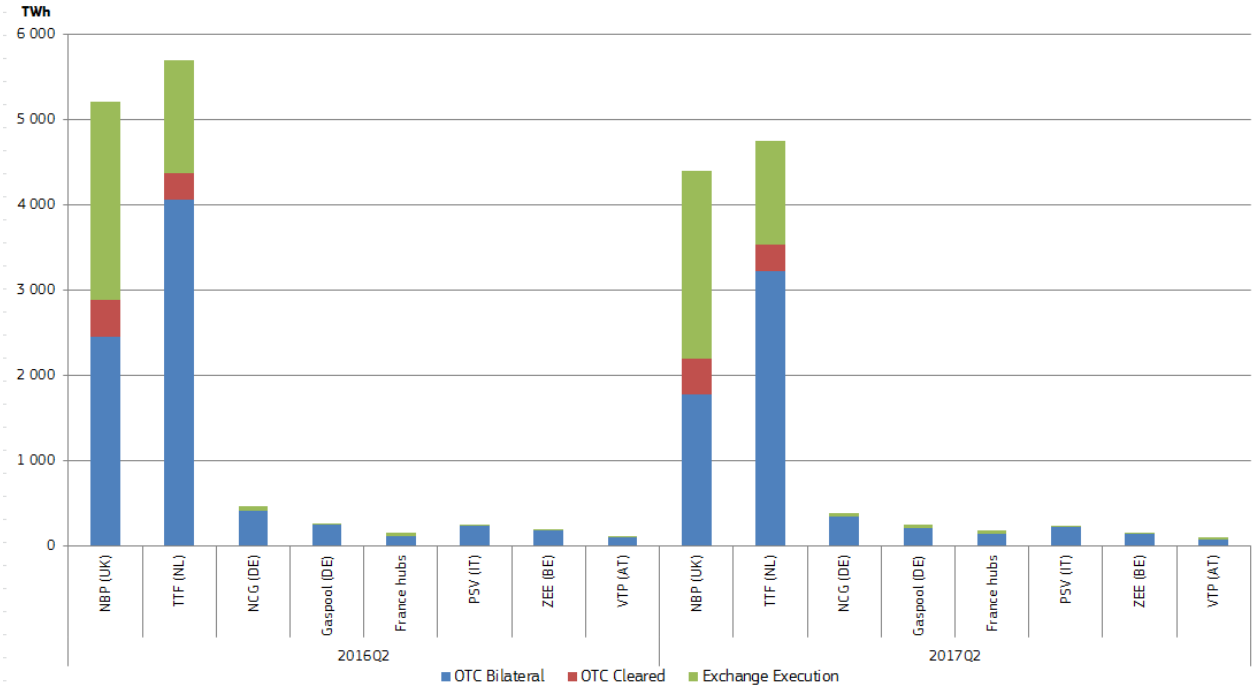
- TTF and NBP continued to have a dominant position in the second quarter of 2017, covering 46% and 42% of hub traded volumes, respectively. These shares are identical with those observed a year earlier. With the increasing trading volumes, French hubs gained some ground: their share increased from 1.3% in the second quarter of 2016 to 1.8% in the same period of 2017.

- On the UK NBP hub, half of total traded volumes were executed directly on an exchange in the second quarter of 2017. This share was 25% on the Dutch TTF hub, 23% at the French hubs, 21% at the Austrian hub, 13% at the German hubs but only 1% at the Belgian and Italian hubs. At the Austrian hub, the share of exchange trade was significantly higher than a year earlier (6%).

- At EU level, OTC markets remained the main trading venue but their share slightly decreased from 69% in the second quarter of 2016 to 66% in the same period of 2017. 11% of OTC volumes were cleared at a clearinghouse in the second quarter of 2017, up from 9% in the same period of the previous year.

- In May, the German Federal Cabinet adopted a draft regarding amendments to the Gas Network Access Ordinance, according to which the two existing German gas market areas, NCG and Gaspool, are to be merged as of 1 April 2022.[30] In July, the legislation was approved by the Bundesrat.[31] The merged hub, with its increased liquidity, is expected to have a stronger position in the European gas market.

Figure 20. Traded volumes on the main European gas hubs in the second quarter of 2016 and 2017

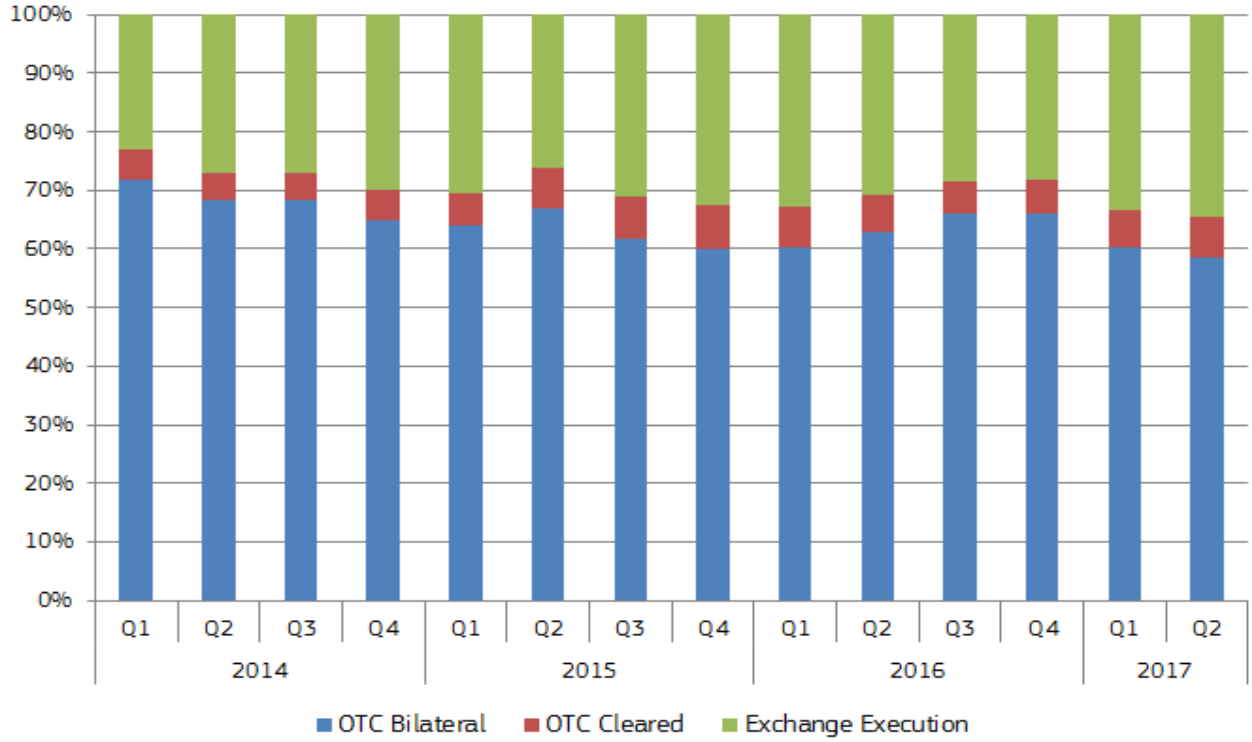


The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point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

[29] ICIS European Gas Markets, 15 June 2017
[30] http://www.bmwi.de/Redaktion/EN/Pressemitteilungen/2017/20170524-bundeskabinett-bringt-aenderung-der-gasnetzzugangsverordnung-auf-den-weg.html
[31] http://www.bundesrat.de/SharedDocs/TO/959/tagesordnung-959.html?cms_topNr=90#top-90

- Since 2014, exchanges gradually gained ground: their share from total trading volumes was 34% in the second quarter of 2017, compared to 31% in the same period of 2016. The share of cleared OTC volumes was 7% of total traded volumes in the second quarter of 2017, up from 6% a year earlier.

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 (NetConnect 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

2.3.2. Wholesale price developments in the EU

- European hub prices significantly increased between September 2016 and January 2017, supported by cold weather (especially when compared to the previous year), strong demand in the power sector, depleting stocks, the outages of several French nuclear reactors, low LNG imports in Northwest Europe and uncertainty about the Rough storage site in the UK. In February and especially March, relatively mild weather and growing LNG imports helped prices to reverse.

- In the second quarter, European hub prices averaged around 16 Euro/MWh, roughly 18% more than in the same period of 2016. A late cold spell and strong injection demand provided some support to prices in April but in May and June prices decreased, helped by higher temperatures and rising LNG imports.

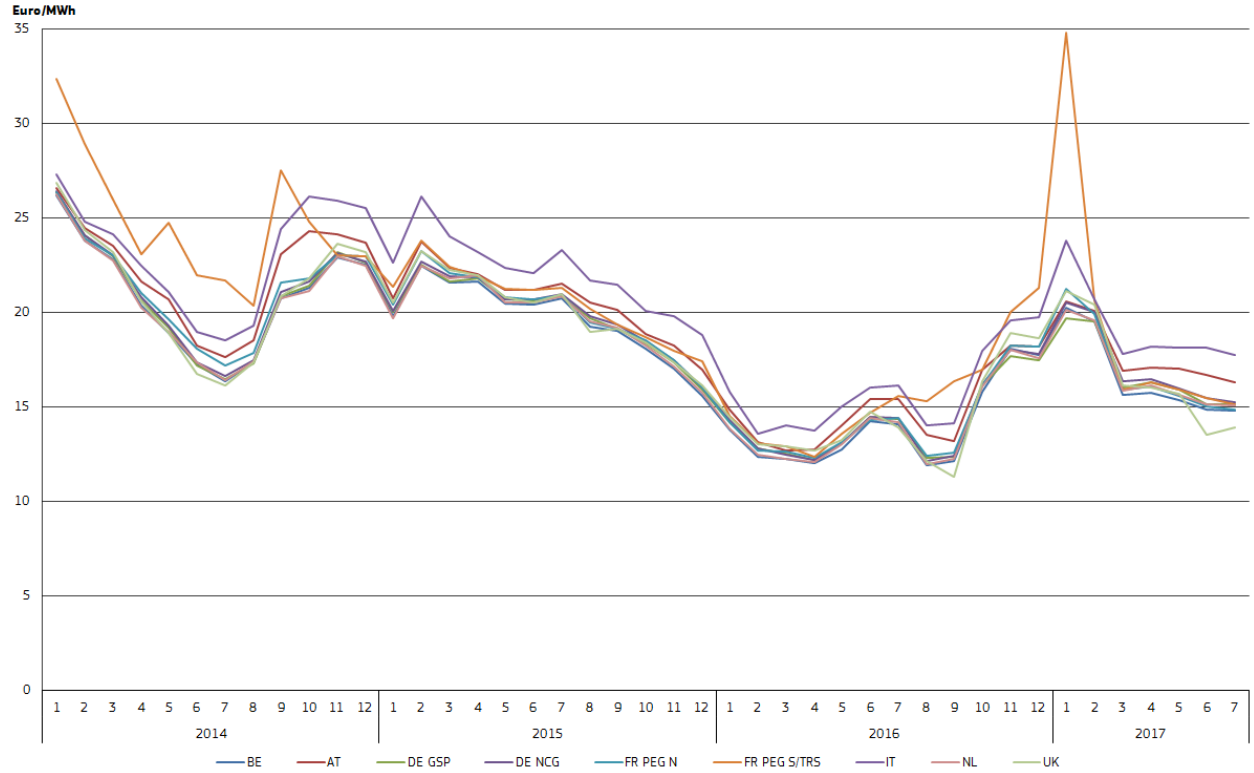
- During the past winter, gas at the UK hub traded at an usually high price compared to mainland Europe: in the November 2016-February 2017 period, the average difference compared to the Dutch TTF hub was nearly 1.0 Euro/MWh. Low stock levels after the outage of the Rough site, the UK's largest storage 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. The trend turned with the arrival of summer: in June, gas at the UK hub traded 1.6 Euro/MWh cheaper than at the Dutch hub. With no injection demand at Rough, the UK market was oversupplied, putting pressure on day-ahead prices. The Belgium-UK Interconnector was closed for annual maintenance between 14 and 28 June; as the surplus gas could not leave the country, the discount of NBP to TTF reached up to 5.0 Euro/MWh in this period.

- Prices at the Italian PSV hub remained relatively high in the second quarter of 2017, with an average premium of 2.5 Euro/MWh above TTF, the Dutch hub. Reduced imports from North Africa and strong storage injections provided support to Italian prices.

- In France, the premium of TRS over PEG Nord reached exceptional levels, averaging 13.5 Euro/MWh in January 2017 when high seasonal demand coupled with low LNG imports (and the persistent capacity restrictions on the north-south pipelines within France) caused supply tightness in the southern part of the country. By early February, milder weather and additional LNG cargoes allowed the situation to ease and the premium of TRS over PEG Nord has practically disappeared. In the second quarter of 2017, TRS

traded only 0.3 Euro/MWh above PEG Nord on average. In this period, the average price at the PEG Nord hub was slightly lower than at TTF, helped by a significant increase in LNG imports to the terminals in northern France.

Figure 22. Wholesale day-ahead gas prices on gas hubs in the EU



Source: Platts

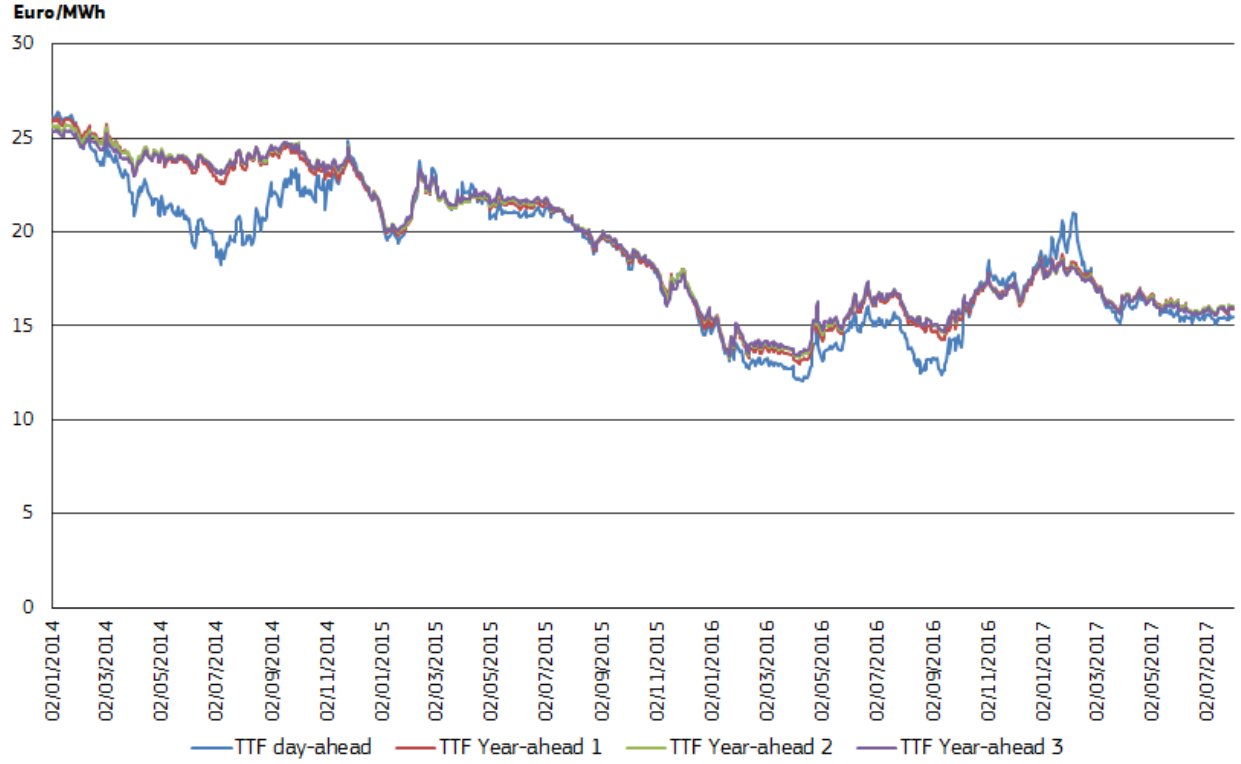
- Figure 23 looks at the development of forward prices one, two and three years ahead in comparison to the development of the day-ahead price on the Dutch TTF. For most of 2014, there has been a situation of contango[32], whereby closer to the present date prices are lower than prices for future deliveries. 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 2016, the year-ahead price was on average 0.7 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 to mid-February 2017, day-ahead prices have been consistently higher than year-ahead prices. In January-February 2017, the difference averaged 1.0 Euro/MWh as day-ahead prices were supported by below-average temperatures while a looming LNG oversupply put pressure on forward prices. From March, forward prices has been again slightly above day ahead prices, with the difference averaging 0.4 Euro/MWh in the second quarter of the year.

[32] See the glossary for a definition of contango

Figure 23. Forward gas prices on the Dutch gas hub



Source: Platts

2.3.3. 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.

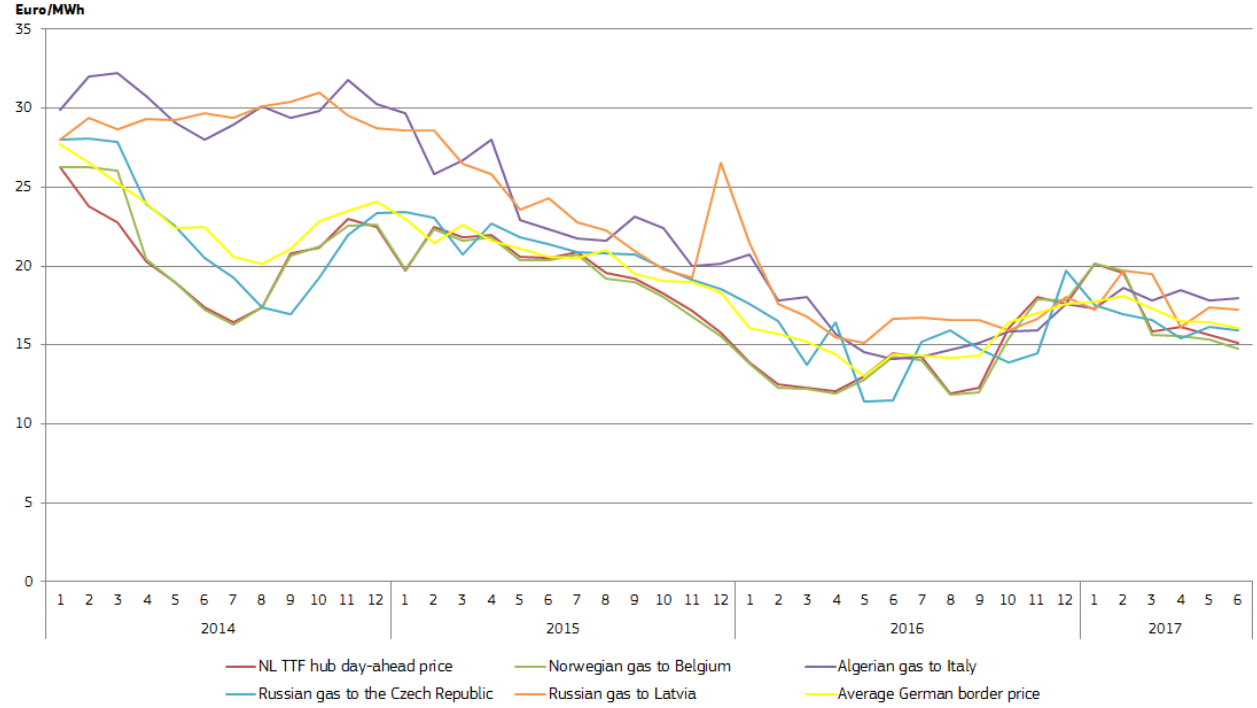
- Estimated border prices showed a clear declining trend over 2015 and the first half of 2016. Driven by the oil price drop observed in the second half of 2014, oil-indexed prices fell faster than hub-based prices, leading to a significant price convergence in mid-2015. From the last quarter of 2015, however, the difference between the prices of various contracts increased again, although not to levels seen in previous years.

- 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 Dutch TTF 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.

- In the first quarter of 2017, both hub prices and oil-indexed prices increased compared to the last three months of 2016. Hub prices were supported by a relatively cold winter while oil-indexed prices grew in the wake of the gradual rise of oil prices during 2016. The different prices have been rather volatile, often moving in the opposite direction but, looking at the average quarterly prices, there was no significant discrepancy between hub prices and oil-indexed prices.

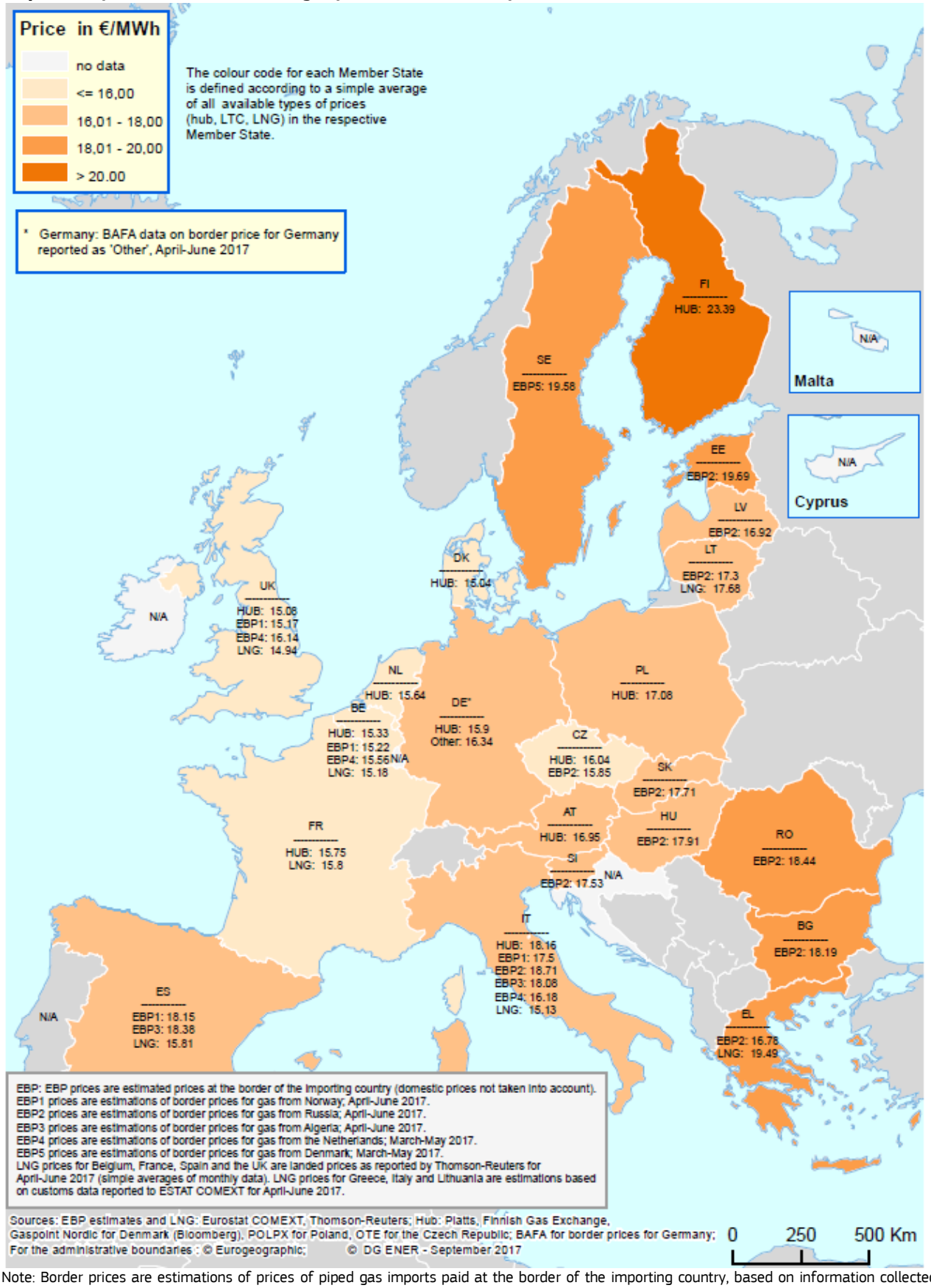
- In the second quarter of 2017, hub prices gradually decreased while oil-indexed prices remained elevated, supported by the delayed impact of the oil price rise seen in 2016. In June, the typically oil-indexed prices of Russian gas to Latvia and Algerian gas to Italy were 2-3 Euro/MWh more expensive than the price at the Dutch TTF hub.

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 2017



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.

3. Retail prices in the EU

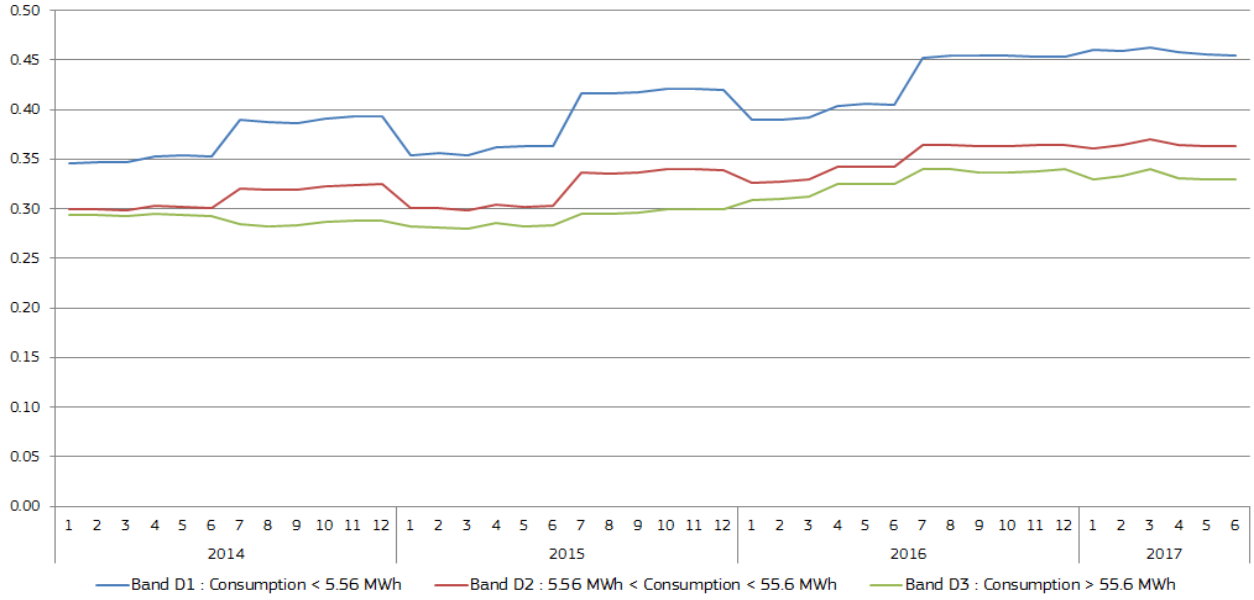
- Figures 25 and 27 show the convergence of retail gas prices for household and industrial consumers, using as a metric the relative standard deviation[33] of the prices in individual Member States. Monthly retail prices are estimated by using half-yearly prices from Eurostat (with the latest available figures relating to the second 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 and decreased afterwards, with signs of a renewed increase in 2017. In the most typical consumption band, D2, the estimated average price (including all taxes) in June 2017 was 6.5 Eurocents/kWh, 7% more than a year earlier. In this period, the estimated price increased in about two-thirds of the Member States.

- 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 since 2014. Since mid-2016, the standard deviations seem to have stabilised, indicating that the diverging trend has come to an end. 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 June 2017, the estimated household price in consumption band D2 varied between 3.3 Eurocent/kWh in Romania and 11.5 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

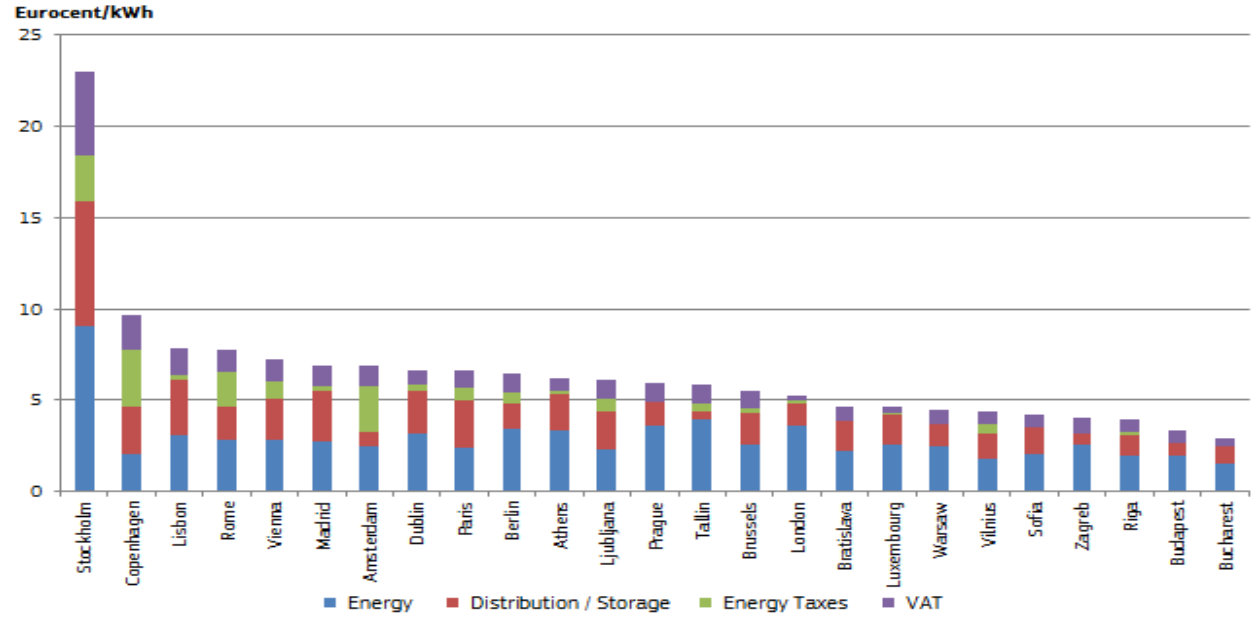
- Figure 26 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in June 2017. On average, 48% of the price covered the energy component, while the rest covered distribution/storage costs (28%), energy taxes (7%) and VAT (16%).[34]

- There are significant differences across Member States, with the share of energy cost ranging from 21 to 70%, the share of distribution/storage costs ranging from 8 to 40% and the share of taxes ranging from 8 to 52%. 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.

- In 15 of the 25 capitals, prices were higher in June 2017 than a year earlier, with the biggest increases in Tallinn (37%) and Athens (16%). At the other end of spectrum, prices decreased by 15% in Lisbon and by 12% in Vilnius.

[33] 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.
[34] Note that these are arithmetic averages.

Figure 26. The breakdown of gas price paid by typical household customers in European capitals, June 2017



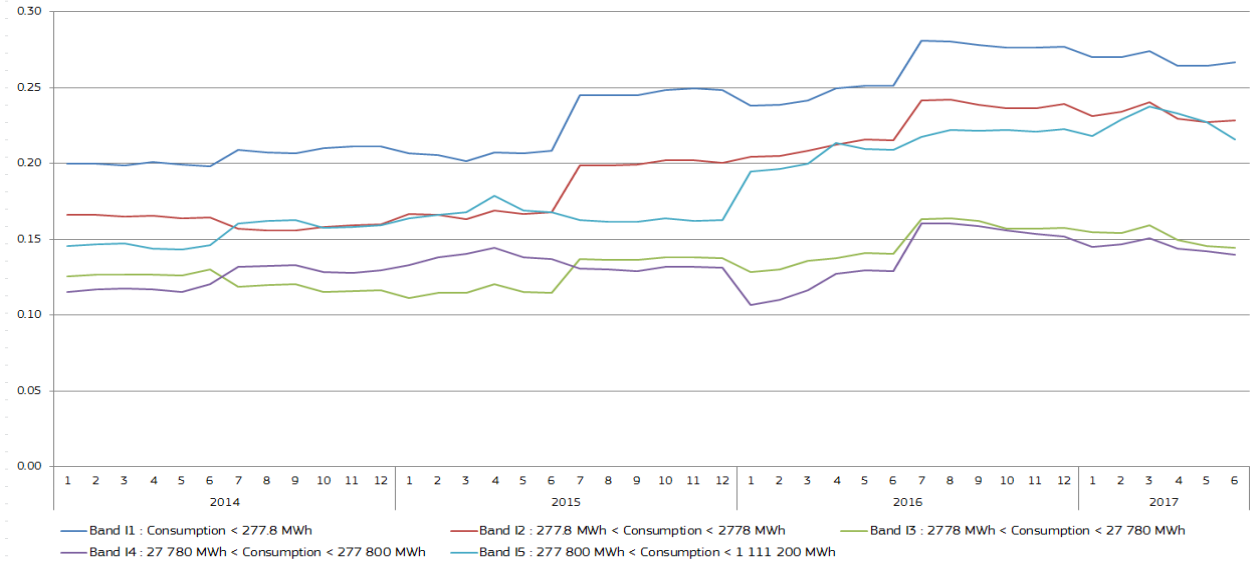
Source: VaasaETT

- Estimated industrial prices started to decrease already in 2014, and the trend continued in 2015 and 2016, with signs of a slight increase in 2017. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.46 Eurocent/kWh in June 2017, 1% more than a year earlier. Prices increased in this period in more than half of the Member States. Greek (15%), Spanish (12%) and French (12%) industrial consumers had to cope with the biggest year-on-year increases while the UK (-12%) and Portugal (-12%) saw double-digit decreases.

- 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 the second half of 2016, relative standard deviations seem to have plateaued, followed by a slight increase in 2017.

- In June 2017, Bulgaria had the lowest estimated industrial price in consumption band I4 (1.78 Eurocent/kWh), while the highest price was observed in Sweden (3.57 Eurocent/kWh). The price differential ratio between the cheapest and the most expensive Member State of the EU increased from 1.7 at the beginning of 2016 to 2.4 in mid-2016 but decreased afterwards, reaching 2.0 in June 2017.

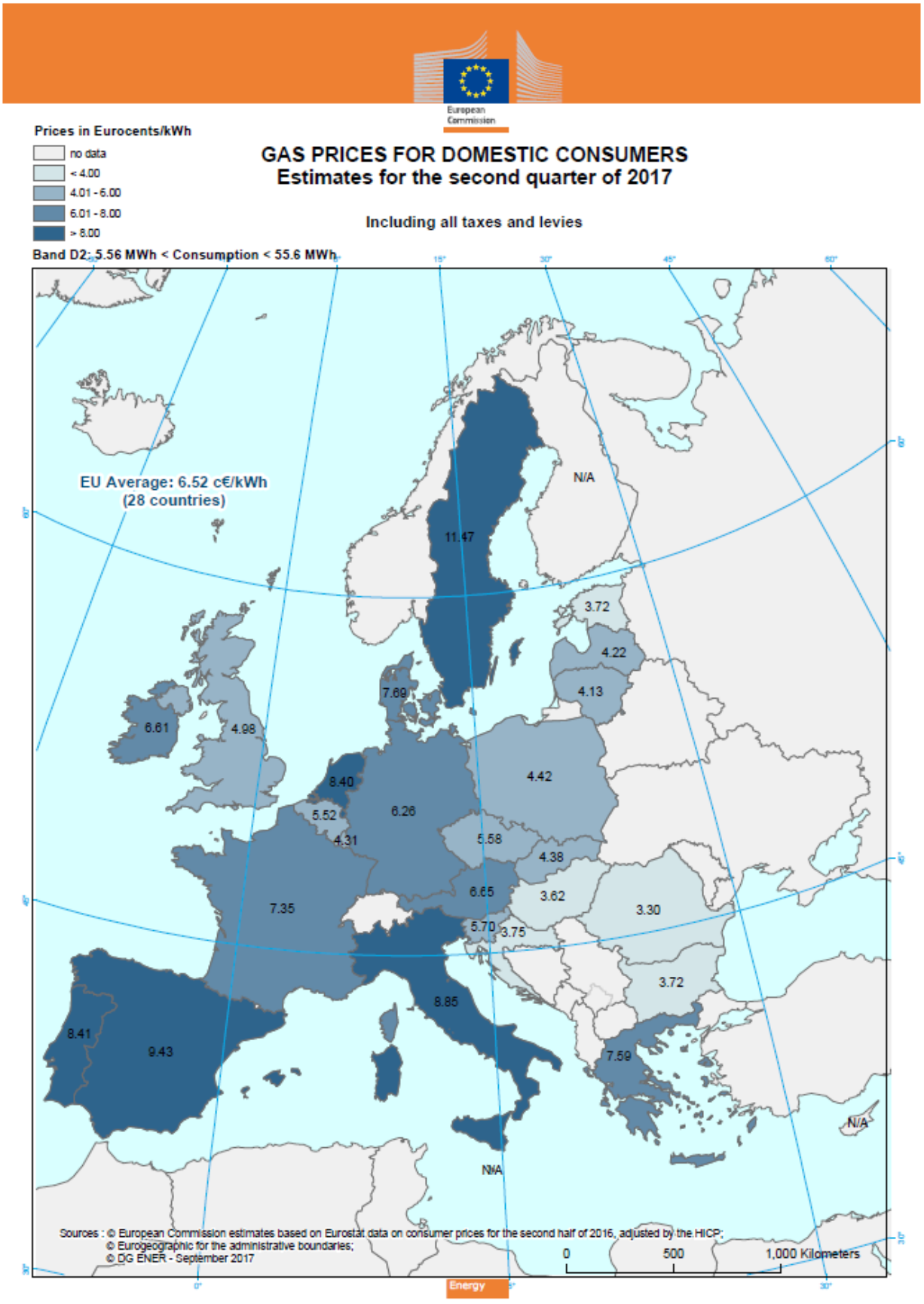
Figure 27. Relative standard deviation of gas prices paid by industrial consumers in EU Member States



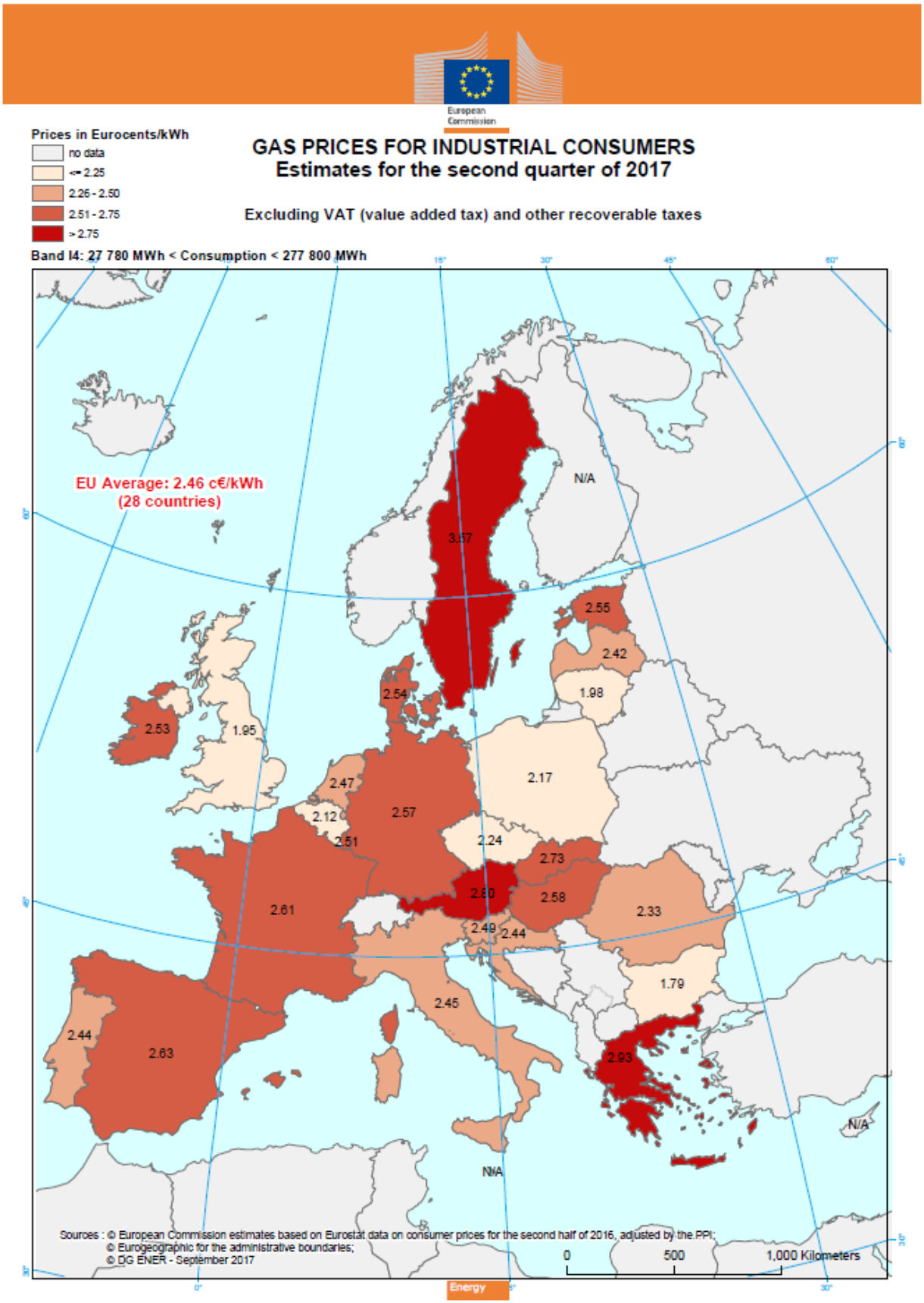
Note: Excluding VAT and other recoverable taxes.
Source of data: European Commission estimates based on Eurostat data on industrial prices adjusted by the PPI

- Maps 2 and 3 show the estimated retail gas prices paid by households and industrial consumers in the second quarter of 2017.

Map 2. Retail gas price estimates for households in the EU – Second quarter of 2017



Map 3. Retail gas price estimates for industrial consumers in the EU – Second quarter of 2017



4. 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 Euro/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.