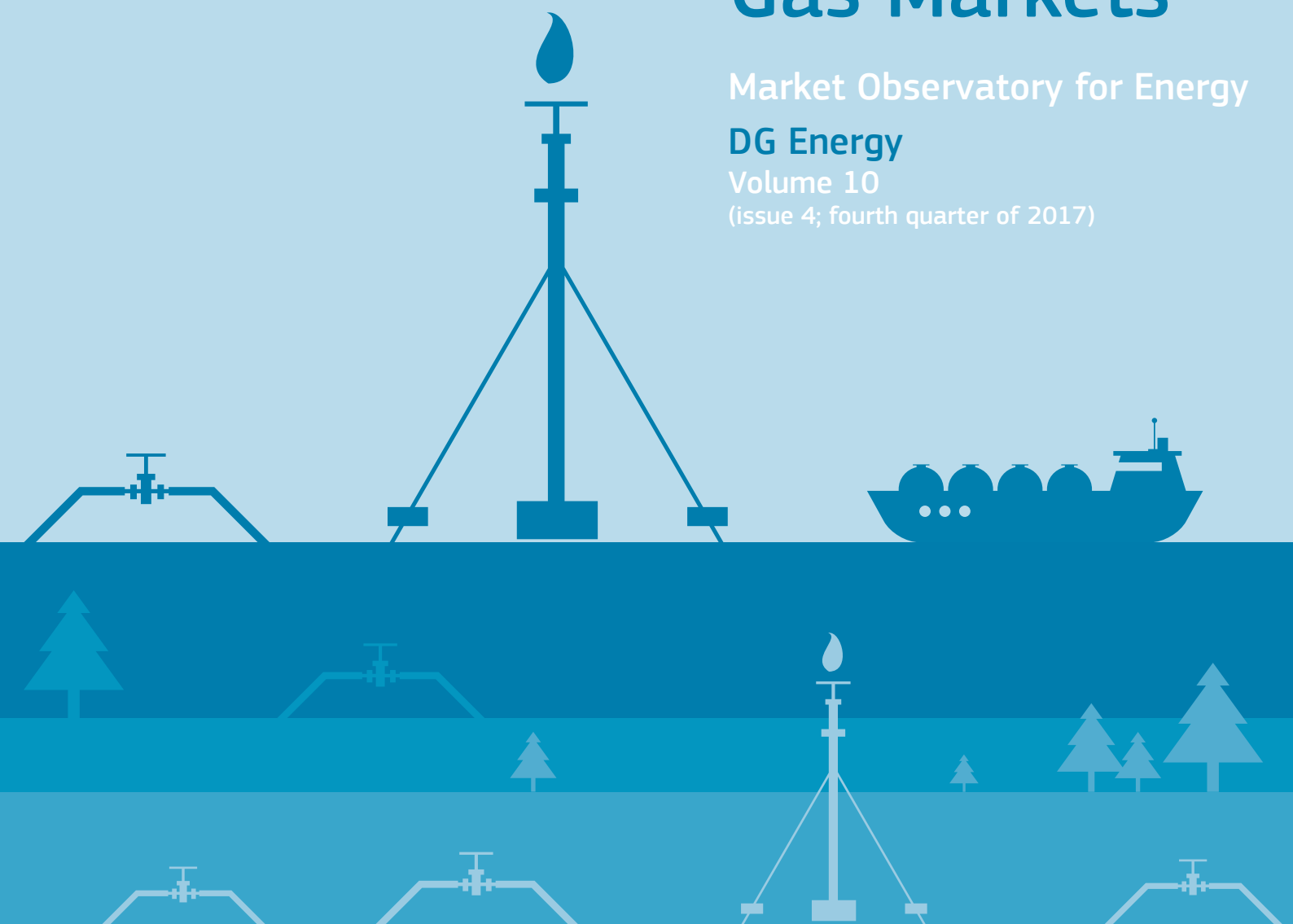




# Quarterly Report

## on European Gas Markets

Market Observatory for Energy  
DG Energy  
Volume 10  
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## HIGHLIGHTS OF THE REPORT

- **After seven quarters of consecutive growth, in the fourth quarter of 2017 EU gas consumption decreased by 2% year-on-year, as relatively mild weather reduced demand for space heating. In 2017 as a whole, consumption was 491 bcm, 6% more than in 2016 and the highest level since 2010.**
- **Imports increased by 6% year-on-year in the last quarter of 2017; apart from Libya, all import sources (Russia, Norway, Algeria and LNG) registered a year-on-year growth. The EU's estimated gas import bill was around 21 billion euros in this period. Imports in 2017 amounted to around 360 bcm, 10% more than in 2016, resulting in an estimated import bill of 75 billion euros.**
- **Following a court ruling related to the OPAL pipeline, a considerable share of Ukrainian transit was rerouted to Nord Stream where throughput reached maximum capacity in the fourth quarter of 2017. However, Ukraine remained the main supply route of Russian gas in this period.**
- **Europe received the first cargo from Novatek's new Yamal LNG facility which means that, for the first time, a company other than Gazprom supplied Russian gas to the EU.**
- **A more flexible pricing strategy allowed Russia to slightly increase its market share in 2017. Algeria also seems to be resolved to move away from long-term oil-indexed contracts.**
- **In 2017, for the first time, the Netherlands became a net importer of gas on an annual basis.**
- **Although high prices in Asia driven by surging Chinese demand made Europe a less attractive destination for LNG supplies, EU LNG imports increased by 16% year-on-year in the last quarter of 2017.**
- **An explosion at the Baumgarten hub in Austria, coupled with a disruption of the Forties pipeline system in the UK, sent European hub prices soaring in mid-December but the outage was quickly resolved.**

## EXECUTIVE SUMMARY

- **EU gas consumption was 146 bcm in the fourth quarter of 2017, 2% less than in the same period of 2016.** After seven quarters of consecutive growth, this was the first time consumption fell compared to same period of the previous year. Although gas use in the power sector continued to grow, this was more than offset by the lower gas demand for space heating as a consequence of seasonally high temperatures. **In 2017 as a whole, driven by growing gas-fired generation, EU gas demand increased by 6% to 491 bcm, reaching the highest level since 2010.**
- EU gas **production decreased by 5% year-on-year in the last quarter of 2017.** On an annual basis, **EU output was 128 bcm in 2017, 3% less than one year earlier.** Falling Dutch production was partially offset by increases in Denmark, Romania and the UK. Driven by a combination of falling output and rising consumption, in 2017, **for the first time, the Netherlands became a net importer** of gas on an annual basis.
- **In the fourth quarter of 2017, EU gas imports were 6% higher than a year earlier.** Apart from Libya, all import sources (Russia, Norway, Algeria and LNG) registered a year-on-year growth. **Russia remained the EU's top supplier,** covering 43% of extra-EU imports, followed by Norway (34%) and LNG imports (12%). After a plunge in the second and third quarters of 2017, the share of North African pipeline supplies recovered (11%) as oil-indexed prices became more competitive relative to hub prices.
- Following a court ruling that lifted a suspension on Gazprom's right to book additional capacity on the OPAL pipeline, **a considerable share of Ukrainian transit was rerouted to Nord Stream** in the last quarter of 2017 but Ukraine remained the main supply route of Russian gas coming to the EU, covering 39% of the total, while Nord Stream accounted for 34%.
- **EU LNG imports increased by 16% year-on-year in the fourth quarter of 2017.** Deliveries remained muted in Northern Europe where LNG has to face with other competitive sources but flows to the Mediterranean countries continued to rise, in spite of the recovery of Algerian pipeline imports and high Asian prices attracting cargoes. **The EU received the first LNG cargo from Russia's new Yamal project,** the first delivery of Russian gas from a company other than Gazprom. France became the ninth Member State to import LNG from the US. Chinese LNG imports showed a robust growth in 2017, overtaking Korea for the first time.
- **In 2017 as a whole, imports were around 360 bcm, 10% more than in 2016,** supported by a combination of increasing consumption and falling indigenous production. **Switching to more flexible "hybrid" contracts allowed Russia to increase its market share** from 42% in 2016 to 43% in 2017. Algeria also seems to be resolved to offer more flexible contractual terms, progressively moving away from long-term oil-indexed contracts.
- For most of the injection period, the average filling rate was 5-10 percentage points lower than a year earlier. However, injections accelerated from September and **the injection season lasted longer than usual.** As a result, by November the filling rate was comparable to the 2016 levels. In the fourth quarter of 2017, **withdrawals were lower than in the same period of 2016,** driven by milder temperatures. On 31 December 2017, the average filling rate was 65%, 1 percentage point higher than a year earlier.
- There has been a **strong correlation between European hub prices and global oil and coal benchmarks** in 2017, reflecting the close relationship between the gas market and the wider energy complex.
- **Spot prices at European gas hubs increased between August and December,** driven by a number of factors, including the relatively low storage levels, continuing coal-to gas switching, rising oil and coal prices, increasing weather-related demand, outages in Norway and the UK and persistent concerns about French nuclear availability. In the fourth quarter, hub prices were roughly 10% higher than a year earlier. **Oil-indexed prices,** on the other hand, **decreased** and by the end of the year became comparable to hub prices in Northwest Europe.
- Since 2016, **prices at the UK gas hub are increasingly disconnected from mainland hubs,** showing a distinct seasonality. Because of the woes of the Rough storage facility, the UK has low injection demand and oversupply in summer and a tighter market in winter, thereby increasing the seasonal spread.
- An **explosion at the Baumgarten hub,** coupled with a disruption of the Forties pipeline system in the UK, **sent European hub prices soaring** in mid-December, with the day-ahead price at the Italian PSV hub reaching a record 80 Euro/MWh. The outage was quickly resolved and prices promptly receded. Price signals and the availability of alternative supply sources and infrastructure kept the gas flowing in both Italy and the UK
- After strong convergence in mid-2017, **international gas prices diverged** again from August as Asian and European prices started to rise while the US Henry Hub price remained remarkably stable. Asian LNG prices spiked as a result of strong seasonal demand and a robust growth of Chinese LNG imports.

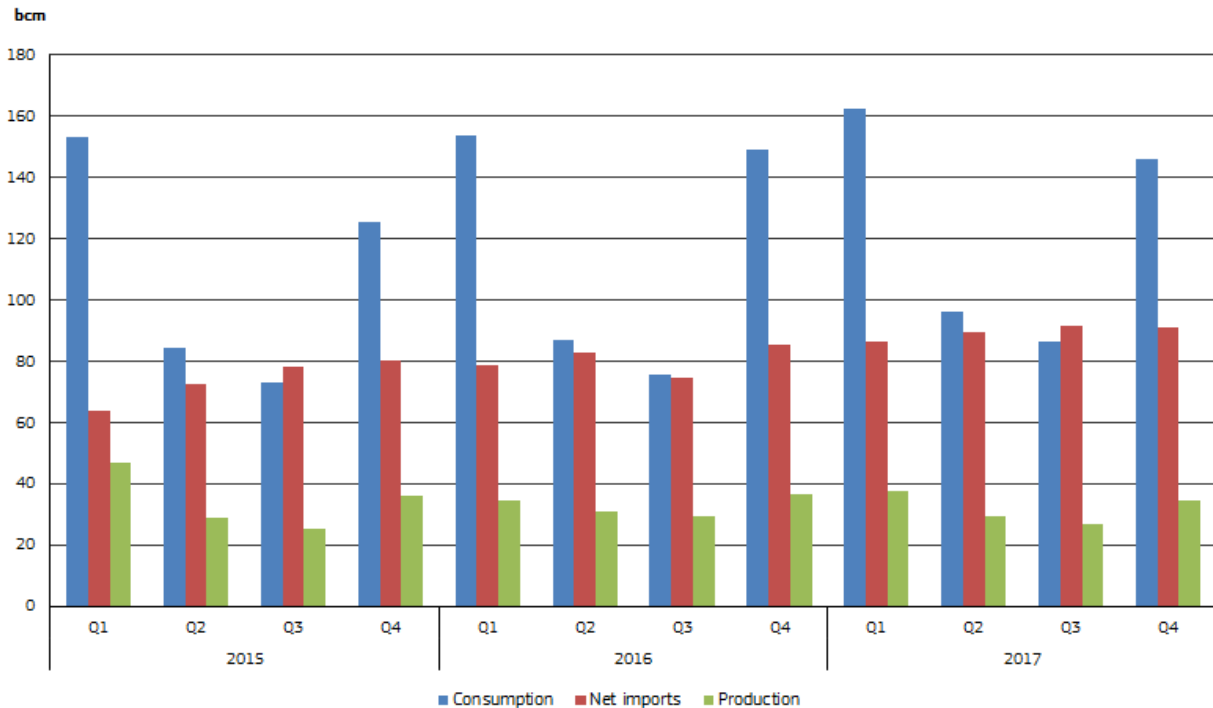
- After a decrease in the first half of 2017, **liquidity on European gas hubs increased** in the third and fourth quarters. In the fourth quarter, the growth rate was 8% year-on-year. On an annual basis, however, traded volumes were 4% lower in 2017 than a year earlier. In 2017, traded volumes amounted to 44,500 TWh, around 11-12 times more than the gas consumption in the countries concerned. The Dutch and UK hubs continued to dominate trading, with the smaller hubs failing to gain ground over the last three years.
- After decreasing in the last 2-3 years, **retail prices seem to have stabilised**. At the same time, the trend of diverging prices across the EU has come to an end in case of both household and industry prices.

# 1. Gas market fundamentals

## 1.1 Consumption

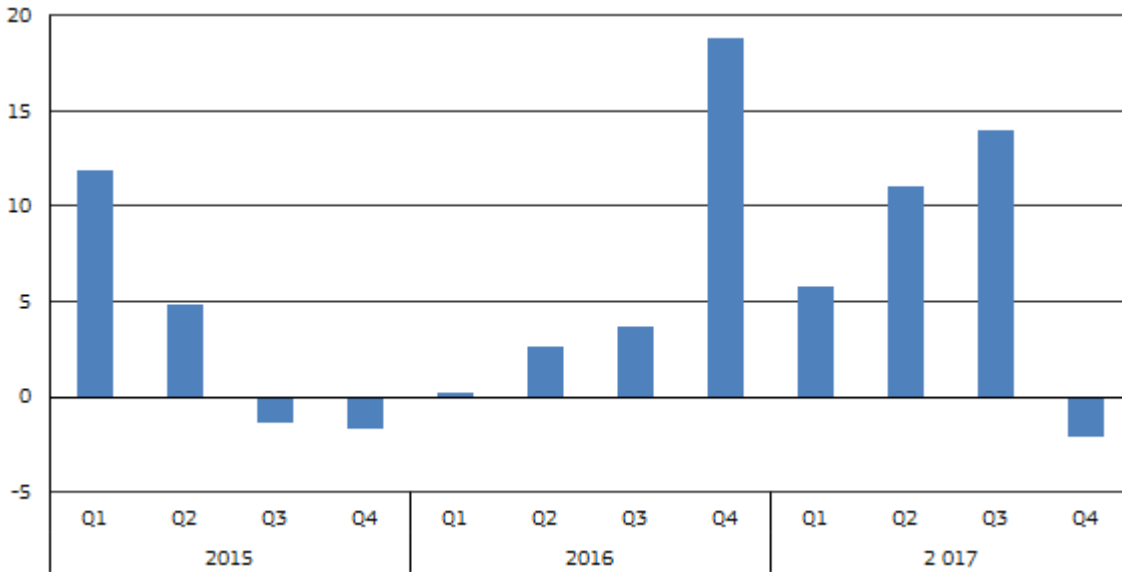
- After seven quarters of consecutive growth, in the last quarter of 2017 EU gas consumption decreased by 2% year-on-year, totalling 146 bcm. Although gas use in the power sector continued to grow, this was more than offset by the lower gas demand for space heating as a consequence of relatively high temperatures (especially when compared to the same period of the previous year). Consumption decreased in the majority of the Member States, with only Greece (1%), Ireland (2%), Italy (1%), the Netherlands (2%), Poland (3%) and Spain (9%) registering a growth. The biggest declines were observed in Denmark (-17%), Finland (-16%), Latvia (-13%) and Sweden (-17%), reflecting relatively high temperatures in Northern Europe. The demand of the two largest consumers, Germany and the UK, decreased by 6% and 3%, respectively.
- In 2017 as a whole, EU gas demand reached 491 bcm, 6% more than in 2016 and the highest level since 2010. The Netherlands showcased the biggest growth: the country used 30% more gas in 2017 than in 2016. Portugal (22%), Greece (21%) and Croatia (14%) also experienced a double-digit growth. At the other end of the spectrum, consumption decreased by more than 10% only in Sweden (-18%). Germany, Europe's largest gas market, had a growth rate of 3% while UK demand decreased by 3%.

**Figure 1. EU gas consumption, net imports and production**



Source: Eurostat, data as of 19 March 2018 from data series nrg\_103m. Net imports refer to imports minus exports.

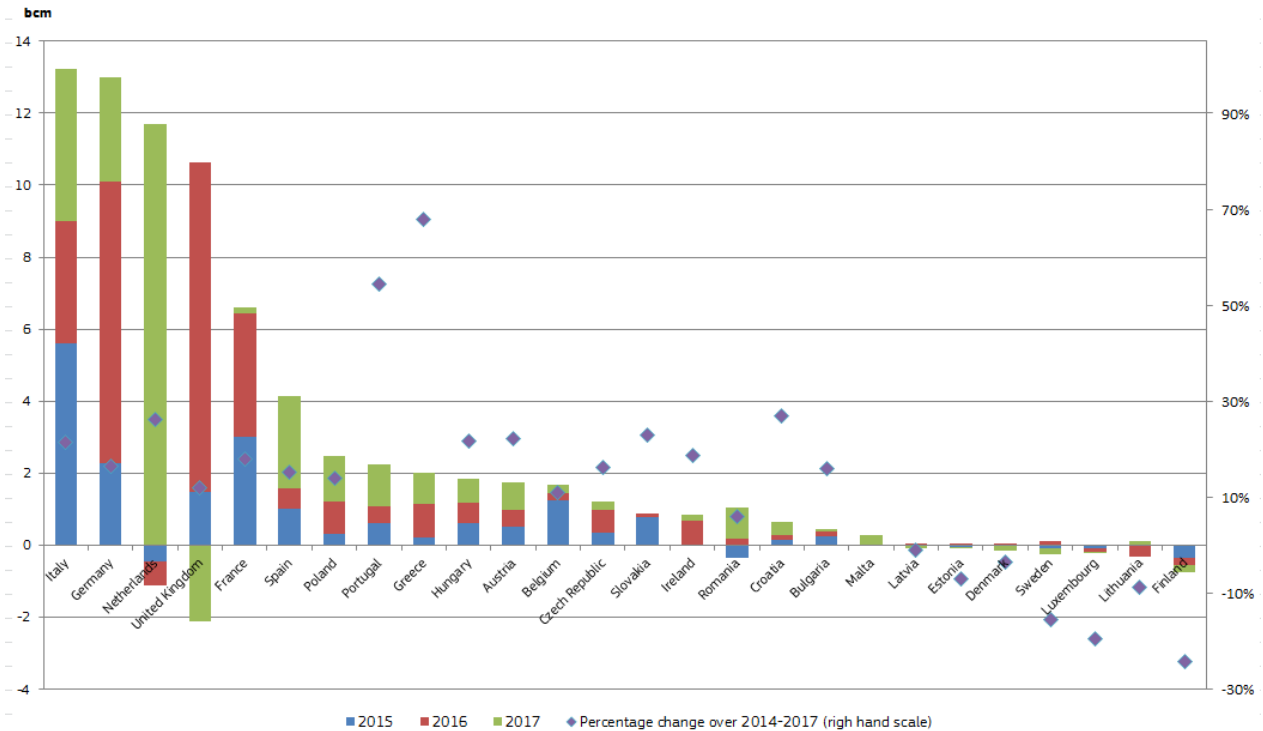
**Figure 2. EU gas consumption Q/Q-4 change (%)**



Source: Eurostat, data as of 19 March 2018 from data series nrg\_103m; calculations of DG Energy (based on consumption measured in bcm).

- EU gas consumption grew for three consecutive years: by 4% in 2015, 7% in 2016 and 6% in 2017. Consumption in 2017 was 72 bcm (17%) higher than in 2014.
- Between 2014 and 2017, Italy and Germany showcased the biggest consumption growth, representing 36% of the incremental EU demand. After robust growth in 2016, UK gas demand fell in 2017. In turn, Dutch consumption showed a strong growth in 2017 following smaller declines in 2015 and 2016. In terms of growth rates, Greece (68%) and Portugal (54%) experienced the fastest growth over this 3-year period.
- In the Baltic States and Northern Europe (Denmark, Estonia, Finland, Latvia, Lithuania and Sweden), gas consumption in 2017 was lower than in 2014, presumably related to weather factors. Finland experienced the biggest decrease in both absolute and relative terms (-24% over the three-year period).

**Figure 3. Change in annual gas consumption in 2015, 2016 and 2017 compared to the previous year**

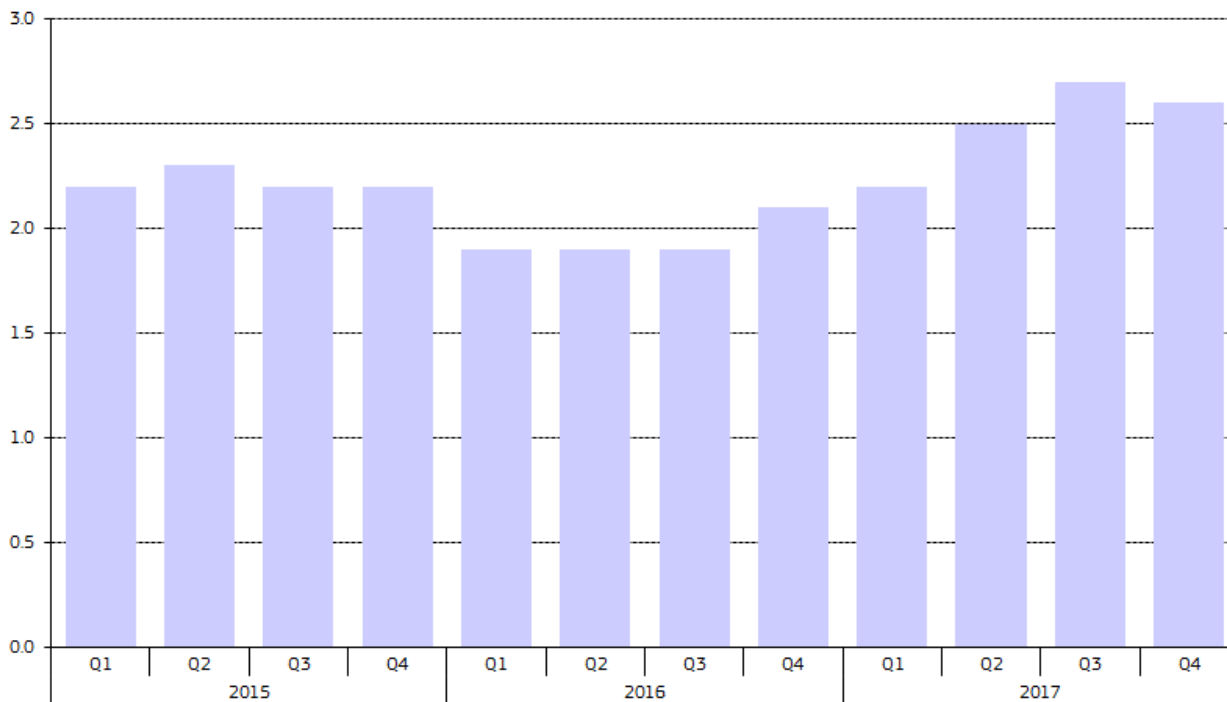


Source: Eurostat, data as of 19 March 2018 from data series nrg\_103m.



- Compared to the same quarter of the previous year, seasonally adjusted gross domestic product (GDP) rose by 2.6% in the fourth quarter of 2017. This is 0.1 percentage points lower than in the previous quarter but still one of the biggest growth rates seen in the last couple of years. Since the first quarter of 2017, GDP has been consistently growing in each Member State. The growing GDP probably contributed to the increase of gas consumption in 2016-2017.
- Industrial activity is also on the rise: the gross value added in the manufacturing sector was 4.5% higher in the fourth quarter of 2017 than a year earlier which is the fastest growth since 2011.<sup>1</sup>

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

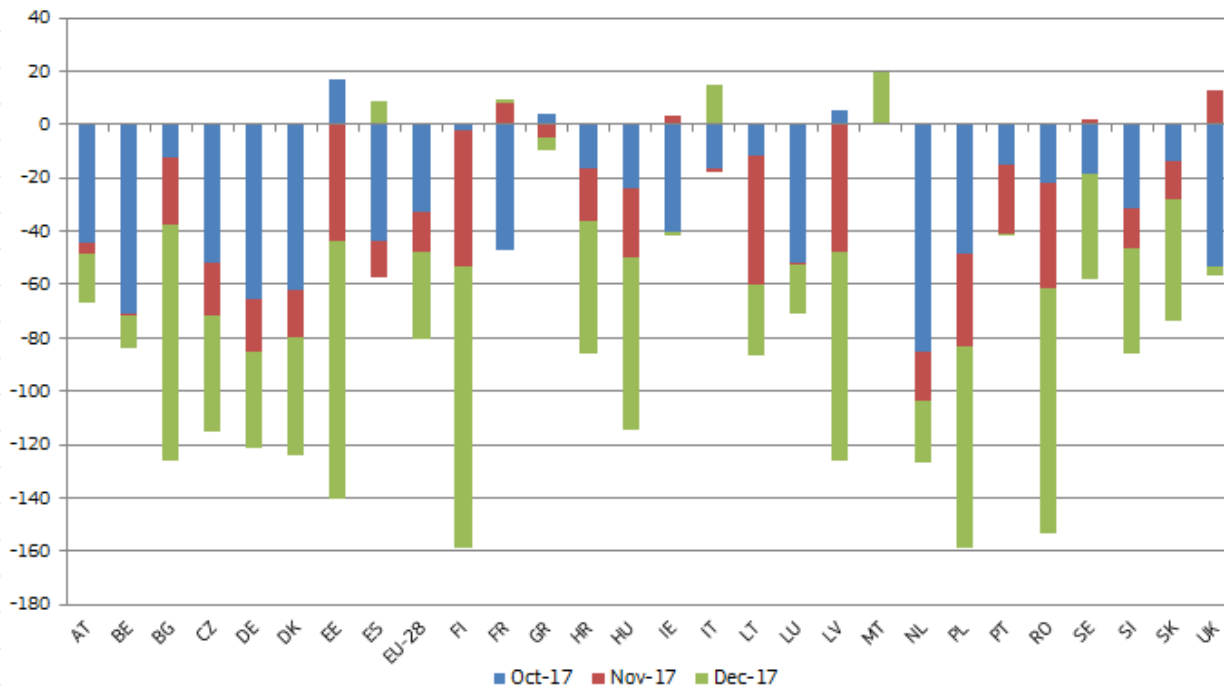


Source: Eurostat, data as of 13 March 2018 from data series namq\_10\_gdp  
Seasonally and calendar adjusted data

- Figure 5 shows the deviation of actual heating degree days (HDDs) from the long-term average in individual EU Member States in the fourth quarter of 2017. Apart from a few Mediterranean countries, the number of heating degree days in this period was well below the long-term average. Temperatures above the seasonal norm mitigated gas demand for space heating compared to the same period of the previous year.

<sup>1</sup> Source: Eurostat, data as of 13 March 2018 from data series namq\_10\_a10; seasonally and calendar adjusted data

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



Source: Joint Research Centre (JRC), European Commission

- In the eight markets<sup>2</sup> reported in Figure 6, gas deliveries to power generation increased by a modest 3% in the fourth quarter of 2017. Volumes increased in Spain (15%), the UK (13%) and Portugal (5%) but decreased in Belgium (-14%), France (-9%), the Netherlands (-4%), Italy (-2%) and Greece (-2%). In Spain, low hydro levels continued to provide support to gas-fuelled generation.
- In the eight selected markets, there was a robust year-on-year growth in November but in December volumes were lower than a year earlier. In December 2017, all these Member States, with the exception of the UK, reported a decrease compared to the same period of 2016.<sup>3</sup> Rising gas prices and an improvement in the availability of French nuclear capacity moderated gas use in the power sector in December.
- On an annual basis, gas deliveries to power generation in these eight markets increased by 11% in 2017, with all countries registering a growth. The growth rate was 48% in Portugal, 27% in Spain, 24% in the Netherlands, 19% in France, 18% in Greece, 8% in Italy and 4% in both the UK and Belgium. The shortage of French nuclear availability was an important driver for the increasing reliance on gas-powered generation in Western Europe.
- UK clean spark spreads – measuring the profitability of gas-fired generation – averaged 7 Euro/MWh in the fourth quarter of 2017. This is the lowest quarterly average level since 2015 but, helped by the carbon price support mechanism, gas-fired generation remained competitive compared to coal. The share of gas in power generation was 39.1% in the third quarter of 2017, compared to 42.9% a year earlier. The share of gas decreased at the expense of renewables while coal continued its declining trend (2.9%, compared to 3.6% a year earlier)<sup>4</sup>. The low share of coal suggests that the potential for further coal-to-gas switching is minimal.
- Clean spark spreads in Germany averaged -1 Euro/MWh in the last quarter of 2017; this is the lowest quarterly average since the second quarter of 2016.<sup>5</sup> Accordingly, the share of gas-fired power generation slightly decreased in the fourth quarter of 2017: according to preliminary data, it was 13.4%, compared to 14.3% in the same period of 2016.<sup>6</sup>

<sup>2</sup> Germany is not included because of gaps in reporting.

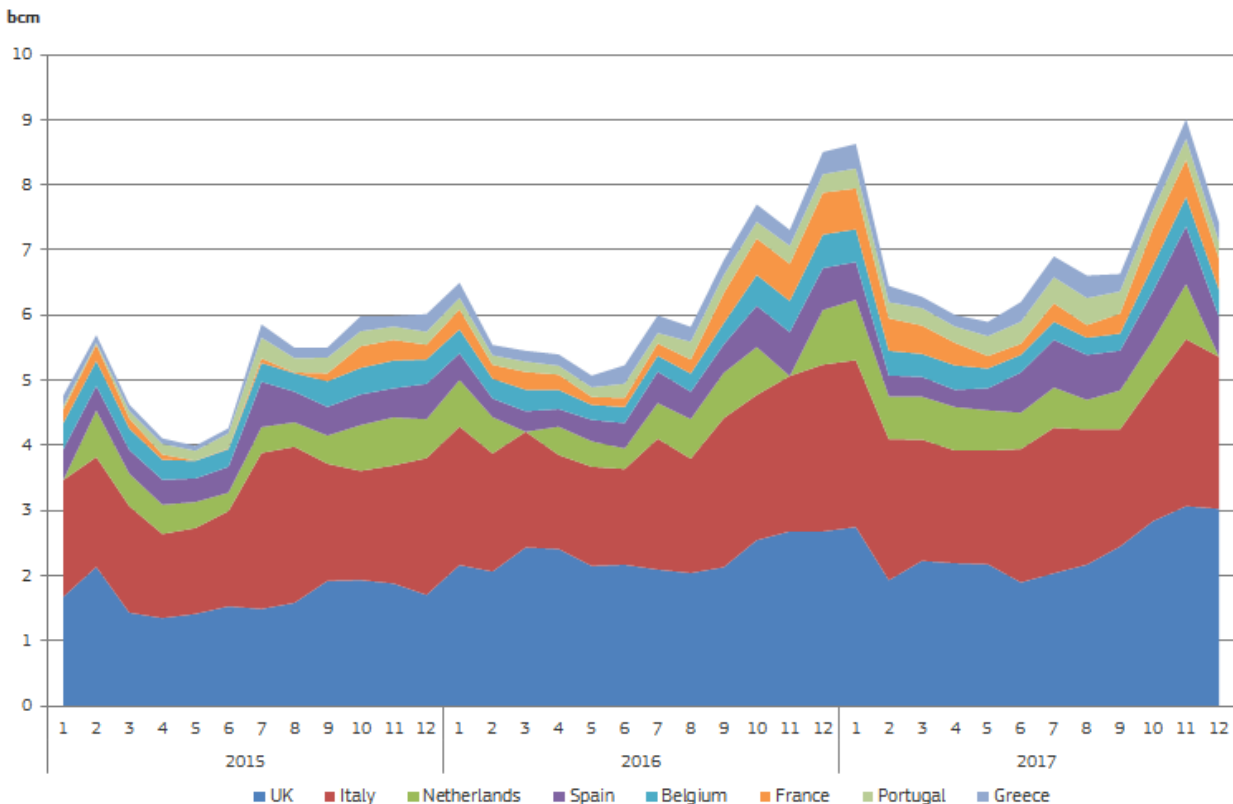
<sup>3</sup> The Netherlands reported no gas deliveries to power generation in December 2017 which is suspected to be an error.

<sup>4</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/669750/Energy\\_Trends\\_December\\_2017.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/669750/Energy_Trends_December_2017.pdf)

<sup>5</sup> Charts of clean spark spreads in Germany and the UK can be found in the Quarterly Report of European Electricity Markets

<sup>6</sup> <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 19 March 2018 from data series nrg\_103m. Germany is not included because of gaps in reporting.

## 1.2 Production

- In the last quarter of 2017, EU gas production was 35 bcm, 5% less than in the same period of 2016. Dutch production decreased by 10% which was partly offset by increases in Denmark (4%), Romania (6%) and the UK (1%).
- In Ireland, the gradual ramp-up of production at the Corrib field was interrupted by a disruption in September-October and, as a result, production decreased year-on-year in both the third and the fourth quarters.
- UK gas production slightly increased in the fourth quarter in spite of the closure of the Forties pipeline system in the North Sea between 11 and 30 December 2017.<sup>7</sup> The pipeline connects 85 oil and gas fields to the British mainland and transports around 40% of the UK's oil and gas production. To address the disruption, the UK increased pipeline imports from Belgium and the Netherlands in this period.
- In December 2017, Maersk Oil announced its largest project investment ever made in the Danish North Sea, for the full redevelopment of Tyra, the country's largest gas field. The investment, which will enable the field to continue operations for at least 25 years, was facilitated by the government's decision to reduce exploration taxes.<sup>8</sup> In the meantime, Total acquired Maersk Oil, closing the deal in March 2018.<sup>9</sup>
- In 2017, EU gas output increased year-on-year in the first quarter (by 8%) but decreased in the second, third and fourth quarters (by 6%, 9% and 5%, respectively). In 2017 as a whole, EU gas production amounted to 128 bcm, 3% less than in 2016. Looking at the largest producers, gas output decreased in the Netherlands (-9%), Germany (-8%), Poland (-2%) and Italy (-4%) while increased in the UK (1%), Romania (8%) and Denmark (7%). In absolute terms, Romania added the largest incremental volume (+0.8 bcm), followed by Ireland (+0.5 bcm). The Netherlands registered the biggest absolute decrease (-4.2 bcm) but this was lower than the decrease seen in previous years (-16.5 bcm in 2015 and -5.6 bcm in 2016).

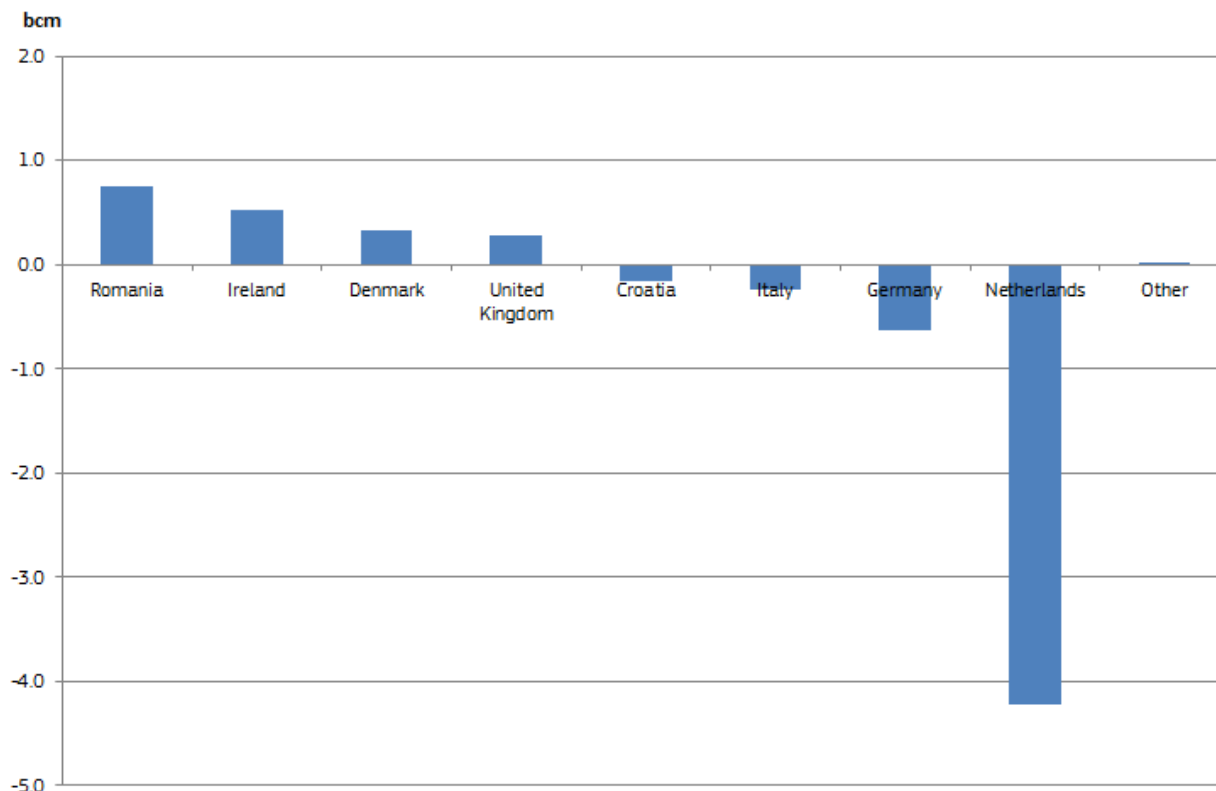
<sup>7</sup> <https://www.ineos.com/news/ineos-group/ineos-forties-pipeline-system-media-update/>

<sup>8</sup> <http://www.worldoil.com/news/2017/12/1/maersk-oil-announces-largest-project-investment-ever-made-in-the-danish-north-sea>

<sup>9</sup> <https://www.total.com/en/media/news/press-releases/total-closes-maersk-oil-acquisition-and-becomes-second-largest-operator-north-sea>

- In Romania, increasing domestic production, coupled with rising oil-indexed prices, allowed the country to reduce Russian imports, with practically no imports arriving in the second and third quarters of 2017.

**Figure 7. Change of annual gas production in 2017 compared to 2016**



Source: Eurostat, data as of 19 March 2018 from data series nrg\_103m.

### 1.3 Imports

- According to Eurostat data, net imports increased year-on-year by 6% in the fourth quarter of 2017. The Netherlands was the main contributor to this increase, considering that the country's net exports were nearly 3 bcm lower than in the same period of 2016. Among the biggest EU gas markets, the net imports of Germany and France increased by 2% and 1%, respectively, those of Italy were flat, while those of the UK fell by 4% year-on-year.
- In 2017 as a whole, net imports were 11% higher than in 2016. The rise of imports was driven by both decreasing indigenous output and growing consumption. Among the biggest gas markets, in 2017 the net imports of Germany increased by 6% while that of the UK decreased by 5%. For the first time, the Netherlands became a net importer on an annual basis, while continuing to be a net exporter in the first and fourth quarters of the year.
- ENTSO-G data show similar increases in extra-EU gas imports: a 6% year-on-year increase in the last quarter of 2017 and a 10% annual increase in 2017 (see Figure 8). Imports in the fourth quarter (1123 TWh) were the highest quarterly level observed in the last four years. EU gas consumption decreased in the last quarter but imports were supported by injection (which continued for most of October) and decreasing production. Apart from Libya, all import sources (Russia, Norway, Algeria and LNG) registered a year-on-year growth.
- Pipeline imports from Russia increased by double-digit rates in the first three quarters of 2017 but the growth slowed down in the last quarter. In this period, Russian supplies were "only" 5% higher than a year earlier but still reached a record quarterly level. Russia remained the top supplier of the EU in the fourth quarter, covering 43% of total extra-EU imports, unchanged from the same period of 2016. In this period, hub prices were firmly on the rise while oil-indexed prices decreased, thereby helping the competitiveness of Russian supplies.

- The first train of Novatek's Yamal LNG project started up in 5 December 2017, providing a new supply route for Russian gas. The plant's current capacity is 5.5 million tons per year.<sup>10</sup> Novatek has already contracted to sell 96%-97% of its LNG from Yamal LNG to off-takers including project partner Total and most contracts are on an oil-indexed basis.<sup>11</sup> The Yamal project is Russia's second LNG export facility, bringing the country's liquefaction capacity to 15 million tons per year. The first plant in Sakhalin delivers LNG to the Asian market; the geographical position of the Yamal plant allows exports to both Asia and Europe.
- The commissioning of Novatek's LNG facility also meant that, for the first time, a Russian company other than Gazprom has exported gas. Gazprom has a monopoly on pipeline exports and is also involved in the Sakhalin LNG project. In its 2022 strategy published on 18 December 2017, Russia's state-controlled oil company Rosneft called for reconsidering Gazprom's export monopoly.<sup>12</sup> Earlier in 2017, the company even signed an agreement with BP that envisages the long-term sale of gas produced by Rosneft to European markets from 2019.<sup>13</sup>
- In 2017 as a whole, pipeline imports from Russia increased by 12% compared to 2016, reaching a record level of gas supplies to the EU. The country remained comfortably the top supplier of the EU and slightly increased its share from total extra-EU imports from 42% in 2016 to 43% in 2017. In order to make sure it can fill the growing import gap resulting from lower indigenous production in Europe, Gazprom is gradually switching to hybrid contracts which are indexed to both hub and oil prices; this model "combines the flexibility of spot markets with the predictability of long-term deals" and "saves the market from price shocks and gives the guarantee of daily supply security".<sup>14</sup>
- Pipeline imports from Norway increased by 4% year-on-year in the fourth quarter of 2017. The country's share from total extra-EU imports decreased from 35% in the same period of 2016 to 34%.<sup>15</sup> In the fourth quarter of 2017, Norwegian gas production amounted to 32.8 bcm, 2% more than in the same period of the previous year.<sup>16</sup>
- In 2017 as a whole, Norwegian pipeline supplies increased by 9% and the country's market share was 34% from total EU imports, unchanged from 2016. The country remained the EU's second gas supplier. In 2017, Norway produced 124.2 bcm of gas, 6% more than a year earlier. For 2018, the Norwegian Petroleum Directorate expects an output of 121.2 bcm, which is 2% less than the 2017 production.<sup>17</sup>
- In the last quarter of 2017, pipeline imports from Algeria increased by 6% while those from Libya decreased by 1% year-on-year. Algerian imports increased in both Spain (9%) and Italy (3%). The combined share of Algeria and Libya from total extra-EU imports was 11%, unchanged from the same period of 2016. After a sizable year-on-year decline observed in the second and third quarters (when high oil-indexed prices provided an incentive for importers to switch to cheaper spot LNG), buyers had to increase purchases in the last quarter to ensure that they comply with their minimum take-or-pay obligations. Falling oil-indexed prices also supported this trend.
- Pipeline imports from North Africa decreased by 2% in 2017 as a whole. Algerian supplies were 2% lower than in 2016 while those coming from Libya decreased by 3%. Algerian supplies to Italy remained practically unchanged whereas deliveries to Spain fell by 5%. The combined share of the two countries from total extra-EU imports was 10% in 2017, down from 11% in 2016.
- The CEO of Algerian oil and gas producer Sonatrach said in October 2017 that the company was looking at renegotiating its long-term contracts with European buyers ahead of the expiry of most of its deals by 2021. Sonatrach also foresees deals with trading companies for the marketing of its gas which would not be priced on an oil-indexed basis and would not be long-term.<sup>18</sup> The company has already become more active in the spot LNG market in 2017.<sup>19</sup>
- In the last quarter, LNG supplies covered 12% of total extra-EU imports, less than the 16% observed in the second and the third quarters. In 2017 as a whole, LNG imports covered 14% of total extra-EU gas imports, up from 13% in 2016 (see further details below).
- The EU's estimated gas import bill was 21.3 billion euros in the fourth quarter of 2017, about 18% more than a year earlier. Both the import volumes (1123 TWh) and the estimated average import price (around 19 Euro/MWh) were higher than in the last quarter of 2016. In 2017 as a whole, the estimated gas import bill was nearly 75 billion euros, 28% more than in 2016.

<sup>10</sup> [http://www.novatek.ru/en/investors/events/archive/index.php?id\\_4=2041&afrom\\_4=01.01.2017&ato\\_4=31.12.2017](http://www.novatek.ru/en/investors/events/archive/index.php?id_4=2041&afrom_4=01.01.2017&ato_4=31.12.2017)

<sup>11</sup> Platts Energy Economist, November 2017

<sup>12</sup> <https://www.rosneft.com/press/releases/item/189201/>

<sup>13</sup> <https://www.rosneft.com/press/releases/item/186763/>

<sup>14</sup> [http://www.gazpromexport.ru/files/021117\\_EVB\\_EAGC\\_Milan252.pdf](http://www.gazpromexport.ru/files/021117_EVB_EAGC_Milan252.pdf)

<sup>15</sup> Note that Norway to UK flows reported by ENTSO-G include some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.

<sup>16</sup> <http://www.npd.no/Global/Norsk/1-Aktuelt/Produksjonstall/P2018/Jan-2018/Data-Jan-2018.xlsx>

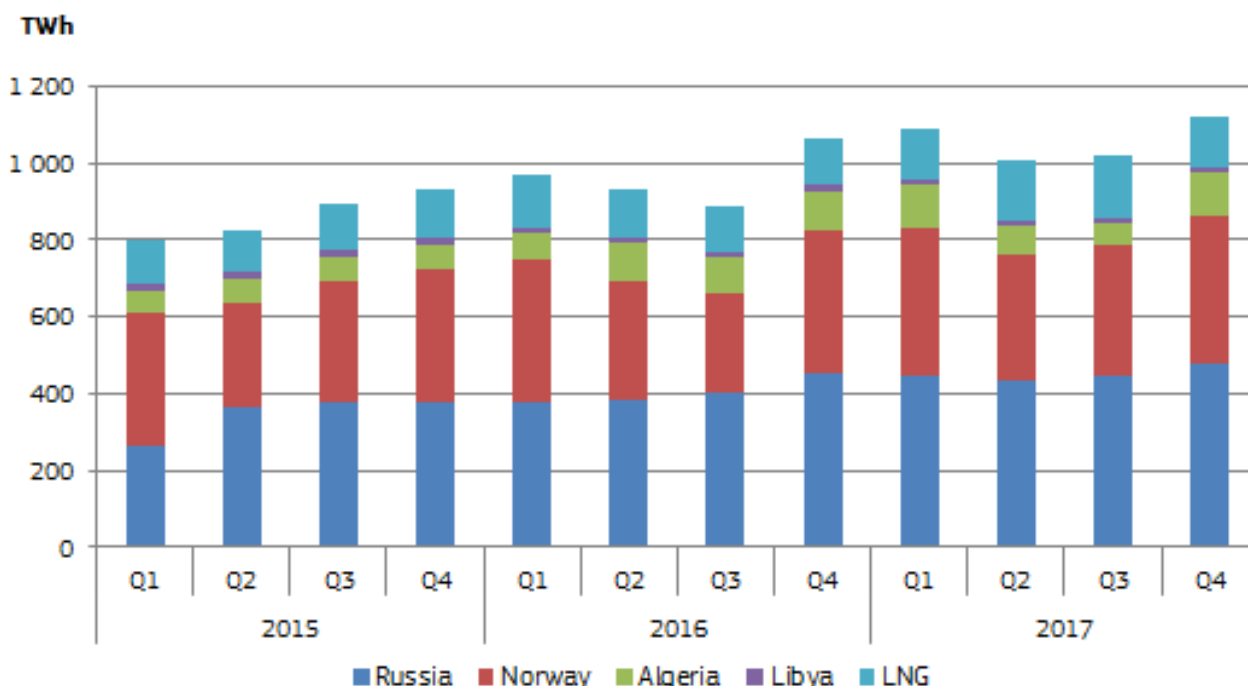
<sup>17</sup> <http://www.npd.no/Global/Norsk/1-Aktuelt/Produksjonstall/P2018/Jan-2018/Data-Jan-2018.xlsx>

<sup>18</sup> <https://www.platts.com/latest-news/natural-gas/london/algerias-sonatrach-eyes-jvs-with-natural-gas-26822469>

<sup>19</sup> ICIS Heren European Oil Markets, 30 November 2017

- On 8 November 2017, the Commission proposed to amend the EU Gas Directive, putting forward common rules for gas pipelines entering the European internal gas market. The aim of the proposed amendment is to clarify that the core principles of EU energy legislation (third-party access, tariff regulation, ownership unbundling and transparency) will apply to all gas pipelines to and from third countries.<sup>20</sup>

**Figure 8. EU imports of natural gas by source, 2015-2017**



Source: Based on data from the ENTSO-G Transparency Platform, data as of 6 February 2018

Russian deliveries to Estonia and Latvia are reported for a limited period (Narva from 15 June 2015 to 10 December 2015, Värskä and Misso Izborsk from 26 May 2015)

Russia, Norway, Algeria and Libya include pipeline imports only; LNG imports coming from these countries are reported in the LNG category.

Norway to UK flows reported by ENTSO-G include some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.

- Figure 9 depicts EU gas imports from Russia on the three main supply routes: Ukraine (which includes the Brotherhood Pipeline and the Balkan route), Belarus (mainly the Yamal pipeline) and Nord Stream.
- In the fourth quarter of 2017, gas flows on the Nord Stream pipeline significantly increased: this route accounted for 34% of total EU imports from Russia, up from 27% in the third quarter. In absolute terms, volumes were 31% higher than in the same period of 2016 and the utilisation of the nominal capacity reached 100.7%. The increase was allowed by the ruling of the EU's General Court that lifted a suspension on Gazprom's right to book additional capacity on the OPAL pipeline.<sup>21</sup>
- Nord Stream flows increased mostly at the expense of the Ukrainian route: in the fourth quarter of 2017, volumes transiting Ukraine covered 39% of total EU imports from Russia, compared to 46% in the previous quarter. This implies that Gazprom rerouted some of the gas flows which previously transited Ukraine. While Ukraine remained the main supply route of Russian gas to the EU, volumes were 9% lower than in the same period of 2016.
- Gas supplies transiting Belarus increased by 2% in the last quarter of 2017 compared to the same period of 2016 and covered 25% of total EU imports from Russia.
- In 2017 as a whole, the share of the main supply routes of Russian gas imports was as follows: Ukraine 44% (up from 43% in 2016), Nord Stream 30% (up from 28%) and Belarus 24% (down from 26%). Volumes arriving through Ukraine, traditionally the main supply route of Russian gas to the EU, were 14% higher in 2017 than in 2016. Nord Stream supplies increased by 17% while those transiting Belarus rose by 6%.
- In the last quarter of 2017, Ukraine continued to rely on imports from Europe. Gas flows coming from Hungary, Poland and Slovakia reached around 3.3 bcm in this period, 29% less than in the same period of 2016.<sup>22</sup> Imports coming from Poland reached

<sup>20</sup> [http://europa.eu/rapid/press-release\\_IP-17-4401\\_en.htm](http://europa.eu/rapid/press-release_IP-17-4401_en.htm)

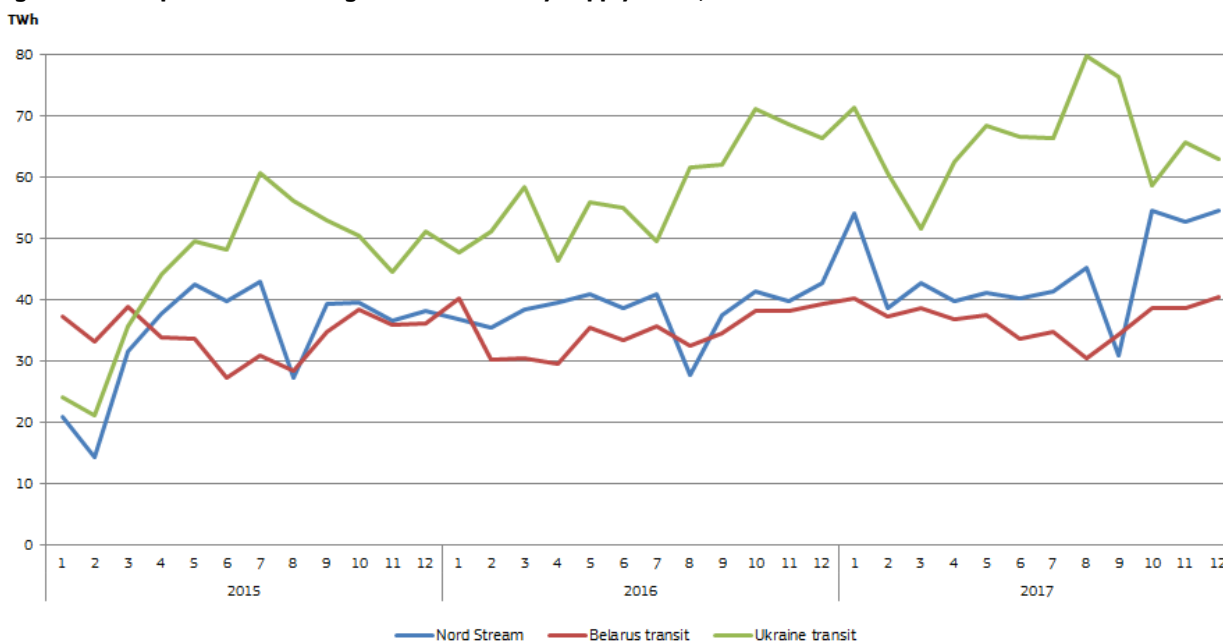
<sup>21</sup> <https://curia.europa.eu/jcms/upload/docs/application/pdf/2017-07/cp170083en.pdf>

<sup>22</sup> Based on data from the ENTSO-G Transparency Platform, data as of 15 March 2018

record levels in the last quarter, allowed by the increase of the transmission capacities from 1 September 2017.<sup>23</sup> Ukraine has not purchased gas from Russia since November 2015.

- On 22 December 2017, the Stockholm Court of Arbitration ruled on the supply contract between Naftogaz and Gazprom. The court reportedly ordered Naftogaz to resume gas purchases from Gazprom but both prices and volumes were revised to the benefit of the Ukrainian company.<sup>24</sup>

**Figure 9. EU imports of natural gas from Russia by supply route, 2015-2017**



Source: Based on data from the ENTSO-G Transparency Platform, data as of 6 February 2018

Deliveries to Estonia, Finland and Latvia are not included; transit volumes to the Former Yugoslav Republic of Macedonia, Serbia and Turkey are excluded

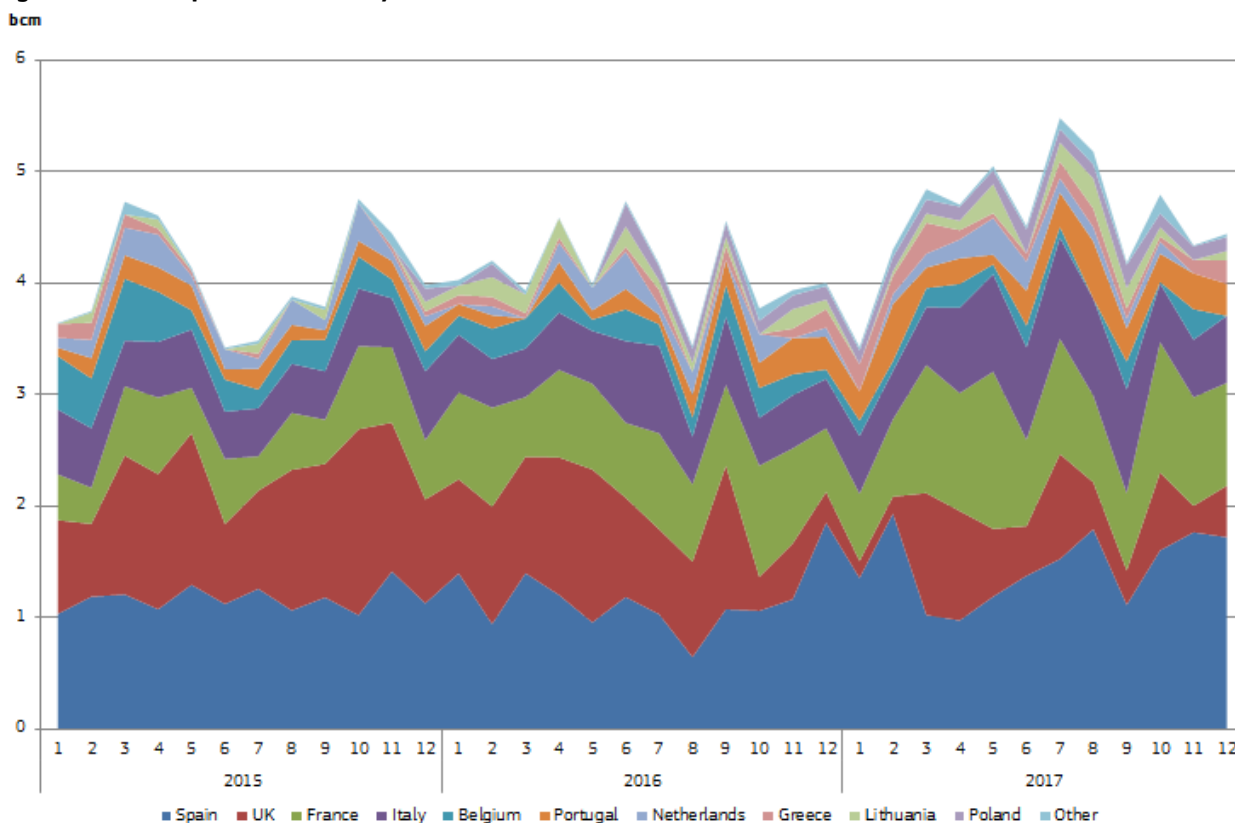
- After increasing by 11% in the first nine months of 2017, in the fourth quarter EU LNG imports increased by 16% year-on-year. In this period, deliveries to Northwest Europe remained rather low, although the UK registered a 29% year-on-year growth from an unusually low base. Imports to the Netherlands and Belgium fell by 68% and 47%, respectively. On the other hand, imports to Mediterranean countries increased: Spain (25%), France (27%), Italy (22%), Portugal (3%) and Greece (51%) all imported more LNG than in the same period of 2016.
- The liquid and well-connected Northwest European market was not very attractive for LNG supplies: in this region, LNG has to compete with indigenous production and pipeline imports from Norway and Russia. Instead, LNG volumes were “pulled” into Southern Europe and to Asia where prices have been higher (see also section 2.2.1). The sizeable Asian price premium triggered a number of reloads (re-exports), especially from France and the Netherlands. In Southern Europe, in particular in Spain, low hydro levels also provided support to LNG imports.
- In 2017 as a whole, EU LNG imports were 12% higher than in 2016. Imports decreased in Northwest Europe: by 38% in the UK, by 40% in Belgium and by 1% in the Netherlands. Lithuanian imports decreased to a smaller extent (-3%). In contrast, deliveries to Spain (25%), France (23%), Greece (36%), Italy (32%), Portugal (76%), Greece (107%) and Poland (57%) showed a robust increase. Spain remained the EU’s main LNG importer with 31% of total imports while both France (20%) and Italy (15%) overtook the UK (12%, down from 21% in 2016).
- On 18 December 2017, a grant agreement was signed under the Connecting Europe Facility, providing EU funds of €101.4 million for the construction of the LNG terminal in Krk, Croatia. By providing access to a new source of gas, the project will improve the security of gas supply and the competitiveness in Central and South Eastern Europe.<sup>25</sup>

<sup>23</sup> <http://en.gaz-system.pl/press-centre/news/information-for-the-media/artyku/202533/>

<sup>24</sup> <http://www.naftogaz.com/www/3/nakweben.nsf/0/1CBBBA42E2336FDCC22581FE0042E27F?OpenDocument&year=2017&month=12&nt=News&>

<sup>25</sup> [https://ec.europa.eu/info/news/eu-invests-energy-security-and-diversification-central-and-south-eastern-europe-2017-dec-18\\_en](https://ec.europa.eu/info/news/eu-invests-energy-security-and-diversification-central-and-south-eastern-europe-2017-dec-18_en)

**Figure 10. LNG imports to the EU by Member State**



Source: Commission calculations based on tanker movements reported by Thomson Reuters  
 "Other" includes Finland, Malta and Sweden

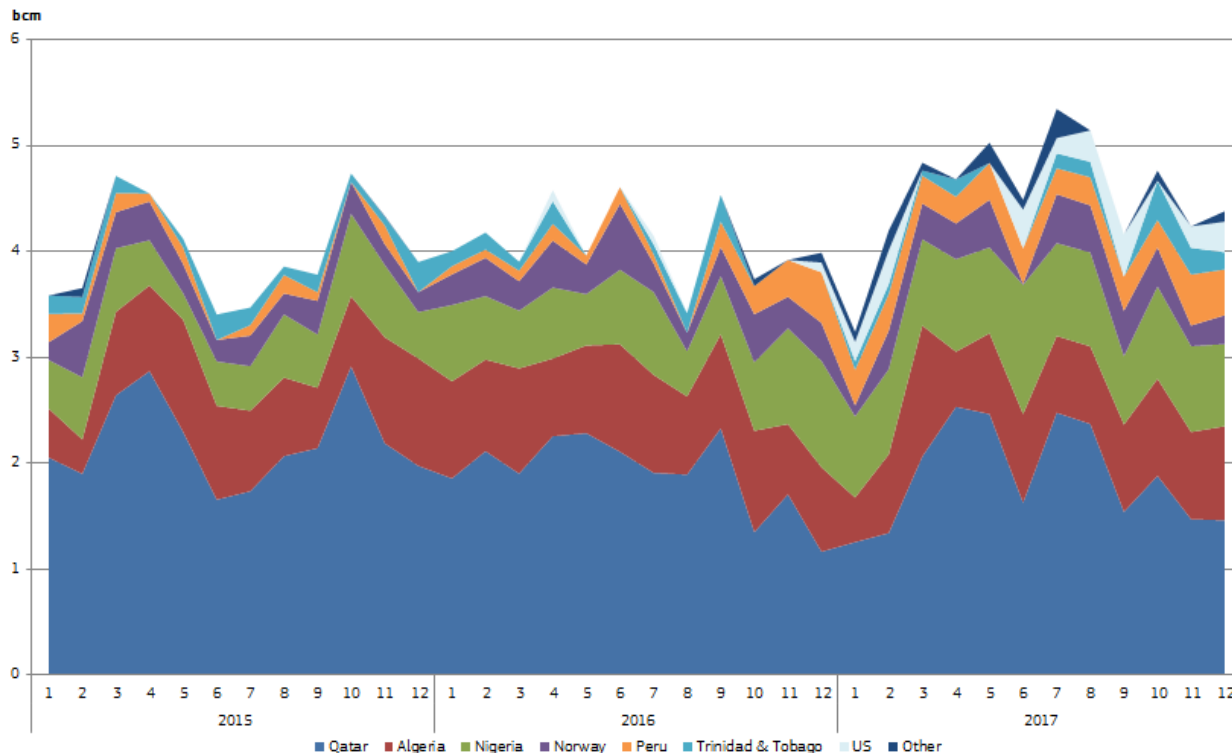
- In the fourth quarter of 2017, Qatar remained the main LNG supplier of the EU but its market share decreased to 36%, well below the typical 45-50% seen in the last few years. (Total Qatari LNG exports slightly decreased in the period, with unusually low volumes in October, and an increasing share of exports was directed to the fast-growing Chinese market.) Qatar was followed by Algeria (20%), Nigeria (18%), Peru (9%), Norway (6%), Trinidad and Tobago (6%) and the US (4%). Algeria and Trinidad and Tobago were the two main beneficiaries of falling imports from Qatar: both countries increased their market share in the EU by 4 percentage points compared to the third quarter.
- In the fourth quarter of 2017, Qatar had a dominant role in the Belgian (61%), Italian (95%) and UK (81%) markets. Algeria was the principal supplier of France (37%), Greece (100%) and the Netherlands (96%) while Portugal's main supplier was Nigeria (65%). Norway was the sole supplier of Lithuania. Spain had the most diverse portfolio: it received LNG from nine different suppliers with the biggest share coming from Peru (23%).
- In late December 2017, Europe received the first LNG cargo from Russia, from the newly commissioned Yamal plant, representing 0.7% of EU LNG imports in the fourth quarter. The vessel arrived to the UK's Isle of Grain facility and at least part of these volumes were reportedly reloaded and sent to the Everett LNG import terminal in New England (US) in January 2018.<sup>26</sup> According to an agreement signed in March 2015, Yamal LNG will use the Zeebrugge LNG terminal for transshipment operations, to support deliveries to the Asian market during winter, when the Northern Sea route is not accessible.<sup>27</sup>
- In 2017 as a whole, Qatar was the EU's main supplier (41%), followed by Nigeria (19%), Algeria (17%), Peru (7%), Norway (7%), the US (4%) and Trinidad & Tobago (3%).

<sup>26</sup> <http://www.naturalgasintel.com/articles/113197-despite-sanctions-russian-lng-cargo-arrives-in-new-england>

<sup>27</sup> <http://yamallng.ru/en/press/news/310/>



**Figure 11. LNG imports to the EU by supplier**



Source: Commission calculations based on tanker movements reported by Thomson Reuters  
 Imports coming from other EU Member States (reexports) are excluded  
 "Other" includes Angola, Brazil, Egypt, Equatorial Guinea, Oman, Russia, Singapore and the United Arab Emirates

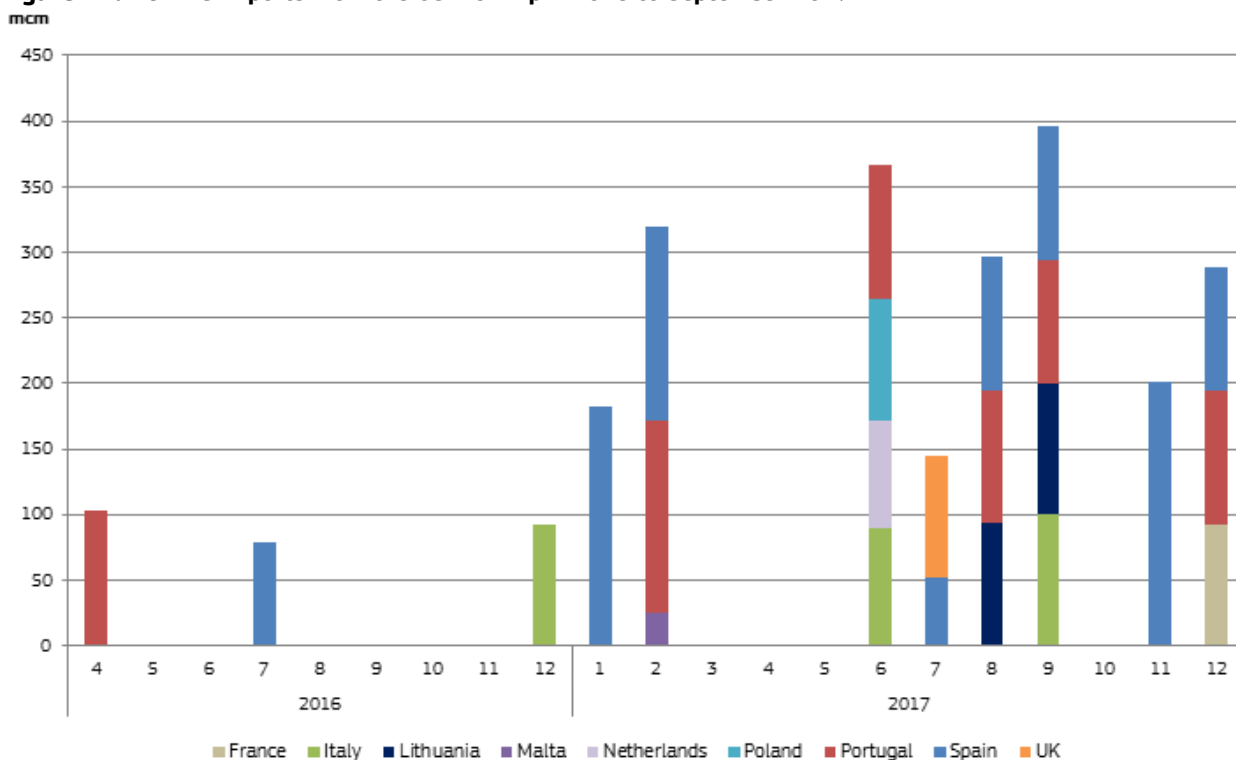
- In the fourth quarter of 2017, five LNG cargoes arrived from the US to the EU: three to Spain, one to France and one to Portugal. France became the ninth Member State to import LNG from the US. US supplies reached the highest market share in Portugal where they represented 12% of total LNG imports in this period.
- In the fourth quarter of 2017, EU LNG imports from the US totalled 0.49 bcm (of gas equivalent), representing 11% of total US LNG exports in this period, down from 23% in the previous quarter. In the fourth quarter, the majority of US exports went to Asia (59%) and Latin America (26%). Asian LNG prices rose sharply in this period, making exports to the region more profitable. In 2017 as a whole, the US exported 17.2 bcm (of gas equivalent) of LNG, 2.2 bcm (13%) of which was destined to the EU.<sup>28</sup>
- In November 2017, Polish gas supplier PGNiG announced a 5-year contract with Centrica for the supply of US LNG to Poland. PGNiG already has a long term contract for LNG deliveries from Qatar. The deal will allow Poland and the wider region to reduce further the dependence on Russian supplies.<sup>29</sup>
- Dominion Energy's Cove Point LNG facility in Maryland started the commissioning process in December 2017. The plant has a nameplate capacity of 5.25 million tons per year and is the second liquefaction facility in mainland US after the Sabine Pass plant in Louisiana.<sup>30</sup>

<sup>28</sup> Commission calculations based on tanker movements reported by Thomson Reuters

<sup>29</sup> <http://en.pgnig.pl/news/-/news-list/id/pgnig-signed-a-5-year-contract-for-lng-with-centrica/newsGroupId/1910852?changeYear=2017&currentPage=1>

<sup>30</sup> <http://dominionenergy.mediaroom.com/2017-12-05-Dominion-Energy-Cove-Point-LNG-Facility-Introduces-Feed-Gas>

**Figure 12. EU LNG imports from the US from April 2016 to September 2017**

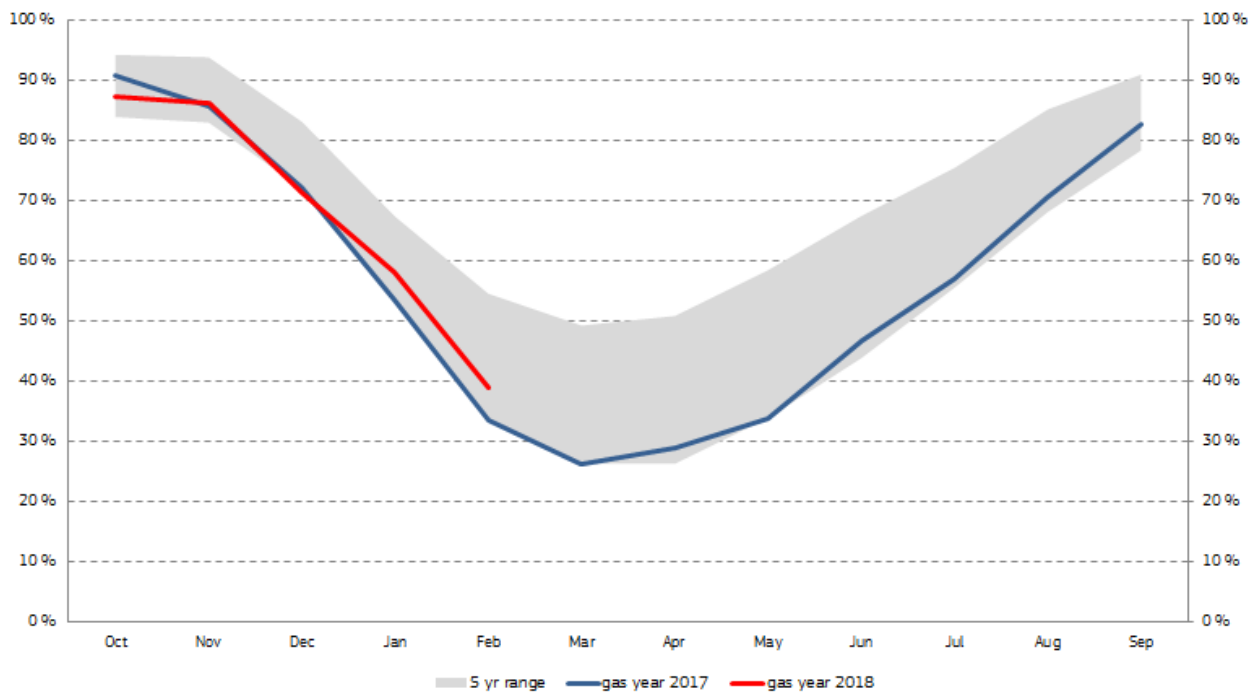


Source: Commission calculations based on tanker movements reported by Thomson Reuters

#### 1.4 Storage

- Figure 13 shows EU stock levels as percentage of storage capacity in gas years 2017 and 2018, compared to the 5-year range of gas years 2013-2017. According to figures published by Gas Infrastructure Europe, EU storage capacity amounted to 1,066 TWh (roughly 100 bcm) on 31 December 2017.
- Between April and August 2017, the average filling rate in the EU remained close to the bottom of the 5-year range and the average filling rate had been 5-10 percentage points lower than a year earlier. At the end of the gas summer, on 30 September 2017, the average filling rate was 85%, compared to 90% a year earlier.
- However, injections accelerated from September and by November the filling rate was comparable to the 2016 levels. This was helped by a relatively long injection season, with the quantity of stored gas peaking on 29 October 2017 at 949 TWh, equivalent to 89% of storage capacity. In comparison, one year earlier the maximum stock level was reached on 9 October 2016 at 981 TWh (91% of capacity). In addition to the relatively mild weather and the high pipeline imports, the long injection season was facilitated by the day-ahead prices being valued below forward contracts for most of October, thereby providing an incentive for operators to inject gas.
- In the fourth quarter of 2017, withdrawals were lower than in the same period of 2016, driven by milder temperatures. On 31 December 2017, the average filling rate was 65%. This is 1 percentage point higher than a year earlier but close to the lower end of the 5-year range.
- Ukraine had relatively comfortable stock levels at the beginning of the gas winter: on 30 September, the filling rate was 53%, 7 percentage points higher than a year earlier. Withdrawals were muted in the last quarter: by 31 December 2017, the filling rate fell to 47%, 8 percentage points higher than a year earlier

**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 19 February 2018. See explanations on data coverage at <https://agsi.gie.eu/#/faq>.

The 5-year range reflects stock levels in gas years 2013-2017. The graph shows stock levels on the 15<sup>th</sup> day of the given month.

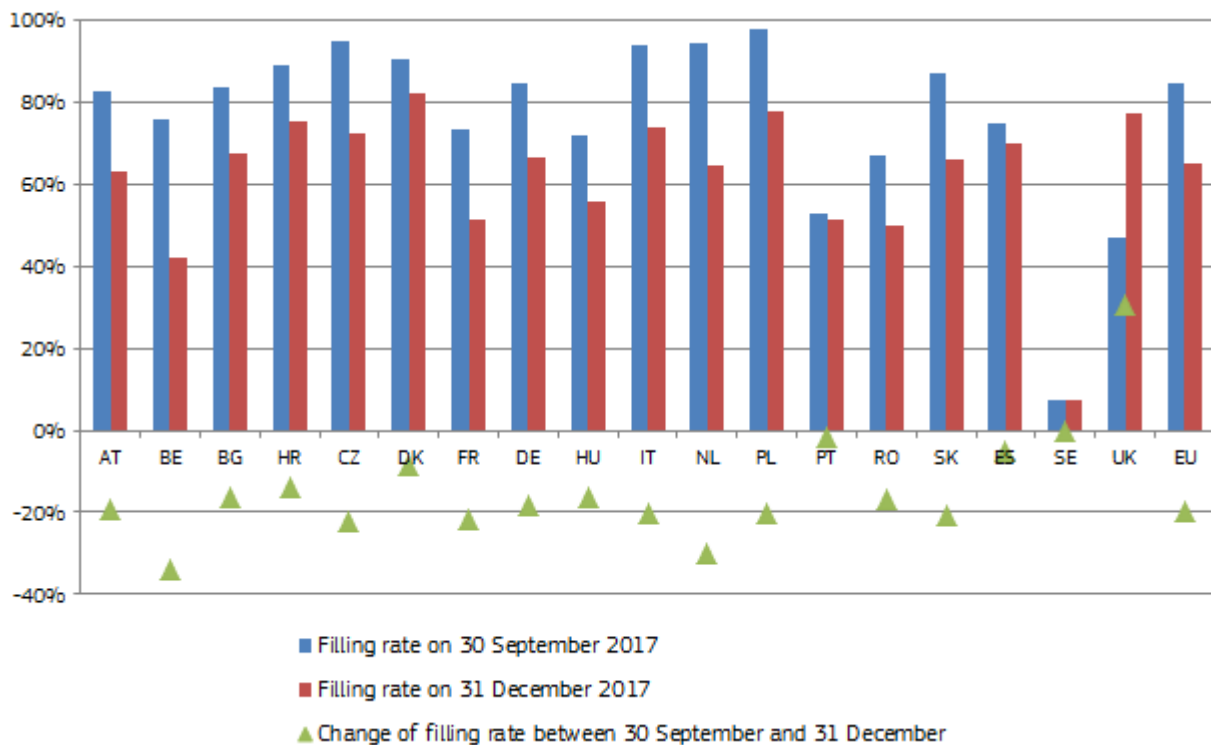
- On average, net withdrawals made during the fourth quarter of 2017 were equivalent to 20% of storage capacity (compared to 26% in the same period of 2016): the average filling rate decreased from 85% on 30 September to 65% on 31 December. However, as Figure 14 shows, there was significant variation among Member States in terms of both the starting position (the filling rate at the end of the third quarter) and the pace of withdrawals.
- Belgium saw the highest rate of withdrawals in this period, with the filling rate falling from 76% to 42%. A year earlier the country used considerable less gas from storage: in the same period of 2016, the filling rate dropped from 84% to 79%. The Netherlands also experienced above-average withdrawals in the last quarter of 2017, with the filling rate decreasing by 30 percentage points.
- On 31 December 2017, six Member States had a filling rate of less than 60%: Belgium, France, Hungary, Portugal, Romania and Sweden. In case of Belgium and France, filling rates were significantly lower than a year earlier (by 36 and 11 percentage points, respectively) but Hungarian and Portuguese stock levels were higher than year-ago levels (by 20 and 13 percentage points, respectively). In case of France, the introduction of more flexible security of supply obligations allowed suppliers to reduce stock levels and to use stocks abroad or LNG supply to count towards their obligations.<sup>31</sup>
- In October 2017, Centrica, the operator of the Rough storage facility requested the approval of the UK Competition and Markets Authority (CMA) to cease storage operations at the facility and remove historic undertakings – designed to ensure competition in the sector – required by CMA.<sup>32</sup> In December, the authority decided that the relevant parties should be released from these undertakings, thereby facilitating the closure of the site.<sup>33</sup> Centrica is now seeking to produce the storage site's remaining cushion gas.

<sup>31</sup> ICIS European Gas Markets, 16 October 2017

<sup>32</sup> <https://www.gov.uk/government/news/cma-reviews-rough-gas-storage-facility-undertakings>

<sup>33</sup> <https://www.gov.uk/government/news/rough-gas-storage-facility-undertakings-to-be-removed>

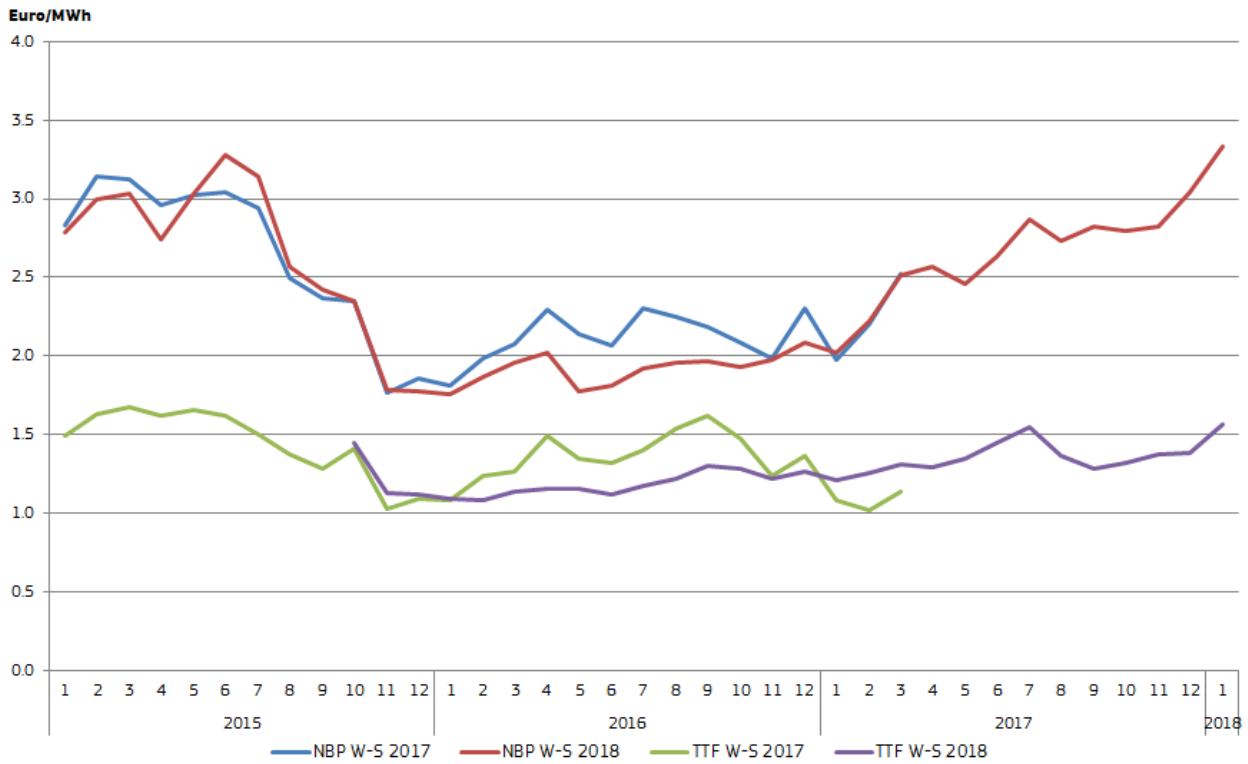
**Figure 14. Gas storage levels as percentage of maximum gas storage capacity by Member State**



Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 15 February 2018; 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 the first half of 2015 but started to fall in July 2015, dropping to 1.5-2.0 Euro/MWh on the NBP and as low as 1.0 Euro/MWh on the TTF. From early 2016, spreads slightly recovered but remained below the levels observed in early 2015. On the NBP, seasonal spreads averaged 2.9 Euro/MWh in the fourth quarter of 2017, around 0.9 Euro/MWh more than in the same period of 2016. On the TTF, the average seasonal spread was 1.4 Euro/MWh in the fourth quarter, 0.1 Euro/MWh more than a year earlier.
- In the UK, seasonal spreads have been clearly on the rise since 2017, reaching levels not seen since 2015. This is probably related to the loss of the Rough storage facility which means a lack of injection demand and oversupply in summer and a tighter market in winter, thereby increasing the seasonal spread. In contrast to mainland Europe, where there is ample storage capacity, the UK market sends a price signal to storage operators incentivising seasonal storage.

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



Source: Platts

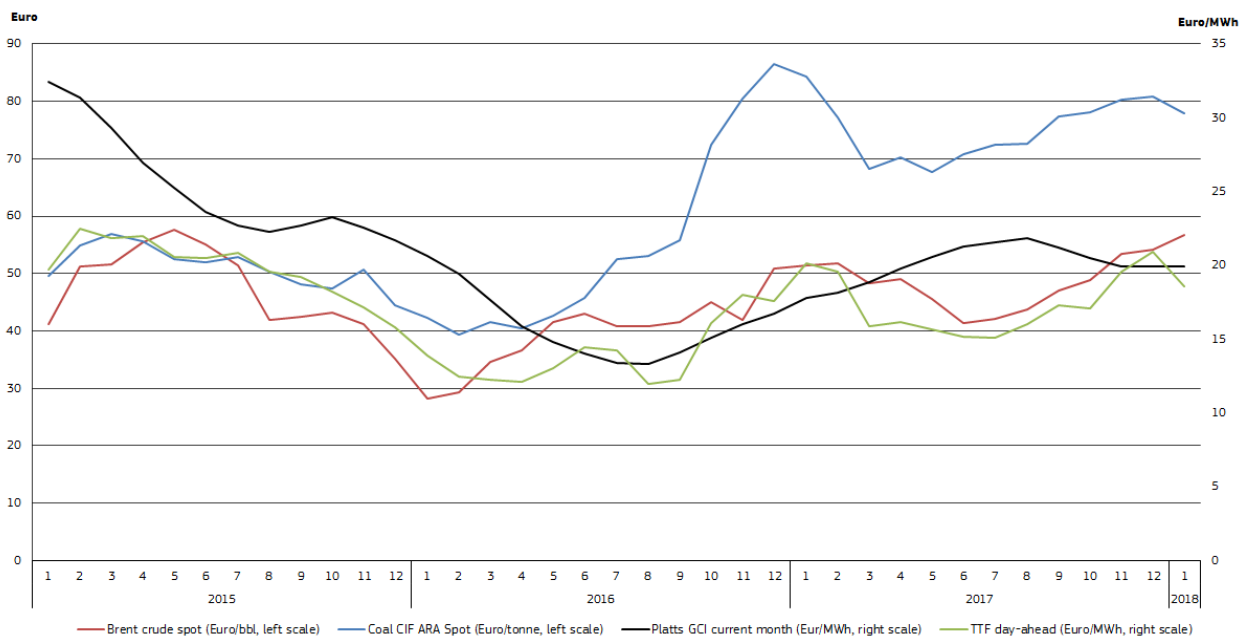
W-S 2017 refers to the difference between the winter 2017-18 price and the summer 2017 price; W-S 2018 refers to the difference between the winter 2018-19 price and the summer 2018 price

## 2. Wholesale gas markets

### 2.1 EU energy commodity markets

- Since dropping below 45 USD/bbl in June 2017, the price of Brent oil has been on the rise. This development was driven by a number of factors, including robust global demand, Middle East tensions, a number of actual supply disruptions (Northern Iraq, hurricanes in North America, closure of the Forties pipeline system in the UK North Sea, a plunge of Venezuelan supply), the weakening of the US dollar and a further extension of the OPEC cut in November 2017. In late December and early January, the protests in Iran also provided support to prices. By January 2018, Brent gradually increased to 70 USD/bbl, the highest level in three years. The market is expected to remain well supplied in 2018 and the oil price predictions by most market analysts remain around 60-65 USD/bbl for 2018.
- The TTF spot gas price started to increase in mid-2017 and averaged 19.2 Euro/MWh in the fourth quarter, 11% more than in the same period of 2016. Among other factors, rising oil and coal prices, increasing seasonal demand, disruptions in Norway and the UK, and ongoing outages in the French nuclear sector provided support to European hub prices in this period. While there is a clear trend of a decline of oil-indexation in long-term contracts, over the last three years there has been a strong correlation between oil prices and European gas hub prices, reflecting the close relationship between the gas market and the wider energy complex. Over 2017 the correlation between gas and coal prices has been also rather strong.
- In spite of the recovery of oil prices since mid-2017, oil-indexed prices decreased in the second half of the year because of the typical 6-9 month time lag used in the pricing formulas. In the fourth quarter, Platt's North West Europe Gas Contract Indicator (GCI), a theoretical index showing what a gas price linked 100% to oil would be, averaged 20.1 Euro/MWh in the fourth quarter of 2017, 0.9 Euro/MWh more than the TTF. Over the period, oil-indexed prices have become increasingly competitive with hub prices, and in December GCI actually fell short of the TTF price.
- Driven by market tightness in Asia after China introduced measures restricting domestic coal output, coal prices increased significantly in the second half of 2016. While prices receded after a peak in December 2016, they remain at an elevated level. High coal prices have been supported by ongoing supply tightness in Asian markets and the threat of industrial action at mines in Australia and South Africa. The CIF ARA spot price averaged 79.7 Euro/ton in the fourth quarter of 2017, practically the same as a year earlier but 68% more than in the same period of 2015. Measured in USD, prices in the last quarter of 2017 were actually 9% higher than in the same period of 2016 but this was offset by the strengthening of the Euro over this period. High coal prices continued to help the relative competitiveness of gas vis-a-vis coal.

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

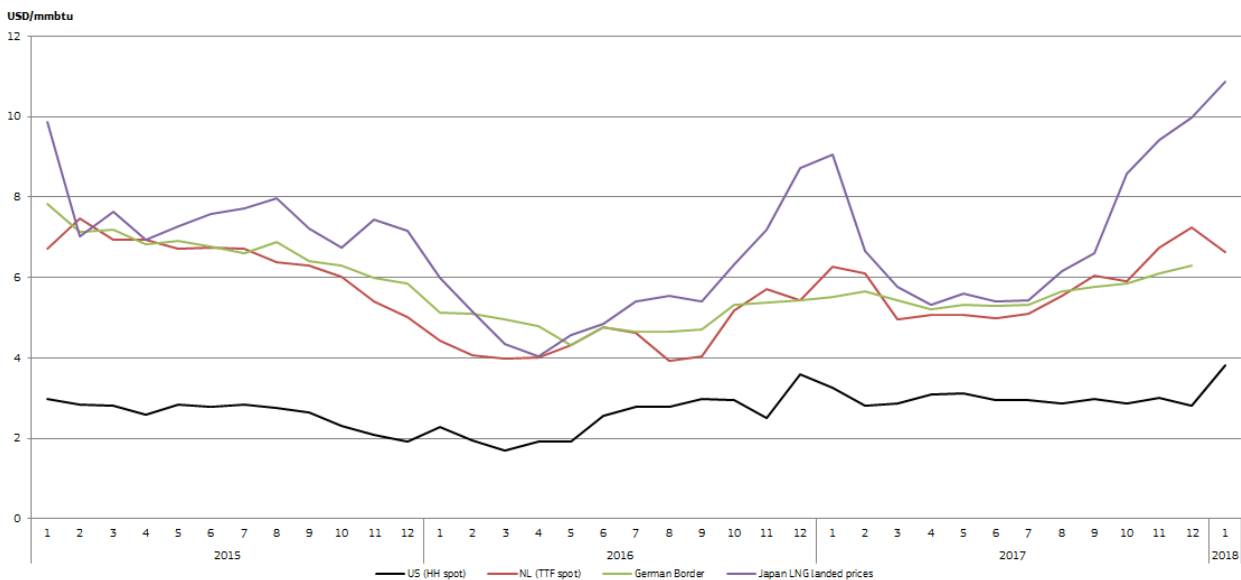


Source: Platts

## 2.2 International gas markets

- Figure 17 displays an international comparison of wholesale gas prices. In the last few years, there has been a convergence of international prices but this trend was interrupted during the last two winters (2016-2017 and 2017-2018) when Asian prices showed a steep rise due to strong seasonal demand. European and US prices also increased but to a lesser extent, resulting in a widening gap between regional benchmarks.
- In the fourth quarter of 2017, Japanese landed prices averaged 9.3 USD/mmbtu, even more than in the same period of 2016 (7.4 USD/mmbtu), which means that the average premium over TTF was 2.7 USD/mmbtu. The premium was practically the same in October, November and December. In December the average Japanese price reached 10 USD/mmbtu, the highest level since late 2014. Prospects of supplies from new projects (Yamal, Cove Point, Wheatstone) failed to prevent the sharp rise of Asian prices. The key driver has been the robust growth of Chinese demand (see details in section 2.2.1).
- European gas prices were rather stable between March and July 2017 but started to rise from August, helped by a combination of factors, including injection demand, continuing coal-to gas switching, rising oil and coal prices, increasing seasonal demand and persistent concerns about French nuclear availability. In the fourth quarter, TTF averaged 6.6 USD/mmbtu (19.2 Euro/MWh). The average German border price was lower (6.1 USD/mmbtu or 17.6 Euro/MWh), especially in December, when falling oil-indexed prices put pressure on the price of gas imported under long-term contracts.
- Since a small peak reached in late 2016/early 2017, the Henry Hub price has been rather stable. The relatively warm weather in the fourth quarter of 2017 held gas demand and storage withdrawals in check and the average price was 2.9 USD/mmbtu, 0.1 USD/mmbtu less than in the same period of 2016.
- In the second quarter of 2017, the convergence among key international gas prices reached the greatest level since the Fukushima accident in 2011. From August, however, international prices diverged again: as Asian and European ones started to rise, their premium to the rather stable Henry Hub benchmark increased.
- The ratio of the Japanese LNG price and US Henry Hub increased to 3.2 in the last quarter of 2017, the highest level since late 2015. In April 2017 this ratio was as low as 1.7. The average TTF/Henry Hub ratio increased to 2.3 in the fourth quarter of 2017 from 1.6 in May 2017. The price spreads between Henry Hub and TTF increased to 3.7 USD/mmbtu in the fourth quarter, up from an average 2.0 USD/mmbtu in the second quarter.
- Over 2017, the Euro has considerably strengthened compared to the US dollar: The exchange rate increased from 1.05 on 2 January 2017 to 1.21 on 2 January 2018. This development has increased the price spread between European and US prices.

**Figure 17. International comparison of wholesale gas prices**



Sources: Platts, Thomson-Reuters, BAFA

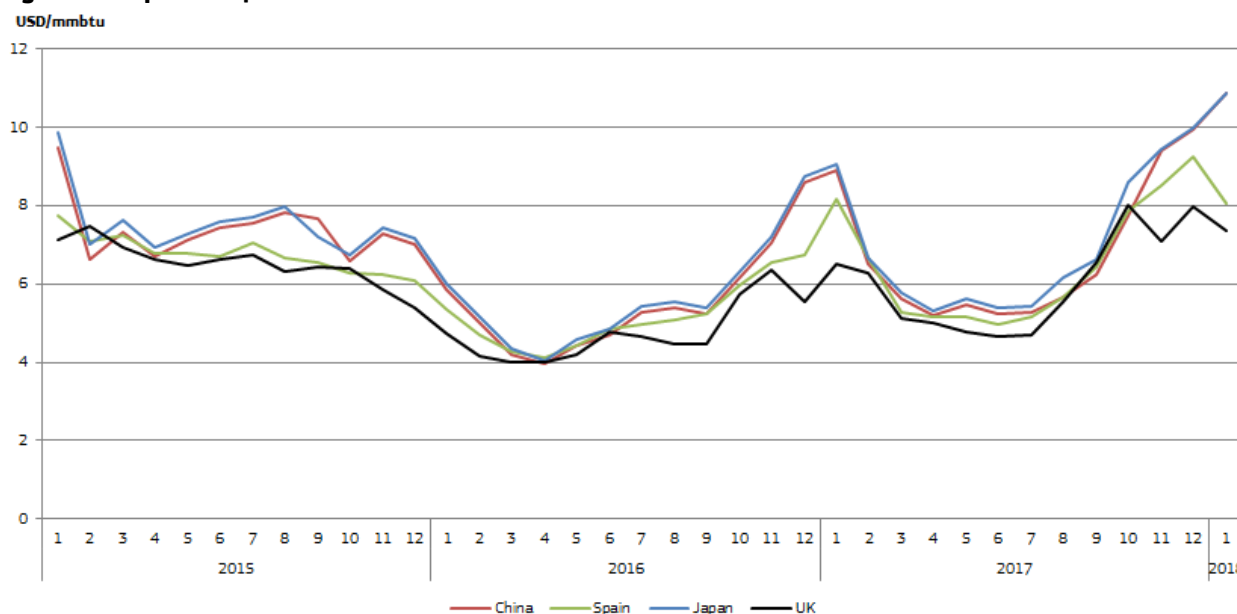
### 2.2.1 LNG markets

- In the second and third quarters of 2017, there has been a clear convergence of international LNG prices, with relatively little differences between Asian and European prices. From November, however, a sizeable gap developed between Asian and European prices. In addition to seasonal factors, rising oil prices, an unexpectedly robust growth of Chinese demand and some project delays

(including the delayed start-up of the Wheatstone project in Australia) supported prices in Asia. In the fourth quarter, spot prices averaged 7.7 USD/mmbtu in the UK, 8.5 USD/mmbtu in Spain, 9.3 USD/mmbtu in Japan and 9.0 USD/mmbtu in China. In November, the difference between the Japanese and UK price reached 2.4 USD/mmbtu, the highest level since late 2016.

- JCC, the Japanese benchmark of oil-indexed LNG prices averaged around 8 USD/mmbtu in the fourth quarter of 2017 which means that, in this period of strong seasonal demand, spot buyers had to pay a premium.
- LNG imports continued to expand in the fourth quarter of 2017 in China (+39% year-on-year) and India (+11%) but decreased in Korea (-13%), Japan (-5%) and Latin America (-4%). In 2017 as a whole, LNG imports increased by 2% in Japan, by 42% in China, by 9% in Korea and by 2% in India. Japan remained by far the largest LNG importer of the world in 2017, covering nearly 30% of global LNG demand and, for the first time, China has overtaken Korea and became the third largest LNG importer behind Japan and the EU. Latin American imports increased by 5% in 2017.<sup>34</sup>
- Surging Chinese imports were supported by both the continued economic expansion and the government policy to reduce air pollution through coal-to-gas switching in power generation, industry and households. The country's "2+26 cities" coal-to-gas switching program alone is estimated to have added 20 bcm of new gas demand in 2017. Domestic production could not keep pace with this demand surge and most of the additional gas imported has been LNG.<sup>35</sup>
- In October 2018, during the LNG Producer-Consumer Conference held in Tokyo, Japan has announced a \$10 billion public-private initiative to boost demand for LNG in Asia's LNG markets.<sup>36</sup>
- Global LNG trade increased by 29 million tons (11%) in 2017. Asian demand grew by more than 17 million tons (with Chinese demand alone increasing by 12 million tons) while Southern Europe was another major contributor of demand growth (+10 million tons). The incremental supplies came mainly from Australia, the US and Africa. The number of LNG spot cargoes reached more than 1,100 in 2017, equivalent to almost 25% of total LNG deliveries.<sup>37</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.

<sup>34</sup> Source: Commission calculations based on tanker movements reported by Thomson Reuters

<sup>35</sup> Source: Platts Energy Economist, December 2017

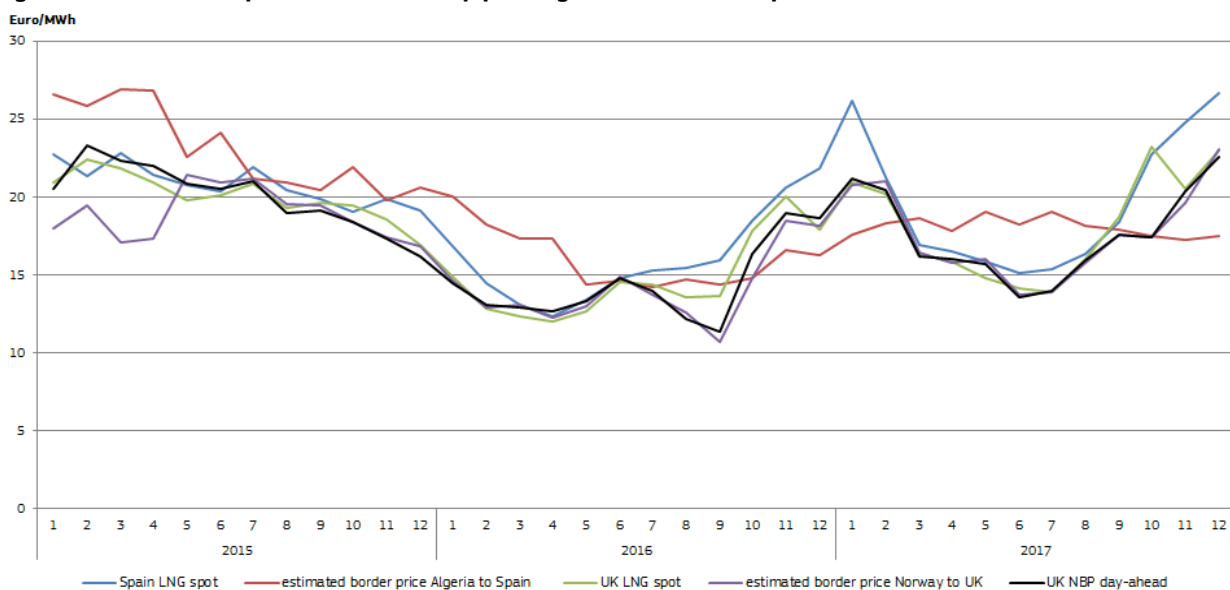
<sup>36</sup> [http://www.meti.go.jp/english/press/2017/1019\\_001.html](http://www.meti.go.jp/english/press/2017/1019_001.html)

<sup>37</sup> Shell LNG Outlook 2018, <https://www.shell.com/energy-and-innovation/natural-gas/liquefied-natural-gas-lng/lng-outlook.html>



- In the UK, spot LNG prices closely follow the NBP price although in October 2017 an unusual gap appeared: the average LNG price was 5.8 Euro/MWh above the average NBP price.<sup>38</sup> Since May 2015, the estimated price of Norwegian imports is also aligned with the NBP price, indicating that Norwegian export prices are now clearly linked to European hub prices. In the fourth quarter of 2017, the estimated price of Norwegian imports was on average 0.1 Euro/MWh below the NBP price while the spot LNG price was on average 2.2 Euro/MWh above the NBP price (due to the high premium in October).
- In 2017, there have been clear seasonal differences in the price development of Algerian pipeline imports and spot LNG in Spain: LNG had a distinct premium during the 2016-2017 and the 2017-2018 winters but was cheaper than Algerian pipeline gas in the summer. While LNG prices exhibit a clear seasonality, with robust Asian demand driving up prices during the past two winters, the development of Algerian prices is mainly influenced by oil prices. Algerian pipeline supplies are sold under long-term contracts with prices linked to oil and the lagged effect of rising oil prices over 2016 were reflected in oil-indexed prices peaking in mid-2017. In the fourth quarter, oil-indexed prices receded while LNG prices increased, resulting in an average difference of 7.3 Euro/MWh between the two. Pipeline imports reflected this price development: supplies from Algeria significantly decreased in the second and third quarters but started to recover in the last quarter of 2017.

**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

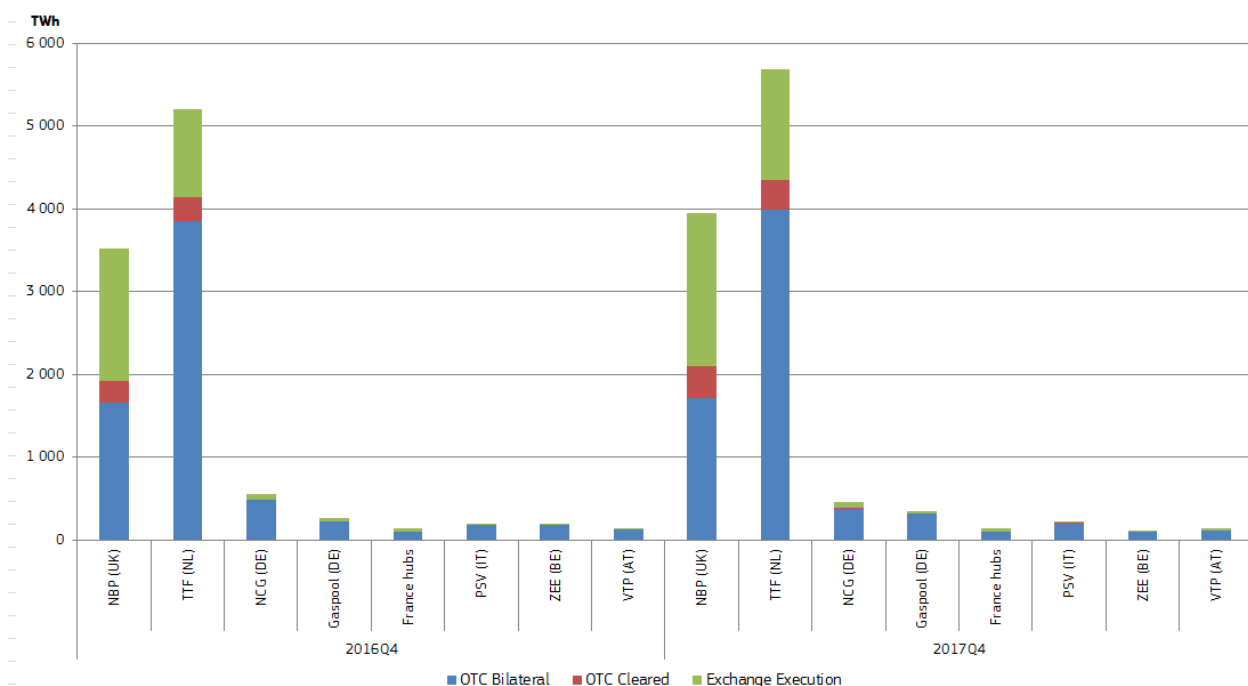
- After decreasing in the first and second quarters of the year, liquidity on the main European gas hubs improved in the third and fourth quarters of 2017. In the fourth quarter, total traded volumes amounted to around 11,000 TWh (equivalent to around 1,035 bcm or 345 bcm/month), 8% more than in the same period of 2016. Traded volumes increased year-on-year in the UK (12%), Dutch (9%), Italian (15%) and Austrian (5%) hubs but decreased in Germany (-3%), France (-5%) and, to a much larger extent, at Belgium's Zeebrugge hub (-47%).
- Increasing seasonal spreads (see chapter 1.4) contributed to the rising liquidity in the UK market and rising volatility towards the end of the year provided support to liquidity in several hubs, increasing trade on the far-curve. The Baumgarten incident and the North Sea outages in December contributed to the rise in traded volumes, especially in the UK, the Netherlands and Austria but less so in Italy. Traded volumes at the sterling-denominated Zeebrugge hub show a clear declining trend since the Brexit referendum.
- Trade on the south German NCG market traditionally exceeds volumes in the northern Gaspool hub but this was not the case in October 2017: in this period, Gaspool was the more liquid market, presumably benefiting from the surge of imports through the Nord Stream pipeline and a widening price difference between the two hubs.<sup>39</sup>

<sup>38</sup> This premium had a discernible impact on LNG imports in the UK which, in October, well exceeded the level observed in previous and subsequent months.

<sup>39</sup> ICIS Heren European Gas Market, 30 November 2017

- In 2017 as a whole, traded volumes amounted to 44,500 TWh (equivalent to around 4,200 bcm or 350 bcm/month), 4% less than in 2016. This is around 11-12 times more than the gas consumption of the seven Member States covered by the analysis in this period. Lower volatility and weak trade in seasonal products in the first half of the year are some of the main reasons for smaller liquidity in 2017.
- The Dutch and UK hubs have a dominant position in the European market, with TTF developing a clear lead in the fourth quarter of 2017: in this period, TTF and NBP covered 52% and 36% of hub traded volumes, respectively. Compared to the same period of the previous year, the share of both TTF and NBP increased, by 1.3 and 0.6 percentage points, respectively. The Dutch and UK hubs gained ground mainly at the expense of Zeebrugge (-1.0 percentage point) and the German hubs (-0.8 percentage point).
- On the UK NBP hub, 47% of total traded volumes were executed directly on an exchange in the last quarter of 2017. This share was 34% at the French hubs, 24% on the Dutch TTF hub, 18% at the Austrian hub, 13% at the German hubs, 9% at the Italian hub and less than 1% at Zeebrugge. Compared to the same period of the previous year, the share of exchange trade increased by 9 percentage points at the Austrian hub and by 5 percentage points at the Italian hub. On the other hand, this share decreased by 4 percentage points at the Belgian Zeebrugge hub.
- At EU level, OTC markets remained the main trading venue but their share decreased from 72% in the fourth quarter of 2016 to 69% in the same period of 2017. 10% of OTC volumes were cleared at a clearing house in the last quarter of 2017, up from 8% in the same period of the previous year.

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

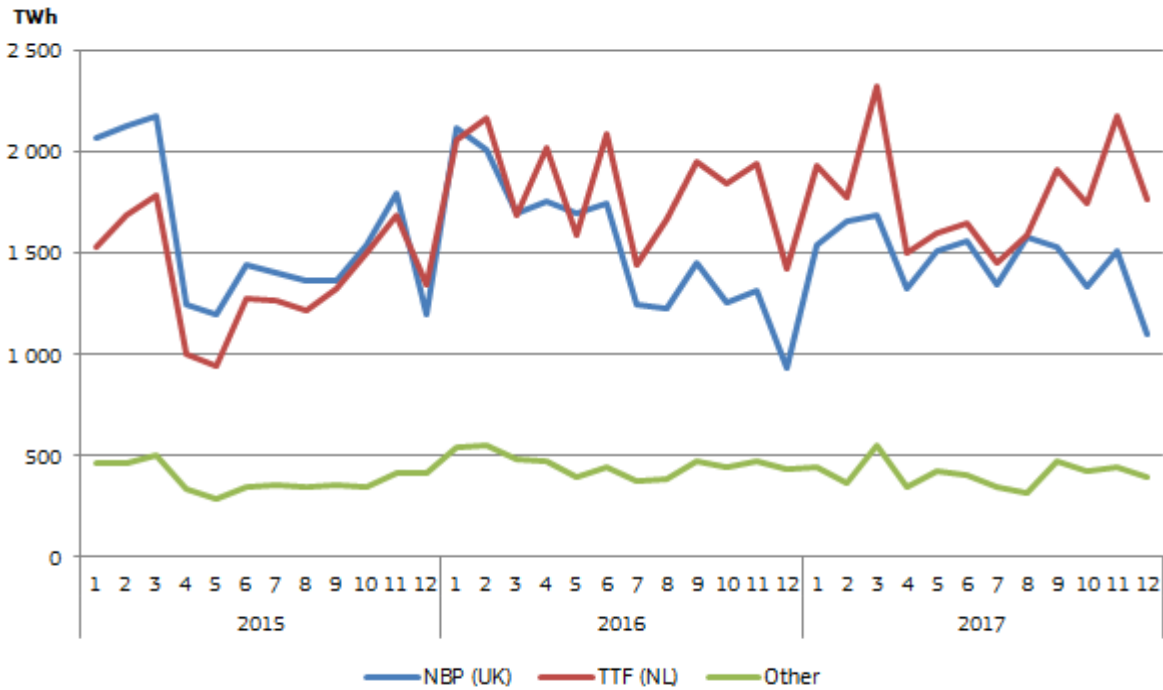


The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point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

Source: Trayport Euro Commodities Market Dynamics Report

- As Figure 21 shows, TTF firmly overtook NBP from the second half of 2016. After the Brexit referendum of 23 June 2016, the regulatory uncertainty and the rising volatility of the GBP/EUR exchange rate added risk to the trade at the UK hub. In addition to the advantage of euro-denomination, the Dutch hub also benefits from its good connection to various supply sources (including domestic production and storage). Liquidity at NBP recovered to some degree in 2017 but in the second half of the year trading volumes at the TTF have been clearly exceeding those at the NBP.
- NBP and TTF continue to overshadow the other European hubs. The combined market share of the Belgian, French, German and Italian hubs was 11% in 2017, compared to 12% in both 2015 and 2016.

**Figure 21. Traded volumes on the main European gas hubs in 2015-2017**



"Other" includes the following trading hubs: Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach.

1 bcm is equivalent to 10,647 TWh.

Source: Trayport Euro Commodities Market Dynamics Report

- In the last three years, there has been a clear trend of exchange trade gaining ground but in the last quarter this trend seems to have turned. In this period, the share of total traded volumes executed directly on an exchange was 31%, compared to 37% in the third quarter. The share of cleared OTC volumes was 7% of total traded volumes in the last quarter of 2017, up from 6% a year earlier.

**Figure 22. The share of traded volumes on the main European gas hubs**



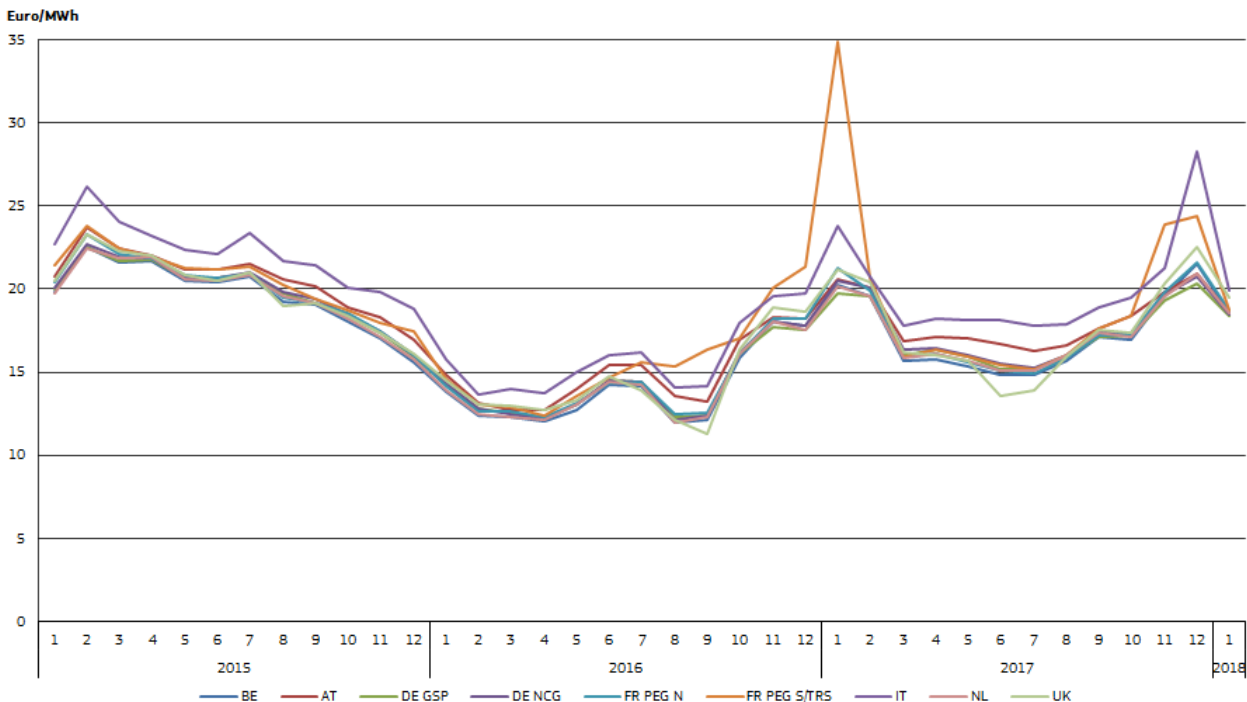
The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point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

Source: Trayport Euro Commodities Market Dynamics Report

### 2.3.2. Wholesale price developments in the EU

- European hub prices had been relatively stable in mid-2017 but started to rise from August, driven by a variety of factors, including relatively low storage levels, continuing coal-to gas switching, rising oil and coal prices, increasing weather-driven demand, a series of production and pipeline outages in Norway and the UK, and persistent concerns about French nuclear availability. In the fourth quarter, European hub prices averaged around 19-20 Euro/MWh, roughly 10% more than in the same period of 2016.
- In mid-December, simultaneous disruptions at the Baumgarten gas facility in Austria and the Forties pipeline system in the UK North Sea sent European hub prices soaring. The In Focus section below provides more details about the outages and their market impact.

**Figure 23. Wholesale day-ahead gas prices on gas hubs in the EU**



Source: Platts

- Since 2016, prices at the UK gas hub are increasingly disconnected from mainland hubs, showing a distinct seasonality. This was visible in 2017 even more than in the previous year: in June and July, gas at the UK hub traded on average 1.4 Euro/MWh cheaper than at the Dutch hub. With no injection demand at Rough and ample imports, the UK market was oversupplied, putting pressure on day-ahead prices and increasing flows to the continent on the Belgium-UK Interconnector.<sup>40</sup> The trend turned from autumn: since September, the NBP price exceeded the TTF price, with the premium increasing to 1.6 Euro/MWh in December. Low stock levels after the outage of the Rough site, low LNG imports and North Sea disruptions 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.
- Prices at the Italian PSV hub have been consistently higher than at hubs in Northwest Europe, mainly because of the additional costs to the gas entering the country through Switzerland, currently the country's marginal source. To address this persistent price spread, the Italian government put forward a scheme called "liquidity corridor". Under the proposal, the government would assign a company to buy unused Swiss transportation capacity and sell it at a discount to companies that ship gas to Italy. It is not clear if and when the scheme would be implemented.<sup>41</sup>
- Italian prices were even higher than usual in the fourth quarter of 2017, with an average premium of 3.8 Euro/MWh above TTF, the Dutch hub. In December, not least because of the Baumgarten explosion (see the In Focus section below), the average premium

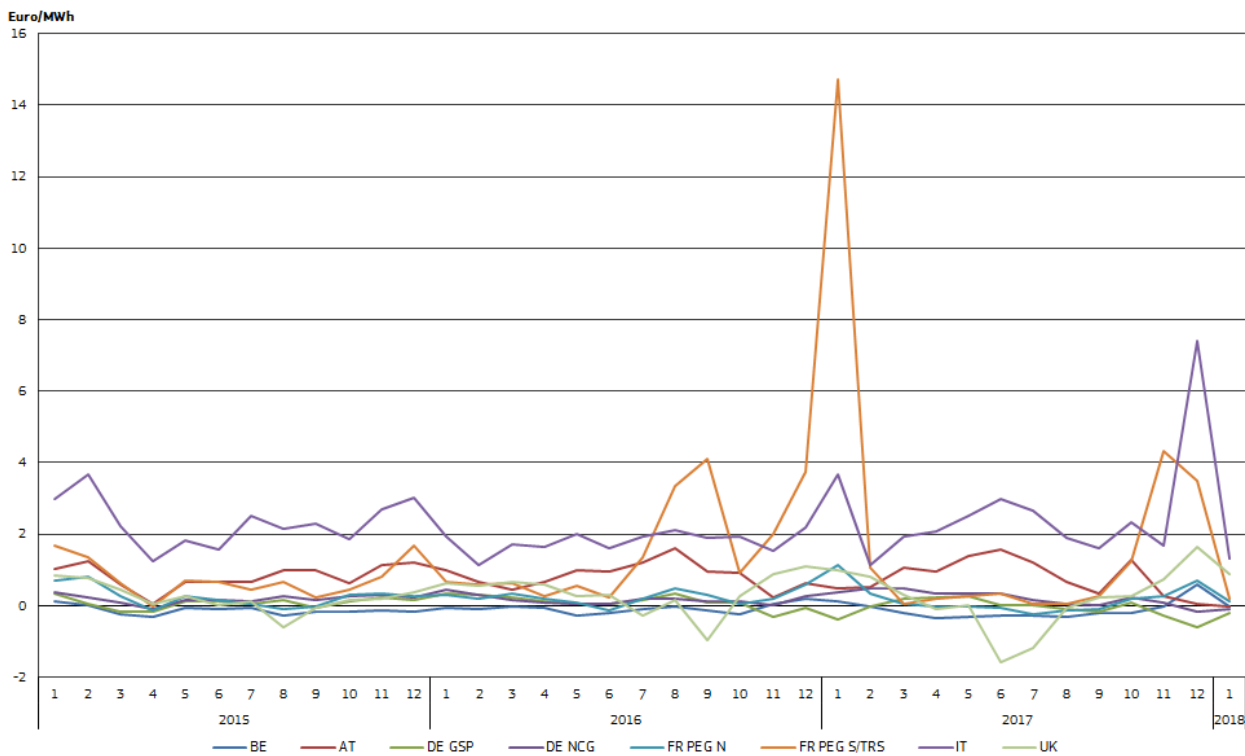
<sup>40</sup> From the autumn of 2019, the BBL pipeline linking the Netherlands and the UK should be also able to deliver gas to mainland Europe; today, physical flows are only possible towards the UK (<https://www.bblcompany.com/news/gas-transportation-in-both-directions-through-the-bbl-pipeline-fr>)

<sup>41</sup> ICIS Heren European Energy Markets, 16 October 2017

reached 7.4 Euro/MWh. The incident had no such impact on VTP, the Austrian hub, where the average price in December was practically identical with the TTF price.

- In France, the premium of TRS over PEG Nord reached 4.0 Euro/MWh in November in the wake of a tightening supply-demand situation in the Southern part of the country but fell short of the exceptional levels seen in January 2017. In the fourth quarter of 2017, TRS traded on average 2.6 Euro/MWh above PEG Nord. The woes of the nuclear sector, low gas stock levels, congestion on the North-South link and increasing gas exports to Spain contributed to the market tightness in Southern France. In December, the improving availability of the French nuclear fleet helped to reduce the premium of TRS, as well as the Baumgarten explosion and the North Sea outages which increased prices at PEG Nord rather than at TRS.

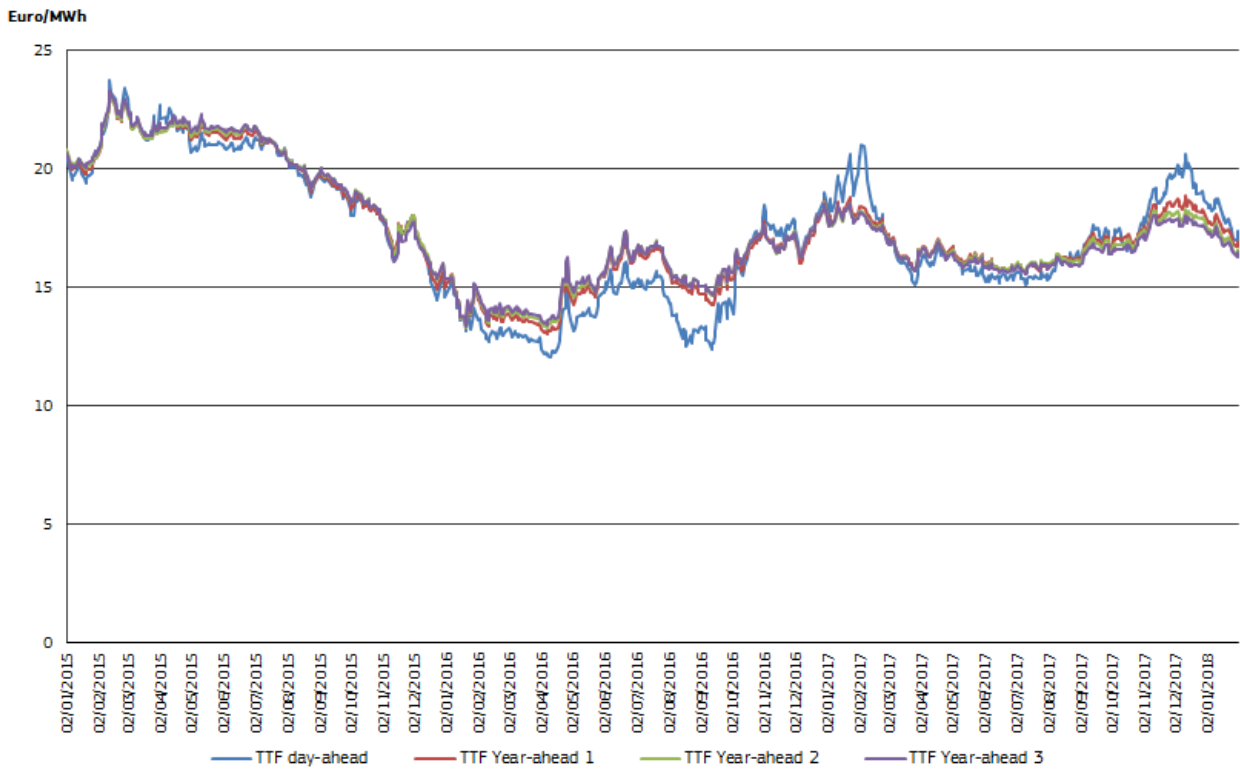
**Figure 24. The premium of wholesale day-ahead gas prices at selected hubs compared to TTF**



Source: Platts

- Figure 25 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.
- 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 higher 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 2016 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, the difference between day-ahead and year-ahead prices has decreased, and by the third quarter has practically disappeared.
- In the last quarter of 2017, day-ahead prices were on average 0.6 Euro/MWh higher than year-ahead prices. The difference increased to 1.7 Euro/MWh on 12 December when the Baumgarten explosion and the closure of the Forties pipeline system triggered a spike of spot prices in European hubs.

**Figure 25. Forward gas prices on the Dutch gas hub**



Source: Platts

## In Focus: The impact of the Baumgarten explosion and the outage of the Forties Pipeline System

The EU's new security of gas supply regulation entered into force on 1 November 2017<sup>42</sup> and quickly had to face the first real-life test. In the morning of 12 December, a deadly explosion at the Baumgarten facility in Austria cut Russian supplies to the country and transit flows to Italy.

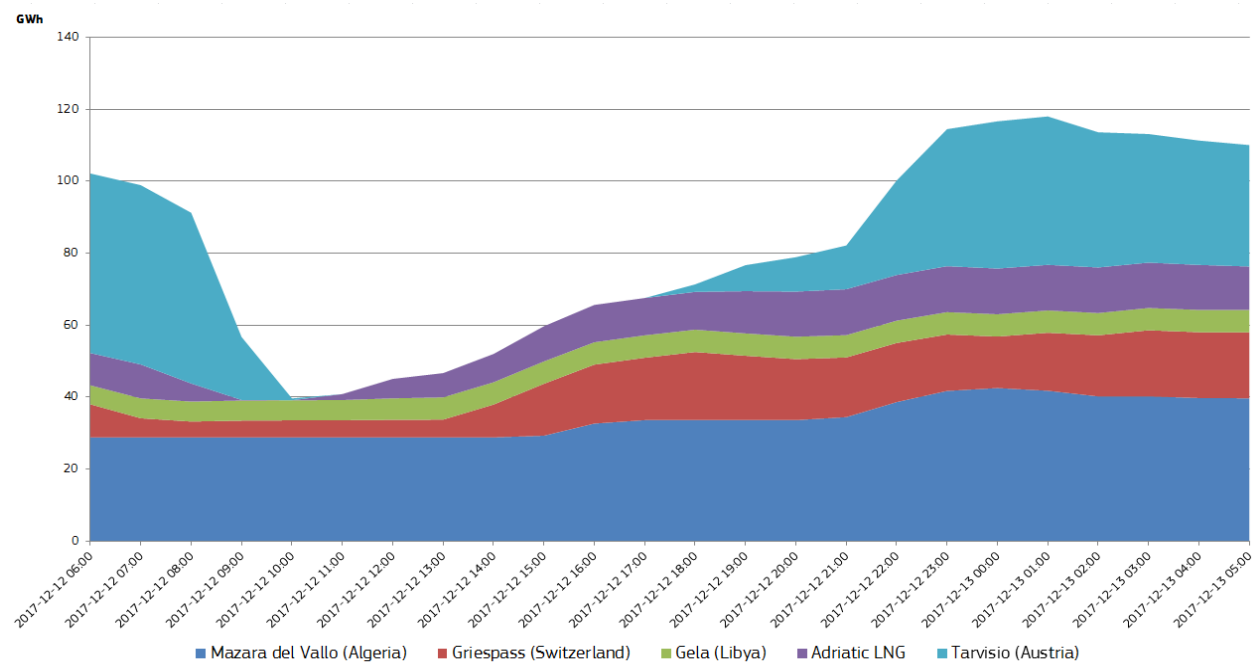
In Austria, domestic supplies were secured from increased storage withdrawals. In Italy, the supply-demand balance was rather tight already before the incident, because of strong winter demand and reduced import capacity through Switzerland; therefore, the country declared an early warning on 4 December. On 12 December, the Baumgarten explosion cut all Russian imports to Italy, the main source of supply to the country, triggering a declaration of emergency by the ministry. On the same day, Slovenia declared an early warning.

In the wake of the disruption, the Italian day-ahead price settled at a record 80 Euro/MWh on 12 December, up from 23.7 Euro/MWh the day before. The price spike allowed demand to fall and alternative supplies to grow. On the Austrian VTP the price increased to "only" 33 Euro/MWh for a short period during the morning of the 12<sup>th</sup>.

Italy has a number of import sources and, within hours, pipeline imports were ratcheted up on all supply routes, with the biggest additional volumes coming from Switzerland and Algeria. To a lesser extent, Libyan supplies also increased. In addition, LNG send-out from the Adriatic LNG facility was also stepped up. As Figure 26 shows, growing imports were not sufficient to replace the missing volumes; increased withdrawals for domestic storages had to fill the gap. Indeed, storage withdrawals were doubled within an hour and, in case of need, could have been maintained at that level for several days. A longer-lasting disruption would have also attracted additional LNG cargoes. However, the outage was resolved in less than a day, with gas flows from Russia resuming before midnight and prices quickly receding to previous levels.

Ample storage availability was crucial to cope with the disruption in both Austria and Italy: storage is the fastest resource that can be activated, not only in terms of volume but also in term of peak capacity.

**Figure 26. Gas imports to Italy on 12 December 2017**



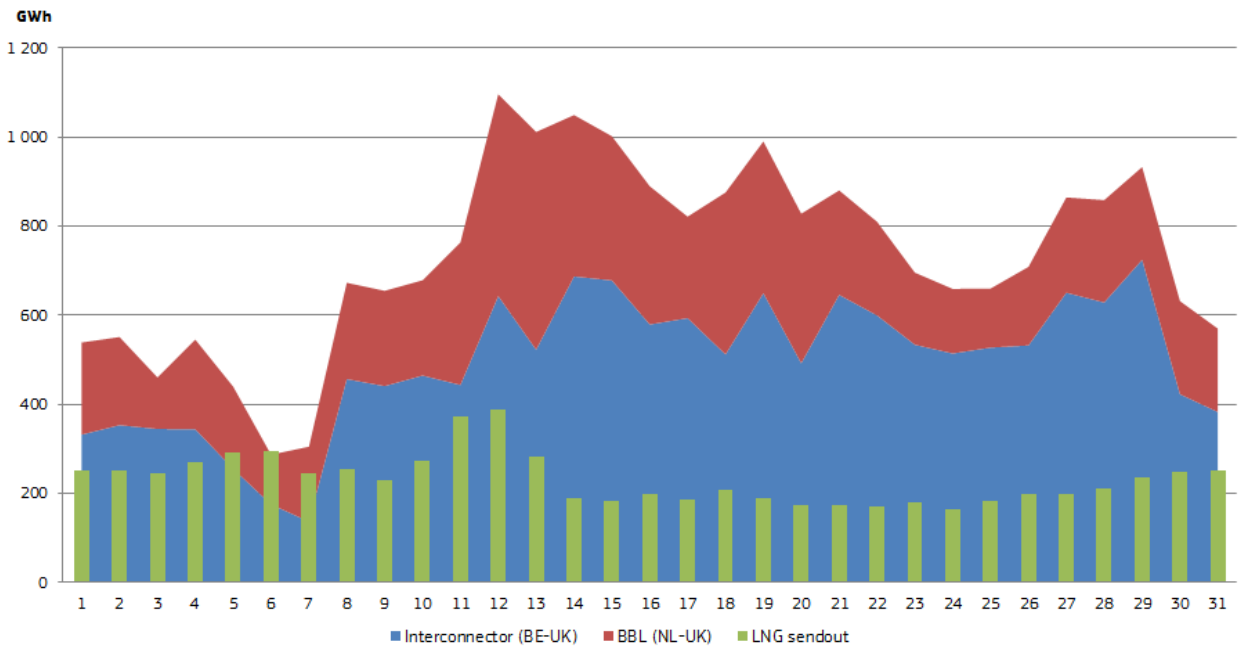
Source: ENTSO-G Transparency Platform, data as of 23 March 2018

More or less at the same time, amid strong seasonal demand, supplies in Northwest Europe were constrained by the unplanned outage of the Forties pipeline system in the UK North Sea and a 2-day loss of output from Norway's Troll field. The outage of the Forties pipeline lasted from 11 to 30 December 2017 and triggered a reduction of UK gas production by 30-40 million cubic meters a day. As a result, UK prices also soared, reaching the highest level in nearly three years and incentivising additional imports. On 12 December, the NBP settled 3.9 Euro/MWh above the TTF and the premium remained around 2 Euro/MWh between 13 and 20 December.

<sup>42</sup> [https://ec.europa.eu/info/news/securing-europes-gas-supply-new-regulation-comes-force-2017-oct-27\\_en](https://ec.europa.eu/info/news/securing-europes-gas-supply-new-regulation-comes-force-2017-oct-27_en)

Increasing imports through the Interconnector (from Belgium) and the BBL pipeline (from the Netherlands) were instrumental in replacing missing volumes and, after 20 December, rising temperatures also contributed to the easing of the market tightness. On the other hand, the price signal was not strong enough to boost LNG imports.

**Figure 27. Pipeline flows from the continent to the UK and LNG sendout in the UK**



Source: ENTSO-G Transparency Platform and BBL company, data as of 23 March 2018

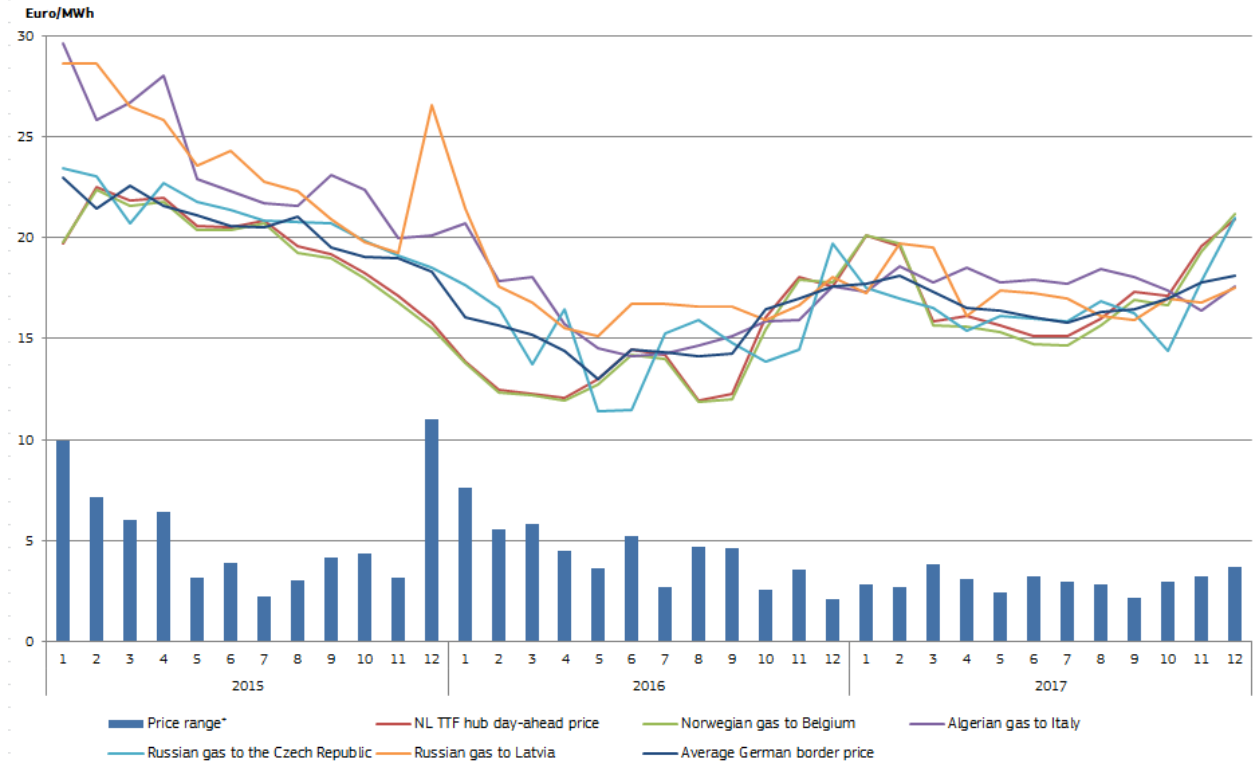
The sum up, the gas systems were coping with the situation: price signals and the availability of alternative supply sources and infrastructure kept the gas flowing in both Italy and the UK. No non-market based measure has been put in place.

### 2.3.3. Comparing the prices of different contracts for gas in the EU

- Figure 28 compares a selection of estimated border prices of gas deliveries from the main exporters to the EU: Russia, Norway, and Algeria. For comparison, the evolution of the day-ahead prices on the Dutch TTF hub is also presented.
- Over the last three years, there has been a gradual price convergence, helped by the significantly falling oil prices in the second half of 2014 and in 2015 and the lagged impact on oil-indexed prices. Moving towards more competitive pricing by certain producers (e.g. introducing a hub element into the pricing formulas) also contributed to converging prices.
- In 2015-2016, the typically oil-indexed prices of Russian gas to Latvia and Algerian gas to Italy remained higher than hub-based prices but in 2017 the difference has practically disappeared. In the second half of the year, hub-based prices started to increase while oil-indexed prices stabilised or even decreased. As a result, in November-December 2017, oil-index prices were actually lower than hub and hub-based prices.
- The difference between the highest and lowest price depicted in Figure 28 decreased to 2.2 Euro/MWh in September, the lowest level since December 2016. In the last quarter, however, this difference increased, reaching 3.7 Euro/MWh in December.



**Figure 28. Comparison of EU wholesale gas price estimations**

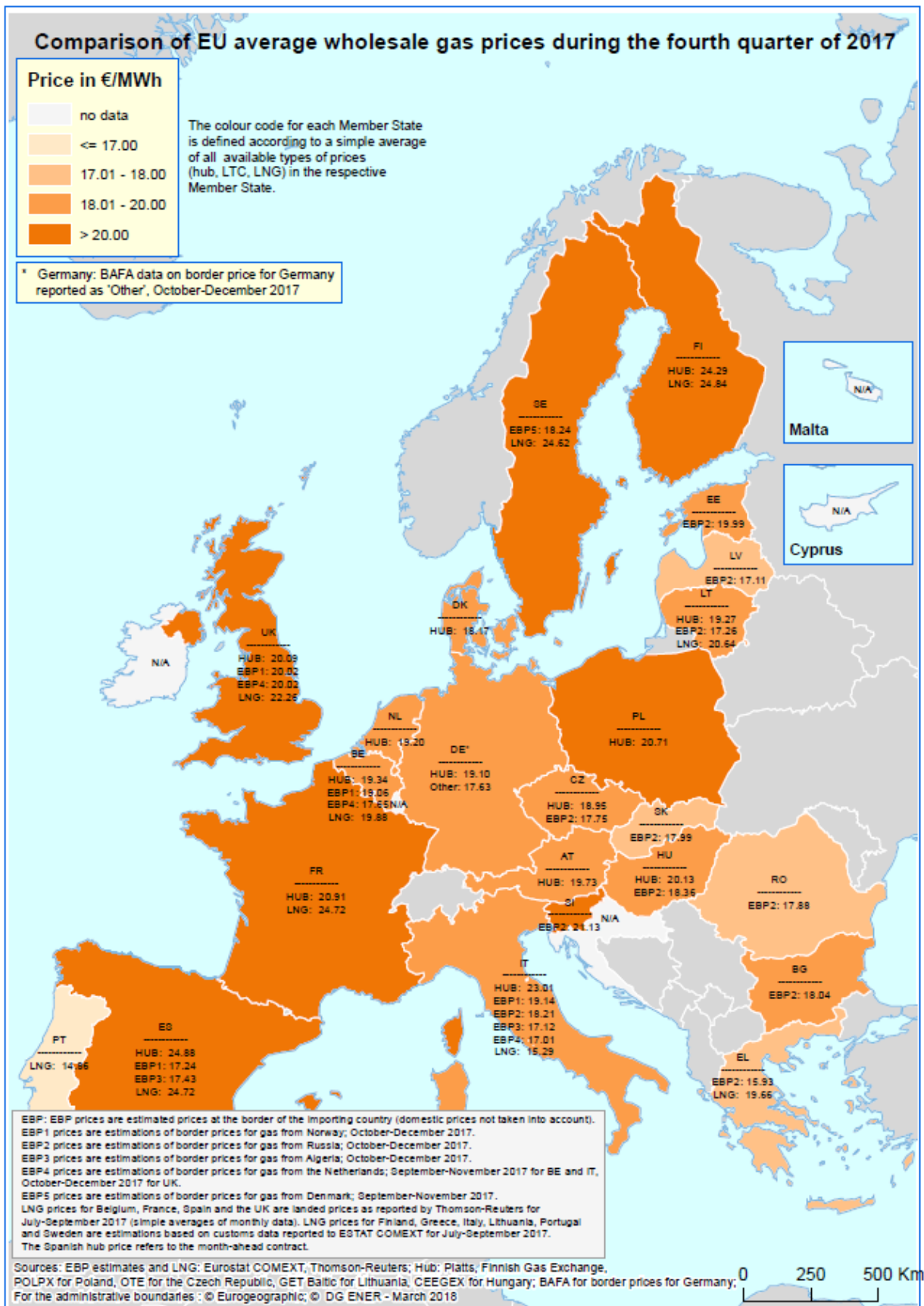


Source: Eurostat COMEXT and European Commission estimations, BAFA, Platts

\*The difference between the highest and lowest price depicted on the graph

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 fourth quarter of 2017**

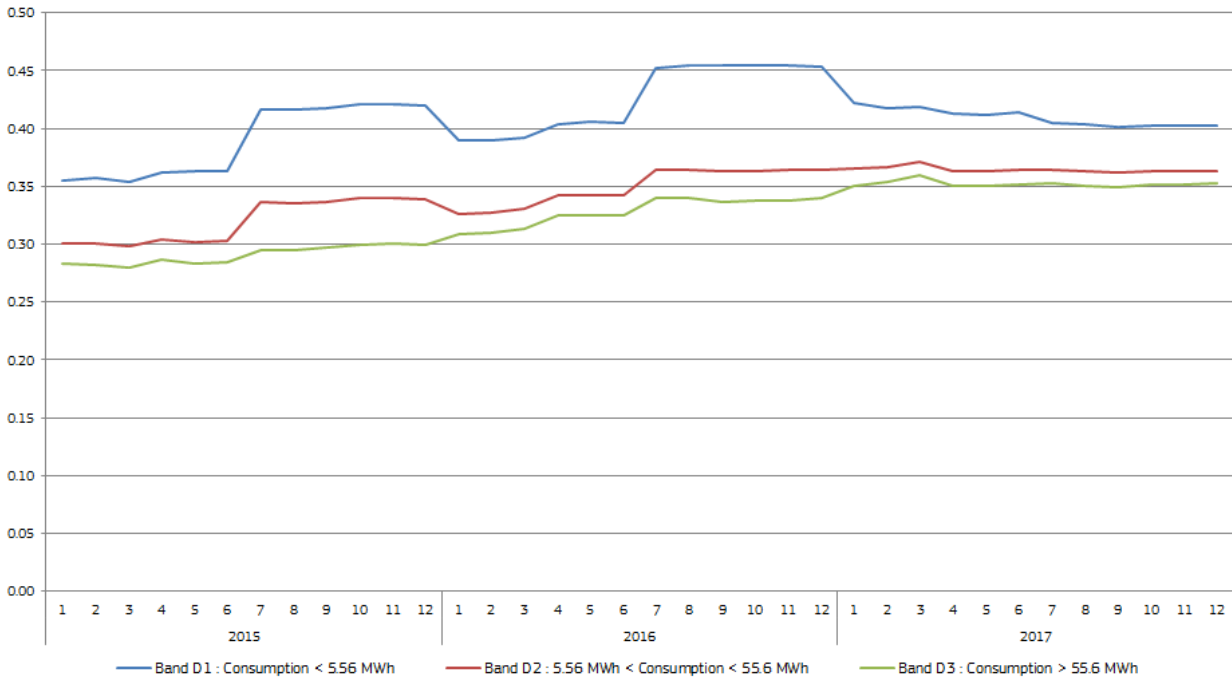


Note: Border prices are estimations of prices of piped gas imports paid at the border of the importing country, based on information collected by customs agencies, and are deemed to be representative of long-term gas contracts.

### 3. Retail markets in the EU

- Figures 29 and 31 show the degree of convergence of retail gas prices for household and industrial consumers, using as a metric the relative standard deviation 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 2017) 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 between 2010 and 2014-2015 and has been decreasing since then. In the most typical consumption band, D2, the estimated average price (including all taxes) in the fourth quarter 2017 was 5.83 Eurocents/kWh, 9% less than a year earlier. In most Member States the estimated price decreased in this period but Bulgaria, Denmark and Estonia experienced a double-digit growth of the estimated price. (See the estimated household prices on Map 2.)
- Retail prices for households show a slightly diverging trend in 2015-2016, as shown by the increase of the relative standard deviation in Figure 29. In 2017, the standard deviations stabilised or – in case of band D1 – even decreased, 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 the last quarter of 2017, the estimated household price in consumption band D2 varied between 3.23 Eurocent/kWh in Romania and 12.15 Eurocent/kWh in Sweden, resulting in a price differential ratio of 3.8 between the cheapest and the most expensive Member State. This ratio decreased from 4.8 in March 2012 to 3.4 in February 2016 but has slightly increased since then.

**Figure 29. Relative standard deviation of gas prices paid by household consumers in EU Member States**



Note: all taxes included.

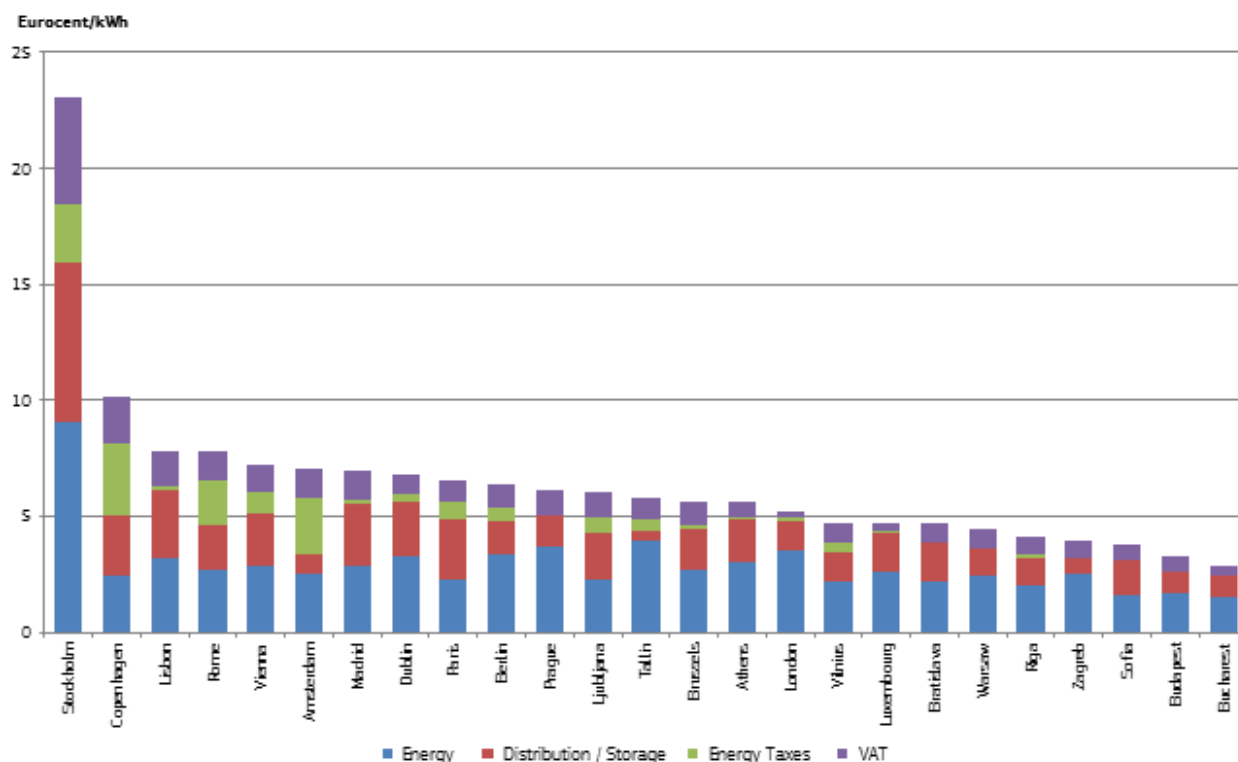
Source: European Commission estimates based on Eurostat data on consumer prices adjusted by the HICP

- Figure 30 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in December 2017. On average, 45% of the price covered the energy component, while the rest covered distribution/storage costs (29%), energy taxes (10%) and VAT (17%).<sup>43</sup>
- There are significant differences across Member States, with the share of energy cost ranging from 24 to 68%, 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.

<sup>43</sup> Note that these are arithmetic averages.

- In 17 of the 25 capitals, prices were higher in December 2017 than a year earlier, with the biggest increases in Tallinn (48%) and Riga (12%). At the other end of the spectrum, prices decreased by 6% in Lisbon and by 4% in Berlin.
- While there are significant differences across Member States in network costs and taxes, Figure 30 also shows that even the energy component is very variable: it is six times higher in Stockholm than in Bucharest. Looking at wholesale prices in Europe (see Map 1) it seems difficult to justify such a divergence.

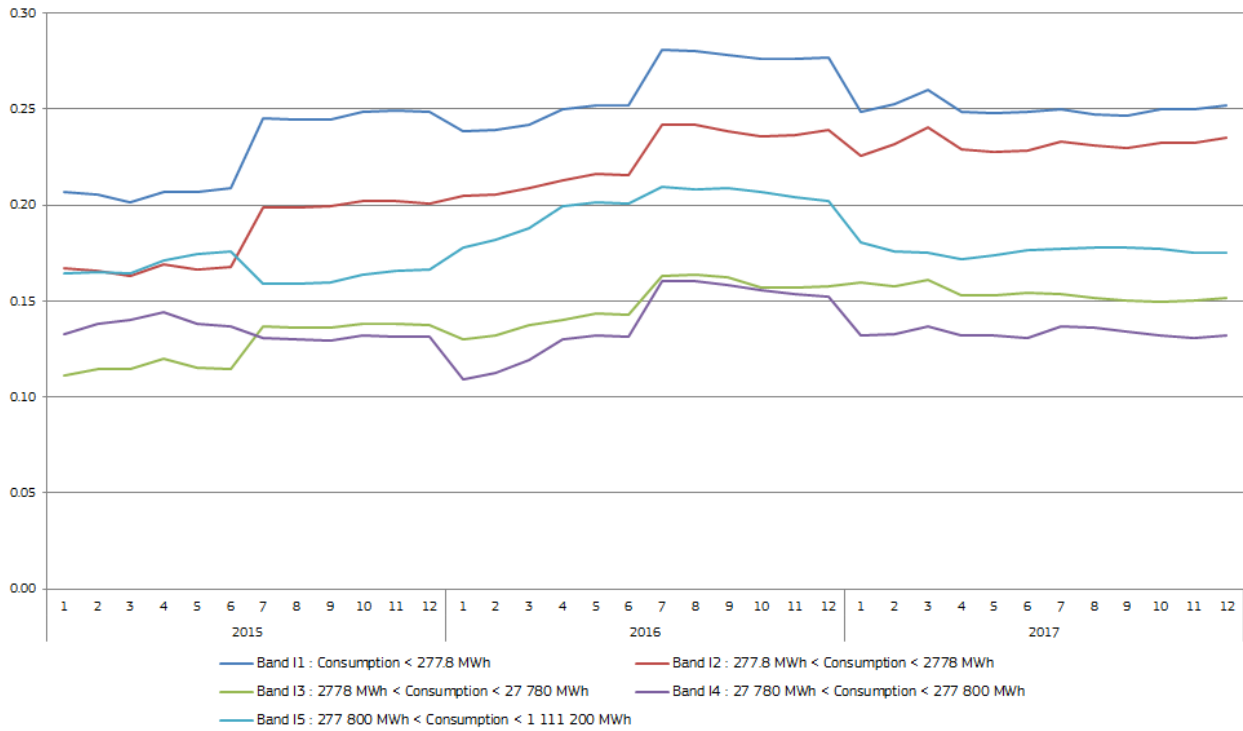
**Figure 30. The breakdown of gas price paid by typical household customers in European capitals, December 2017**



Source: VaasaETT

- Estimated industrial prices started to decrease already in 2014, and the trend continued in 2015-2016. In 2017, industrial prices seem to have stabilised. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.41 Eurocent/kWh in the fourth quarter of 2017, 1% more than a year earlier. Prices increased in this period in around half of the Member States. Estonian (32%), Bulgarian (28%), Lithuanian (24%) and Danish (20%) industrial consumers had to cope with the most significant year-on-year increases while the Slovakia (-9%) and Sweden (-6%) saw the biggest decreases. (See the estimated industrial prices on Map 3.)
- Figure 31 indicates that, 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 in 2015-2016, implying that price differences increased in this period. Relative standard deviations plateaued in the second half of 2016 and decreased in 2017.
- In the last quarter of 2017, the UK had the lowest estimated industrial price in consumption band I4 (1.90 Eurocent/kWh), while the highest price was observed in Sweden (3.35 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 1.8 in December 2017.

**Figure 31. Relative standard deviation of gas prices paid by industrial consumers in EU Member States**

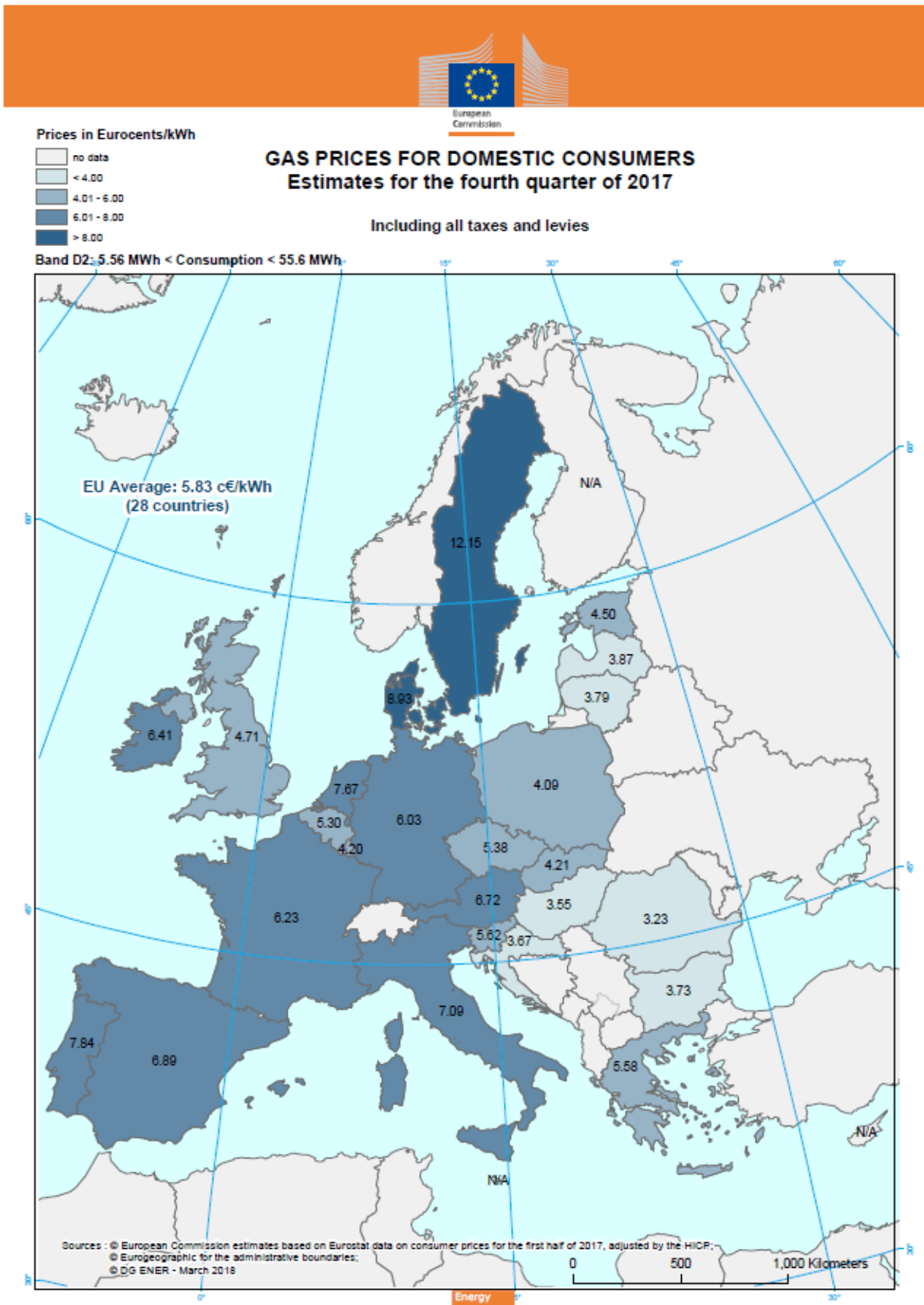


Note: Excluding VAT and other recoverable taxes.

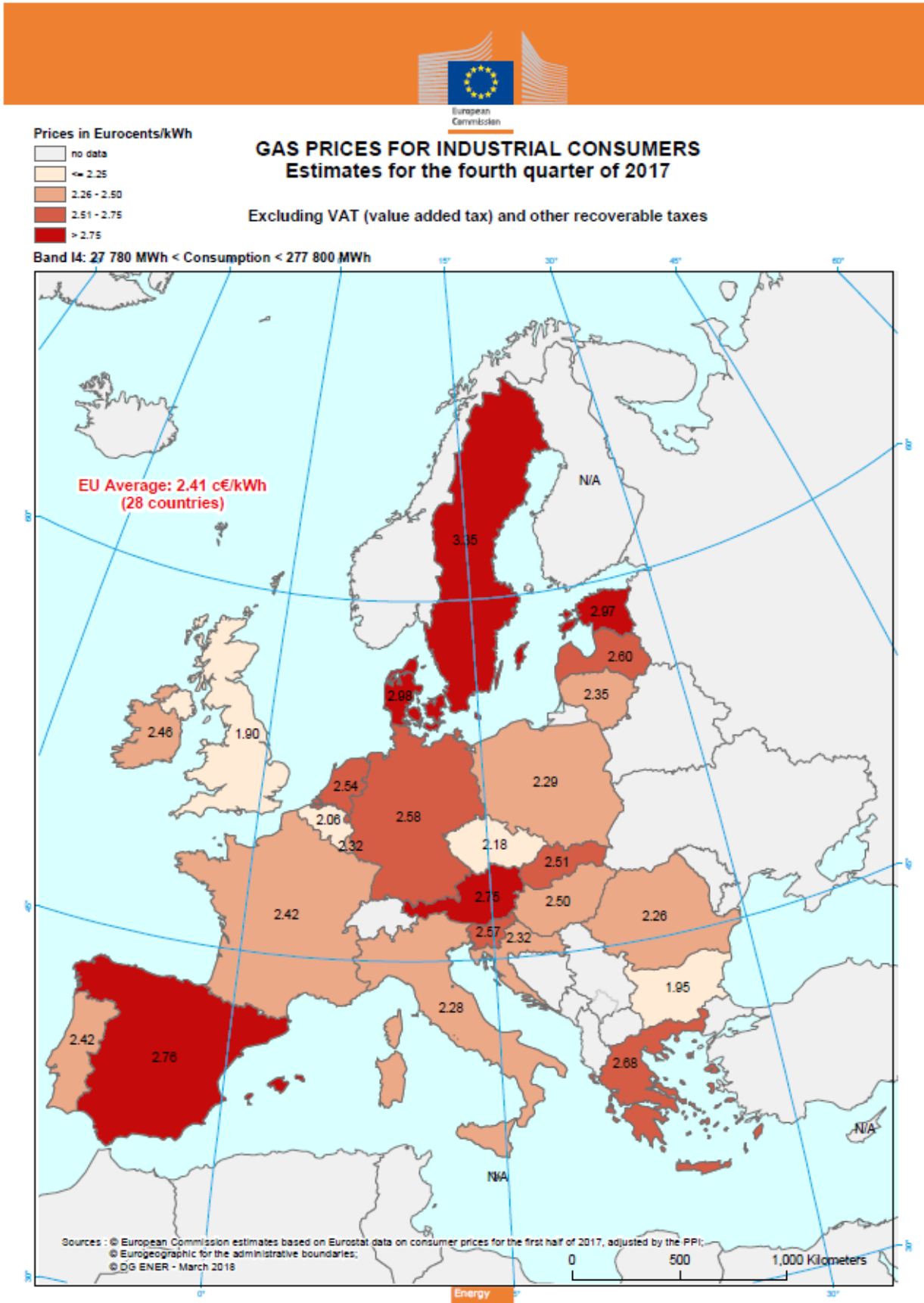
Source of data: European Commission estimates based on Eurostat data on industrial prices adjusted by the PPI

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

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



**Map 3. Retail gas price estimates for industrial consumers in the EU – Fourth 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.

**Relative standard deviation** is the ratio of standard deviation (measuring the dispersion within a statistical set of values from the mean) and the mean (statistical average) of the given set of values. It measures in percentage how the data points of the dataset are close to the mean (the higher is the standard deviation, the higher is the dispersion). Relative standard deviation enables to compare the dispersion of values of different magnitudes, as by dividing the standard deviation by the average the impact of absolute values is eliminated, making possible the comparison of different time series on a single chart.

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