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Quarterly Report on European Gas Markets

Market Observatory for Energy

DG Energy

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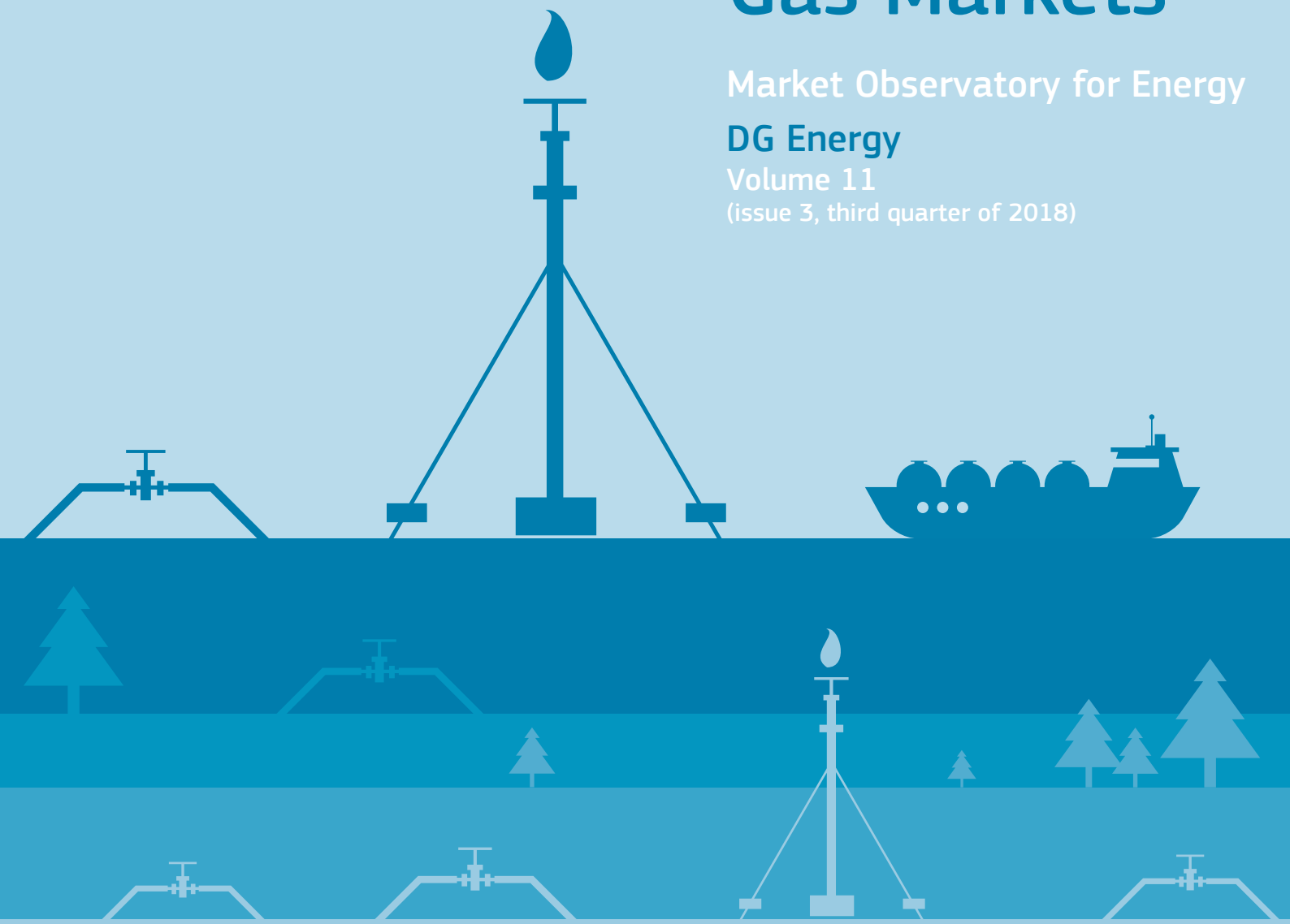

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CONTENT

HIGHLIGHTS OF THE REPORT

- In the third quarter of 2018 EU **gas consumption decreased by 5%** year-on-year, owing to lower gas demand in energy intensive industries and warmer than usual weather in September 2018. This was the second quarter in a row, when gas consumption decreased year-on-year. Gas consumption in Q3 2018 in the EU amounted to 78 bcm, while in the first three quarters of 2018 it was 333 bcm.

- Indigenous **gas production in the EU fell by 7%** in the third quarter of 2018 compared to Q3 2017. Dutch gas production at Groningen field is set for further drop from a potential 19 bcm in 2018 to 5 bcm in 2023, and decreasing production will probably not be offset by the increase in another fields in the country.

- **Imports decreased by 3% year-on-year** in the third quarter of 2018, amid decreasing consumption and production in the EU. Russian pipeline supplies covered 47% of extra-EU imports, up by 3 percentage points year-on-year. The EU's estimated **gas import bill was around 23 billion euros**, 33% more than a year earlier, owing to an increase of 37% in gas import prices in the EU between the third quarter of 2017 and 2018.

- EU **LNG imports decreased by 8% year-on-year** in the third quarter of 2018. Asian prices retained their price premium to Europe, resulting in low LNG shipments, as higher priced Asian markets drew cargoes away from Europe.

- Following the meeting between Commission President Juncker and US President Trump on LNG in July 2018, the Polish oil and gas company PGNiG recently concluded **long term LNG import contracts with US** firms, aiming at diversifying the country's gas import sources. At the end of 2018 LNG imports from the US started to increase measurably in the EU.

- September 2018 monthly average **spot prices at European gas hubs reached the highest since December 2013**, driven by rising oil and generally high energy prices, and the strong injection demand. Spot prices during Q3 2018 were higher than forward contracts (price curve in backwardation).

- Injections started to ramp up from a **lower stock levels** in Q3 2018 than a year before and remained still slightly below last year’s storage level at the end of September. High spot prices made injections costlier to shippers.

- **Higher wholesale gas prices started to filter into retail gas prices** for industrial customers across Europe, increasing in Q3 2018 by 10% on EU average compared to the same quarter of 2017.

EXECUTIVE SUMMARY

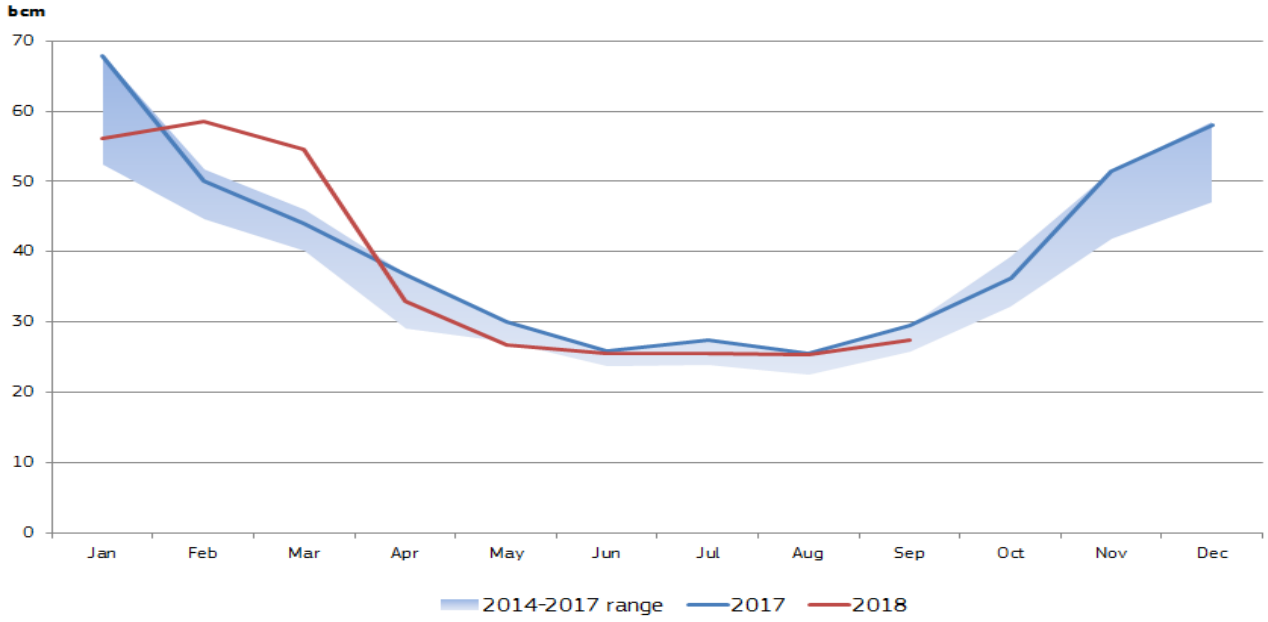
- In the third quarter of 2018, **EU gas consumption was almost 5% less than in same period of 2017**. This was the second quarter in row when year-on-year gas consumption decreased. Although gas-fired electricity generation was up (by 6%) in the EU, lower demand in energy intensive industries and milder than usual weather in September might have contributed to the overall consumption decrease. In absolute level, gas consumption in Q3 2018 amounted to 78 bcm, down from 83 bcm a year earlier. In the first three quarters of 2018 total gas consumption in the EU was 333 bcm, down by 1% year-on-year.
- EU gas **production fell by 7%** year-on-year in the third quarter of 2018; amounting to 28 bcm. In Netherlands, the biggest producer in the EU, it fell by 16% and in the UK it increased only slightly (4%). In the Netherlands domestic gas production is expected to decrease further, as for the 2018 gas year the annual production cap of the Groningen field is set to 19 bcm, falling gradually to 5 bcm until 2023. Other gas fields in the country will probably not offset this measurable decrease. In the first three quarters of 2018 total EU gas production amounted to 90 bcm, 7% less than in the same period of 2017.
- In parallel with decreasing consumption, **EU gas net imports also fell by 3% in the third quarter of 2018** compared to Q3 2017. Imports from Russia grew by only 2% year-on-year, while Norwegian imports decreased slightly (by 1%). Imports from Algeria and Libya rose significantly, by more than 20%, while LNG imports fell back in Q3 2018. In this quarter the total net EU gas imports was 85 bcm, while in the first three quarters of 2018 it reached 263 bcm, still up by 1% compared to the same period of the previous year.
- **Russian pipeline supplies remained the main source of EU imports**, covering 47% of extra-EU imports in Q3 2018, up by 3 percentage points compared to the same period of 2017 It was followed by Norwegian pipeline imports (34%), LNG imports (11%) and pipeline supplies from North Africa (8%). With average EU import prices increasing measurably between the third quarter of 2017 and 2018 (by 37%, from 17 €/MWh to 23 €/MWh), the EU's estimated gas import bill rose to around 23 billion euros in the Q3 2018, 33% more than a year earlier.
- In the third quarter of 2018, **Ukraine remained the main supply route of Russian gas to the EU**, covering 48% of the total Russian supplies (19 bcm). Due to the maintenance works on Nord Stream and Yamal pipelines in July 2018, the share of Nord Stream was 30% (12 bcm) while gas supplies transiting Belarus covered 23% (9 bcm) of total EU imports from Russia in Q3 2018.
- **The European Commission** continued to work on the future long-term gas transit framework after the expiration of the current supply contract between Russia and Ukraine at the end of 2019. This involved a high level trilateral meeting between the EU, Ukraine and Russia in July 2018, which was followed by a series of senior technical meetings afterwards.
- **EU LNG imports decreased by 8%** year-on-year in the third quarter of 2018 and were 9% lower than in the second quarter of 2018. Unlike to the previous two years, LNG imports did not pick up in summer 2018, owing to the unusual price premium of Asian markets to Europe this time of the year, which drew cargoes away from Europe and even providing incentives from some reloads/re-exports to the higher priced region.
- In the third quarter of 2018, Qatar remained the largest import LNG supply to the EU, with a share of 43%, followed by Nigeria (17%) and Algeria (12%). The share of the US was only 3%. However, following the meeting between European Commission President Juncker and US President Trump on LNG trade increase in July 2018, aiming at gas supply source diversification, the **Polish oil and gas company PGNiG concluded long term LNG import contracts with US firms over the recent months.** At the end of 2018 LNG imports from the US started to increase measurably in the EU.
- **Storage injections ramped up in Q3 2018** at the beginning of the quarter from a level lower than in 2017 (on 30 June the average filling rate was 49%, compared to 51.2% a year earlier) to 82.7% by the end of September, being still 1.8% lower than a year before. Spot prices being higher than forward contracts (price curve in backwardation) throughout the quarter made it costlier for the shippers to fill up the storages.
- **Spot prices at European gas hubs rose significantly in the third quarter of 2018, and in September they reached the highest monthly average (27-29 €/MWh) since December 2013**. Significant increase in oil prices (at four-year high at the end of September), generally high energy prices, coupled with strong injection demand, all provided support to hub prices in this period. Oil-indexed gas prices were following oil prices, which were increasing since the beginning of 2018. At international level, European and most of the Asian gas contracts widened their price premium to the US Henry hub, being fairly stable in this period.
- **Liquidity on European gas hubs increased** by 4% in the third quarter of 2018 in year-on-year comparison. The share of the Dutch TTF hub in the total trade rose to 58%, while that in UK fell to 31%, ensuring growing lead to TTF ahead of NBP. Within total traded volumes, over-the-counter (OTC) trade ensured 63% of the total trade.
- **Retail gas prices** for household customers were stable in Q3 2018**.** However, the **impact of increasing wholesale gas prices already started to filter in retail industrial gas prices, rising by 10% year-on-year in the EU**.

1. Gas market fundamentals

1.1 Consumption

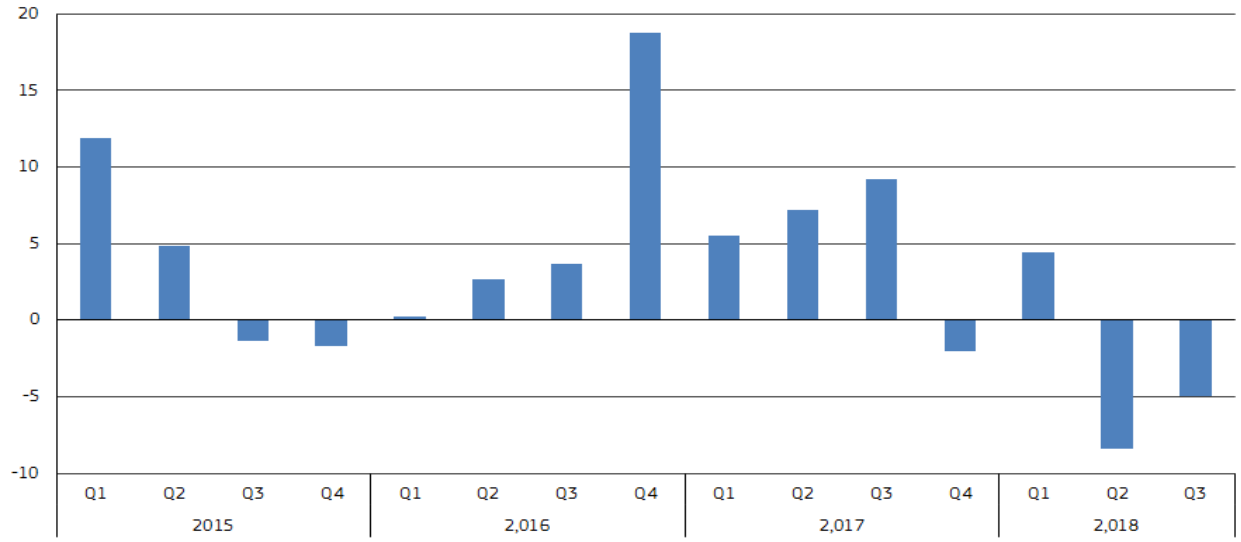
- EU gas consumption decreased by 4.9% in year-on-year comparison in the third quarter of 2018. This was the second consecutive quarter in 2018 when less gas was used in the EU as in the same quarter of the previous year. In absolute level, the quarterly consumption amounted to 78.4 bcm, down from 82.5 in Q3 2017. Milder weather in September 2018 might have contributed to the year-on-year gas consumption decrease. In the first three quarters of 2018 total gas consumption in the EU was 333 bcm, down by 1% year-on-year.

Figure 1. EU gas consumption



Source: Eurostat, data as of 17 December 2018 from data series nrg_103m. Data missing for the Netherlands in September 2018 and for Belgium in July 2018, data of the previous month was used instead as proxy.

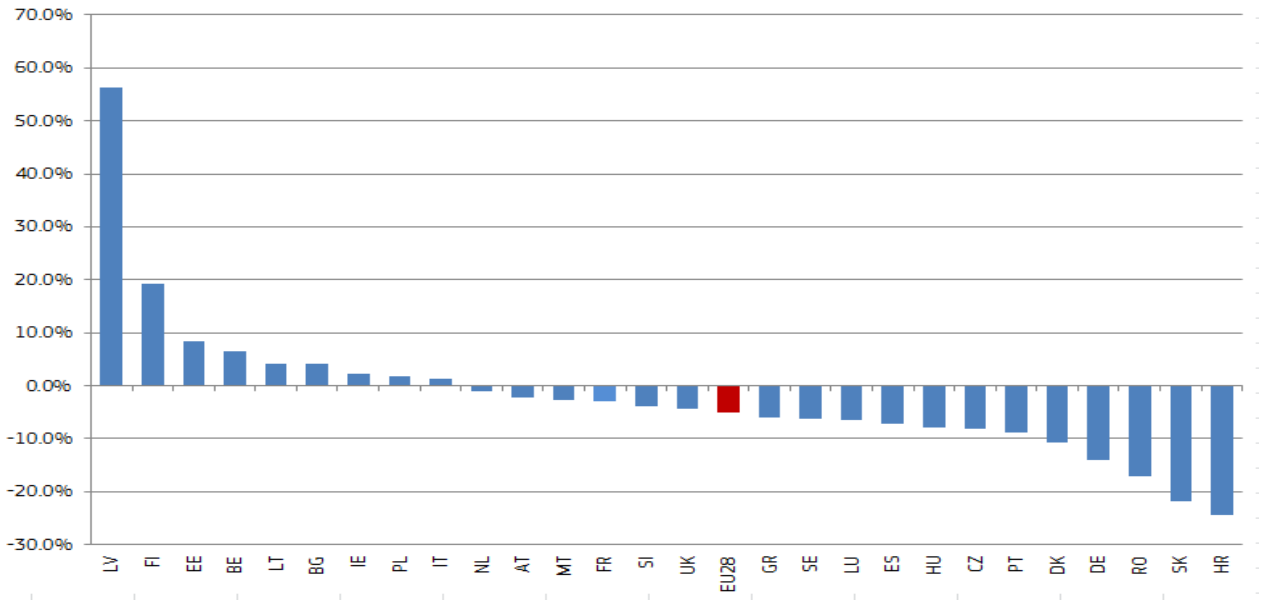
Figure 2. Year-on-year change in EU gas consumption in each quarter (%)



Source: Eurostat, data as of 17 December 2018 from data series nrg_103m. Data missing for the Netherlands in September 2018 and for Belgium in July 2018, data of the previous month was used instead as proxy. Calculations of DG Energy; based on consumption measured in bcm.

- In the third quarter of 2018, the biggest year-on-year increase in gas consumption could be observed in Latvia (56%), followed by Finland (19%). The biggest year-on-year decrease was observed in Croatia (24%), Slovakia (22%), Romania (17%), Germany (14%) and Denmark (11%), while in the remaining 20 the annual rate of change in gas consumption was less than 10%, and in the EU whole consumption went down by 4.9%, as it was mentioned before. In absolute numbers, gas consumption in Q3 2018 decreased by 2.2 bcm in Germany, by 0.6 bcm in the UK, by 0.5 bcm in Spain and by 0.4 bcm in Romania, compared to the same period of 2017. In the other Member States the change in gas consumption remained below 0.2 bcm over this period.

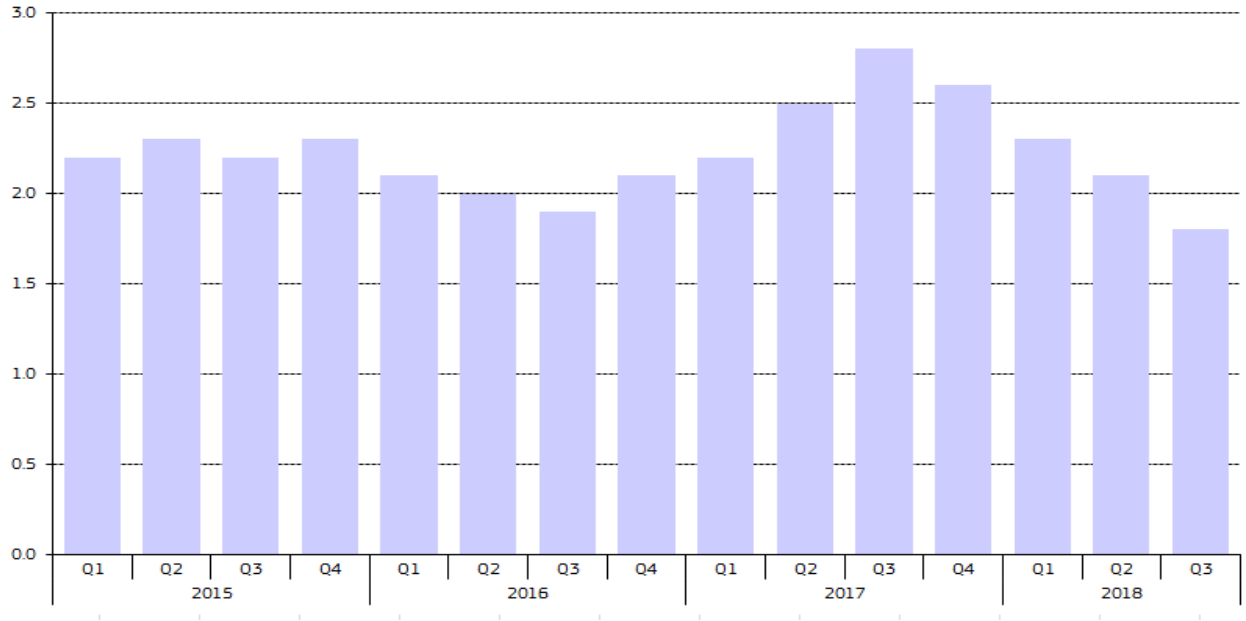
Figure 3. Year-on-year change in gas consumption in the third quarter of 2018



Source: Eurostat, data as of 17 December 2018 from data series nrg_103m. Data missing for the Netherlands in September 2018 and for Belgium in July 2018, data of the previous month was used instead as proxy. Calculations of DG Energy; based on consumption measured in bcm.

- Economic growth continued to slow down in the EU in the third quarter of 2018, and GDP grew by 1.8% in year-in-year comparison, being measurably lower than in Q3 2017 (2.8%). The growth of industrial activity was also lower than during the last year: the gross value added in the manufacturing sector was 1.1% higher in the third quarter of 2018 than a year earlier[1], which might also have impacted the consumption of natural gas in the EU.

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

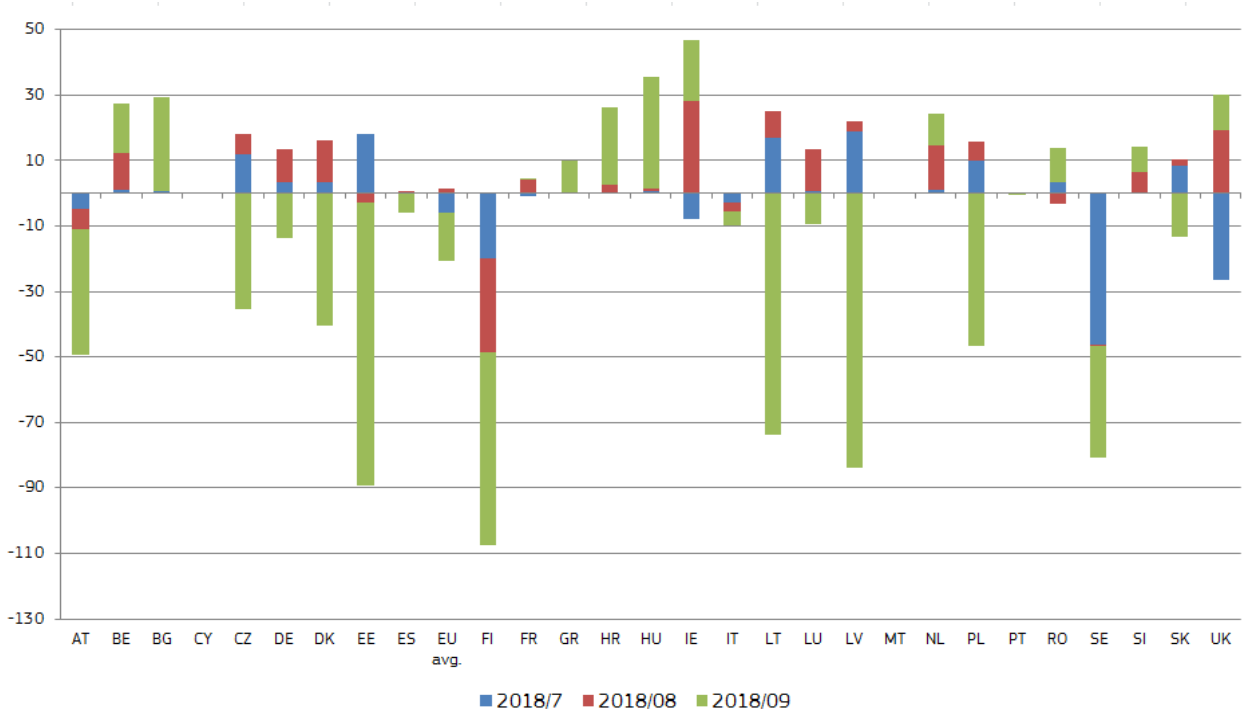


Source: Eurostat, data as of 7 December 2018 from data series namq_10_gdp - Seasonally and calendar adjusted data

[1] Source: Eurostat, data as of 7 December 2018 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 third quarter of 2018. As July and August fall into the summer period, characterised by out-season for heating, HDDs do not have much significance in these two months. However, in September 2018 temperatures were higher in most of the EU than the seasonal monthly average, implying a lower-than-usual demand for natural gas.

Figure 5. Deviation of actual heating degree days from the long-term average in the third quarter of 2018



Source: Joint Research Centre (JRC), European Commission

- Based on ENTSO-E data, gas-fuelled power generation was up by 6% in the third quarter of 2018 compared to the same period of 2017, in spite of increasing gas prices over the quarter. This was mainly related to high coal prices and steadily increasing emission allowance prices, which improved the relative position of gas vis-à-vis coal (due to less carbon intensive electricity generation for gas than coal for the production of 1 MWh electricity). At the same time variable renewable generation (especially wind) was low during some periods of summer 2018 in many EU countries, ensuring the need for more gas-fired generation.

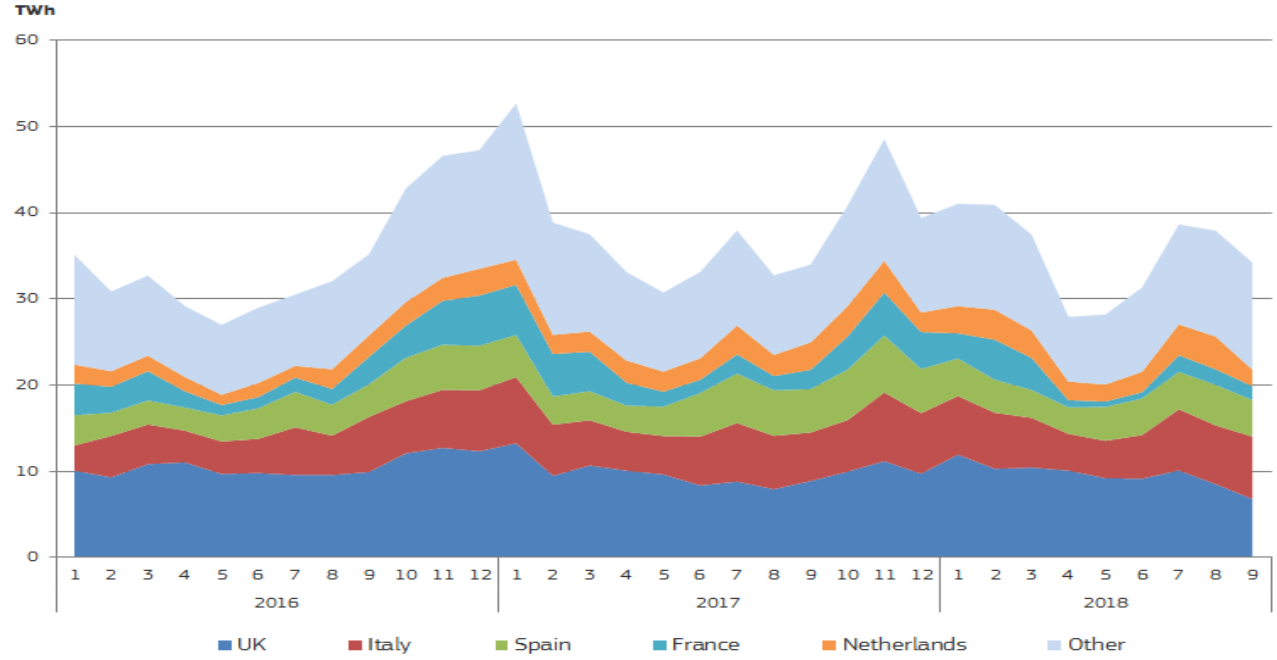
- In Italy the amount of electricity generated from gas increased by 14% in Q3 2018 in year-on-year comparison, owing to dwindling wind and solar power generation in this period. However, in Spain gas fired generation was down by 17%, owing to increasing hydro generation and in France it decreased by 14%, due to increasing solar and hydro. In the Netherlands gas-fired electricity generation increased by 4%, while in the UK it decreased by 1% in Q3 2018, if compared to the same period of the previous year.

- UK clean spark spreads – measuring the profitability of gas-fired generation by taking into variable costs – averaged 5.9 €/MWh in the third quarter of 2018, which was similar than in the previous quarter, but lower than a year before (8.4 €/MWh). However, gas-fired generation in the UK remained profitable. The share of gas in power generation was 41.5% in the UK in the third quarter of 2018, slightly less than one year earlier (42.3%).

- Clean spark spreads in Germany averaged 1.3 €/MWh in the third quarter of 2018; and in September 2018 they were in the positive range for the first time since the end of 2017[2]. Gas-fired generation in Germany was barely profitable during this period, and the slight improvement in September was mainly due to increasing wholesale electricity prices. The share of gas in the power sector in the third quarter of 2018 was only 4.3%, comparable with the share of 3.9% in the same period of 2017.

[2] Charts of clean spark spreads in Germany and the UK can be found in the Quarterly Report of European Electricity Markets. Data on the share of gas in electricity generation come from the database of ENTSO-E

Figure 6. Gas-fuelled power generation in the EU



Source: Based on data from the ENTSO-E Transparency Platform, data as of 30 November 2018

1.2 Production

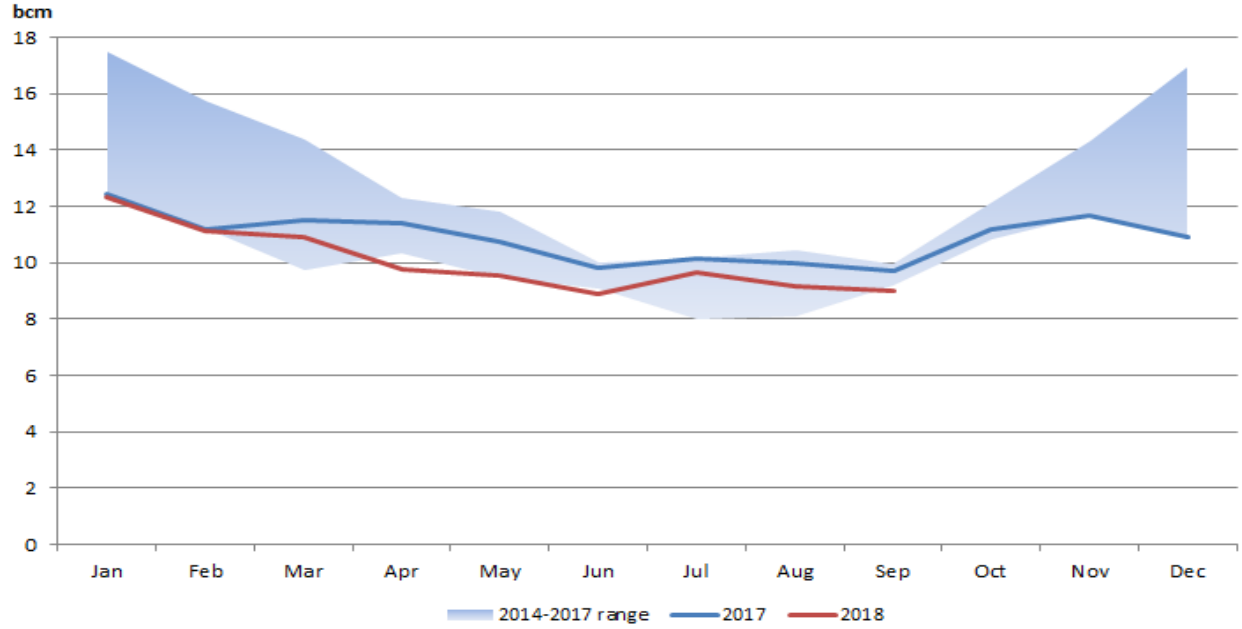
- In the third quarter of 2018, EU gas production was 27.8 bcm, 7% (2 bcm) less than in the same period of 2017. In September 2018 gas output was outside the 2014-2017 range, reinforcing the decreasing trend of domestic production. In the Netherlands[3], being the largest EU producer, gas production dropped by 16%, while in the UK, which is the second biggest producer, it went up slightly (by 4%) in Q3 2018 in year-on-year comparison. Looking at the following six largest producers, gas output decreased in Denmark (-21%), Germany (-15%), Italy (-4%), Poland (-4%), Romania (-1%). In Ireland gas production increased by 11% in Q3 2018. In the first three quarters of 2018 total EU gas production amounted to 90 bcm, 7% less than in the same period of 2017.

- As from gas year 2018 (starting as of 1 October 2018) the production cap for the Dutch Groningen gas field has been set to 19.4 bcm per year and it is set to gradually decrease to 5 bcm until 2023[4]. However, the actual gas production might even be lower in the forthcoming years. Dwindling domestic L-gas (low calorific) production will mainly be offset be increasing H-gas (high calorific) imports, and to a lesser extent, by domestic production in other gas fields in the Netherlands.

[3] In some countries (e.g.: NL) data were not available for September 2018, implying that when final data replace the estimations, the quarterly consumption data can change retrospectively

[4] Source: S&P Global Platts, European Gas Daily, 4 December 2018

Figure 7. EU gas production



Source: Eurostat, data as of 17 December 2018 from data series nrg_103m. Data missing for the Netherlands In September 2018 and for Belgium in July 2018, data of the previous month was used instead as proxy.

1.3 Imports

- In parallel with EU consumption decreasing by almost 5% in the third quarter of 2018, Eurostat data show that net imports[5] in this period were also down by 3% compared to the same period of 2017. In most of the EU countries net imports decreased measurably, however, in the Netherlands (63%), Latvia (23%), Finland (19%), and France (18%) net imports showed a double-digit growth over the same period of the previous year in Q3 2018. Net imports in Germany decreased by 10%, while in Italy it increased slightly (by 2%). In this quarter the total net EU gas imports were 85 bcm, while in the first three quarters of 2018 they reached 263 bcm, still up by 1% compared to the same period of the previous year.

- According to ENTSO-G data, imports amounted to 991 TWh in the third quarter of 2018, 3% less than in Q3 2017. Imports from Russia increased moderately, while from Algeria and Libya it went up by more than 20%. At the same time, Imports from Norway decreased slightly whereas LNG imports fell significantly.

- In the third quarter of 2018, pipeline imports from Russia were 2% higher than in the same period of 2017. Unlike 2017, when the amount of imported pipeline gas from Russia increased in the third quarter compared to the previous quarter, in 2018 imports were lower in the summer months compared to the second quarter of the year, primarily owing to maintenance works on key supply routes from Russia.

- Due to maintenance works, between 17 and 30 of July 2018 flows on the Nord Stream, entering in Germany at Greifswald were cut to zero, while in earlier between 9 and 14 July no gas deliveries arrived at Mallnow point through the Yamal pipeline. During the maintenance works on Nord Stream transit through Ukraine, (via Slovakia and the Czech Republic to arrive in Germany) and German imports from the Netherlands were ramped up. Gas imports through the Velke Kapusany entry point (Ukraine-Slovakia) went up by more than 5 bcm in July 2018 compared to the previous month.

- Russia remained the top supplier of the EU, covering almost 47% of total extra-EU imports in the third quarter of 2018, 3 percentage points more than in the same period of 2017 and the highest quarterly share seen in the last five years.

- In July 2018 the European Commission led trilateral ministerial talks between Ukraine and Russia, to discuss the future framework of the long-term transit of Russian gas through Ukraine[6]. In the following months expert groups focussed their discussions on the

[5] Net imports equal imports minus exports and do not account for stock changes.
[6] http://europa.eu/rapid/press-release_STATEMENT-18-4568_en.pdf

future contractual framework, tariff methodology and the future transmission system operator in Ukraine, as well as gas needs of the EU, in the light of the expiration of the Russia-Ukraine gas transit contract at the end of 2019.

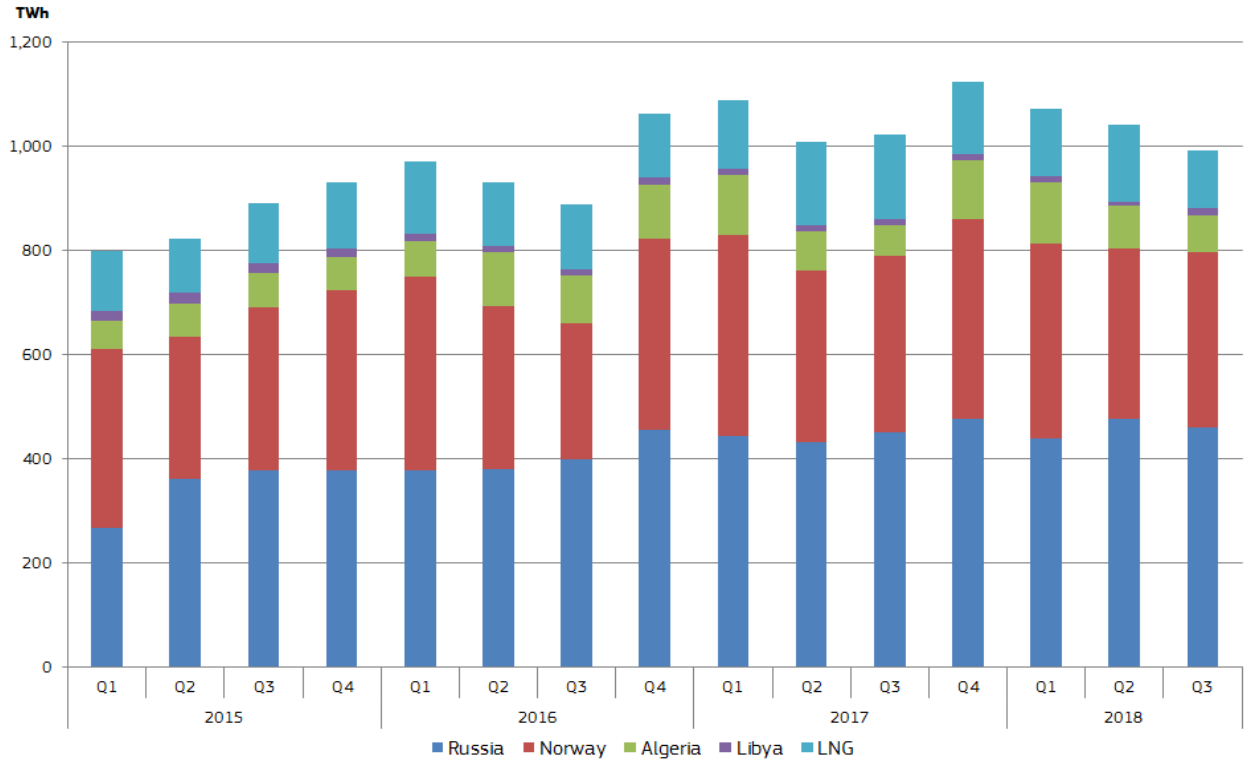
- Imports from Norway, the EU's second gas supplier, decreased by 1% year-on-year in the third quarter of 2018, but the country's share in extra-EU gas imports rose slightly to 34% from 33% in year-on-year comparison.[7] In the third quarter of 2018, Norwegian gas production amounted to 29.6 bcm, 5% more than in the same period of the previous year.[8]

- Imports from Algeria grew by 20% in the third quarter of 2018 while imports from Libya, coming back from the transitory disruption in Q2 2018, also went up by 21% year-on-year. The combined share of Algeria and Libya from total extra-EU imports was 8.6% in the third quarter of 2018, slightly up compared to the same period of 2017 (7%).

- According to ENTSO-G data, imports of LNG decreased measurably in the third quarter of 2018 and covered 11% of total extra-EU gas imports, down from 16% one year earlier (see further details below).

- Import volumes of natural gas decreased from 1021 TWh to 991 TWh in the third quarter of 2018 compared with the same period of 2017, while at the same time the estimated average import price went up by 37%, from 16.7 €/MWh to 22.9 €/MWh. As a result, the EU's estimated gas import bill increased by 33% year-on-year, reaching around 22.7 billion euros in the third quarter of 2018.

Figure 8. EU imports of natural gas by source, 2015-2018



Source: Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2018
Russian deliveries to Estonia and Latvia are reported for a limited period (Narva from 15 June 2015 to 10 December 2015, Värska 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 third quarter of 2018, the volume of Russian imports transiting Ukraine was 2% lower than in the same period of 2017. However, Ukraine continued to be the main supply route of Russian gas to the EU, especially in July, when the aforementioned

[7] Note that Norway to UK flows reported by ENTSO-G includes some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.
[8] http://www.npd.no/Global/Norsk/1-Aktuelt/Produksjonstall/P2018/Nov-2018/Data-nov-2018.xlsx

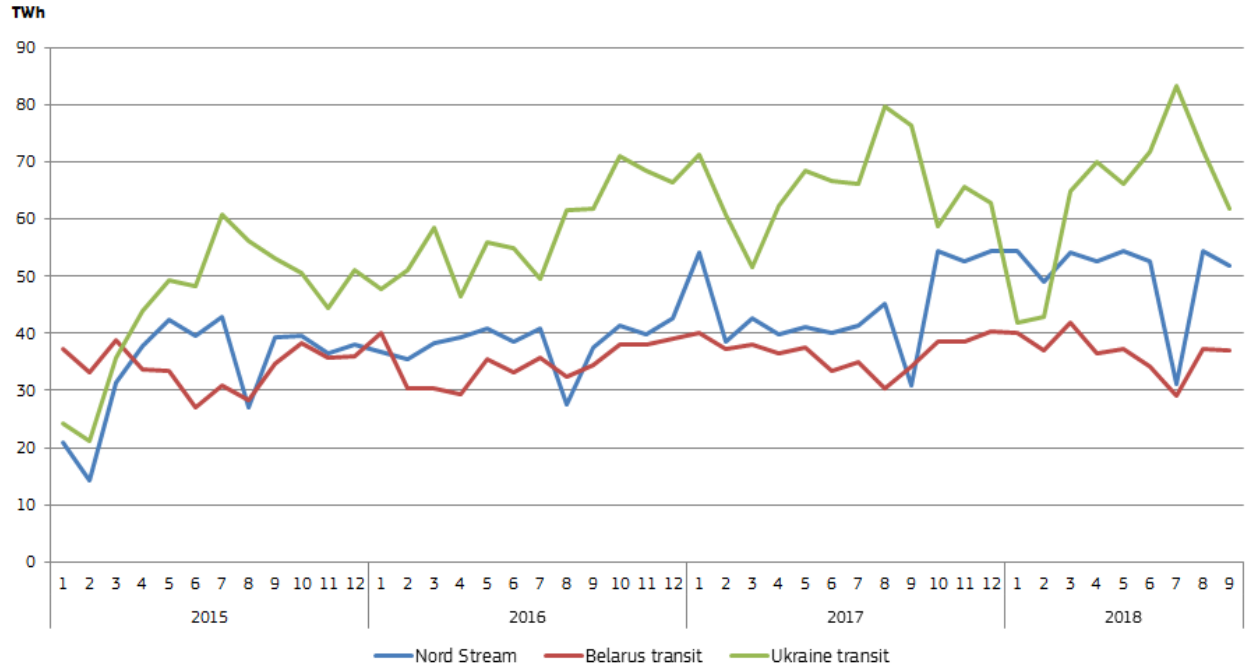
maintenance works were carried out on the Yamal and the Nord Stream pipelines. On quarterly average the Ukraine route covered 48% of the total gas imports from Russia, but in July this share amounted to 58%.

- Gas flows on the Nord Stream pipeline represented 30% of total EU imports from Russia in the third quarter of 2018, being slightly higher than a year before (27% in Q3 2017). In 2018 maintenance works took place in July on Nord Stream, while in 2017 the work period fell in September, implying that on quarterly average the impact was not significant on the import volume change. In absolute terms, volumes were 17% higher in Q3 2018 than in the same period of 2017.

- Gas supplies transiting Belarus in the third quarter of 2018 slightly increased (by 4%) from the same period of 2017 and covered 23% of total EU imports from Russia. However, deliveries on this route decreased by around 17% in July 2018 year-on-year, presumably because of maintenance works.

- In the third quarter of 2018, Ukraine continued to rely on imports from the EU. Gas flows coming from Hungary, Poland and Slovakia reached about 3.6 bcm in this period, 3% (or by 0.1 bcm) less than in the same period of 2017. During the three months of Q3 2018, following the seasonal pattern that could be observed over the last few years, a strong increase in deliveries came from Hungary, offsetting declining volumes from Slovakia. However, imports from the latter remained the most important supply route of Ukrainian imports from the EU[9]

Figure 9. EU imports of natural gas from Russia by supply route, 2015-2018



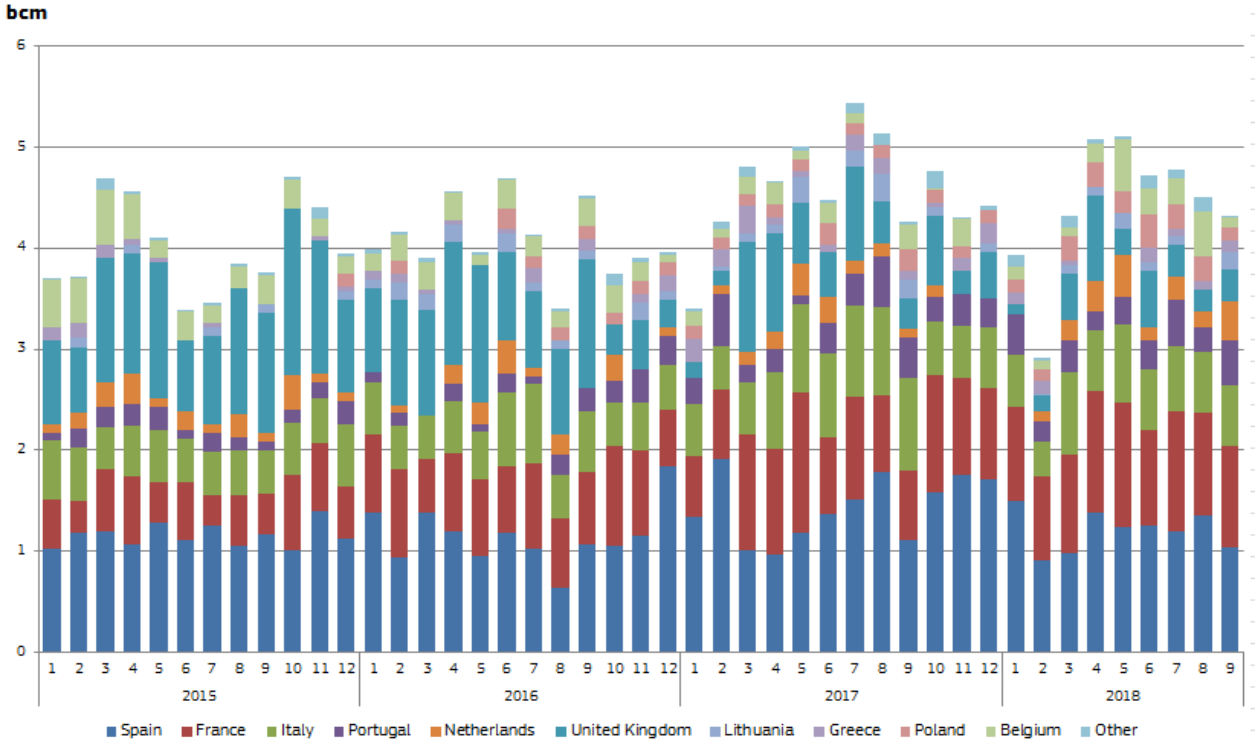
Source: Based on data from the ENTSO-G Transparency Platform, data as of 11 December 2018
Deliveries to Estonia, Finland and Latvia are not included; transit volumes to the Former Yugoslav Republic of Macedonia, Serbia and Turkey are excluded

- After a 5% year-on-year increase in the second quarter, EU LNG imports fell by 8% year-on-year in the third quarter of 2018. Decreases in the UK (-49%), Greece (-32%), Italy (-31%), Spain (-18%), and Portugal (-5%) were only partially offset by increases in the Netherlands (131%), Belgium (134%), France (29%), and Poland (34%).

- Although over the last two-three years EU LNG imports showed a counter-seasonal behaviour, with volumes peaking during summer and ebbing in winter, in the third quarter of 2018 LNG shipments to Europe did not pick up (contrarily, they were 9% lower than in the previous quarter), primarily owing to the persisting price premium in the Asian LNG markets to Europe (see Figures 17 and 18), which made Europe a less attractive destination for spot LNG cargoes. Unlike in 2016 and 2017, the spread between European and Asian prices remained measurable during the third quarter of 2018, drawing cargoes away from Europe and even providing incentives from some reloads/re-exports (see also Section 2.2 and 2.3).

[9] Based on data from the ENTSO-G Transparency Platform, data as of 27 November 2018

Figure 10. LNG imports to the EU by Member State

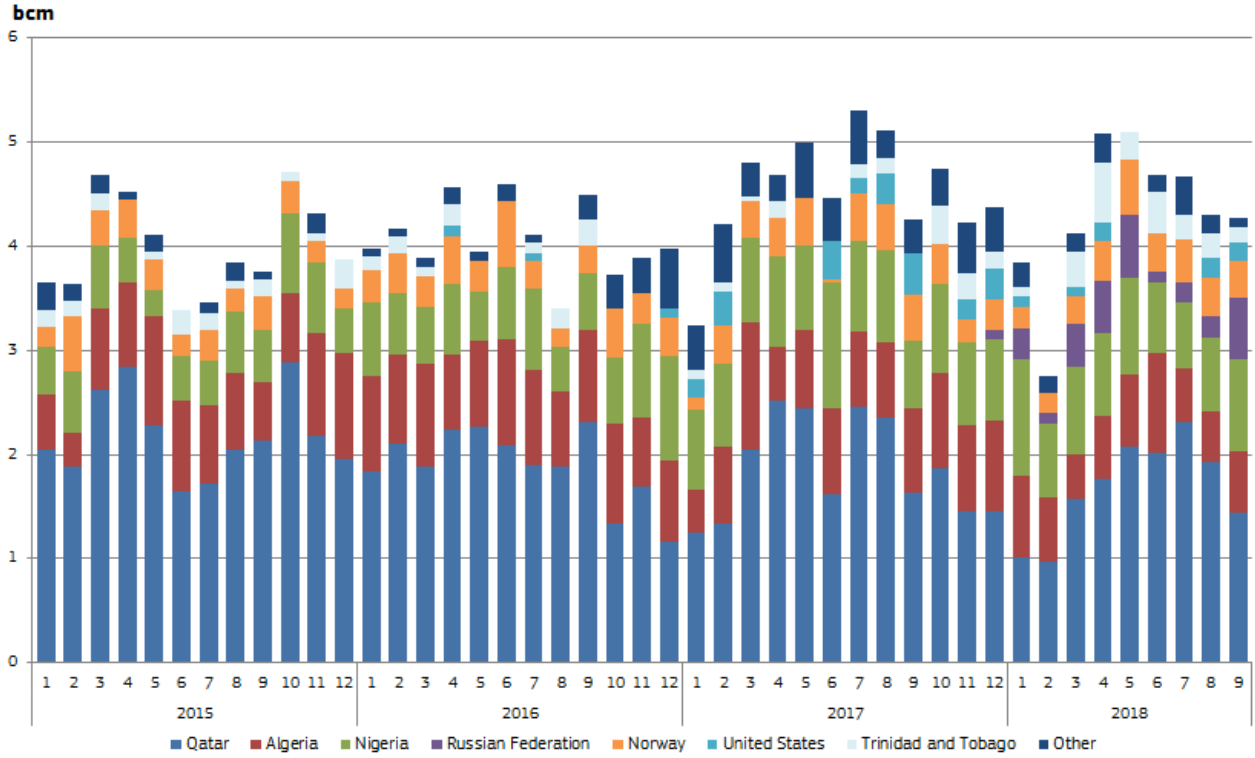


Source: Commission calculations based on tanker movements reported by Thomson Reuters
"Other" includes Finland, Malta and Sweden

- In the third quarter of 2018, Qatar remained the largest LNG supplier of the EU, with its market share increasing from 39% to 43% from the previous quarter. Qatar was followed by Nigeria (17%), Algeria (12%), Norway (8%) and Trinidad and Tobago (5%). The share of the US was only 3%, around half as much as in the same period of 2017 (6%).

- In the third quarter of 2018, Qatar had dominant role (more than 80% of the imports) in the Belgium, Poland, Italy and the UK LNG markets. Nigeria was the biggest LNG supplier in Portugal (48% and the French market (35%). Algeria was the largest LNG supplier of Greece (70%). Norway was the sole LNG supplier of Lithuania. Spain had the most diversified portfolio: it received LNG from seven extra-EU suppliers, with Qatar having the biggest market share (28%).

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 (re-exports) are excluded
"Other" includes Angola, Brazil, the Dominican Republic, Egypt, Equatorial Guinea, Oman, Russia, Singapore and the United Arab Emirates

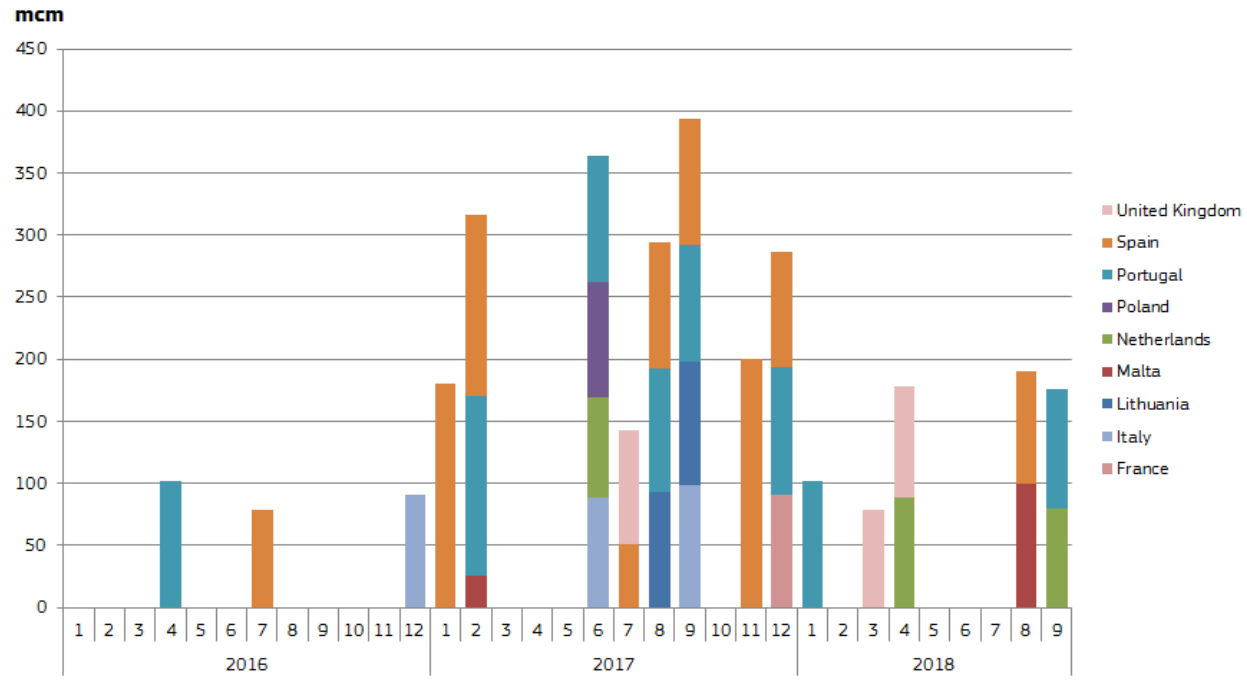
- In the third quarter of 2018 twelve LNG cargoes arrived from the US, unloading in August in Malta and Spain, in September in the Netherlands and Portugal. The total quarterly volume (0.37 bcm of gas equivalent) was 56% lower than in the same period of 2017 and represented 7% of total US LNG exports in this period. Total US LNG exports picked up by 43% compared to the third quarter of 2017 and the majority of supplies went to the Latin American (48%) and Asian (44%) market.

- US liquefaction capacities under development are expected to exceed 100 bcm per year by 2023[10], implying that US LNG exports will not face any obstacles to expand from liquefaction infrastructure side. In the summer of 2018, European Commission President Juncker and US President Trump agreed to strengthen the strategic cooperation with respect to energy, which would be of particular interest in Europe, given security of gas supply and import source diversification aspect[11].

- Over the last months of 2018 The Polish state-owned oil and gas company PGNiG concluded contracts with different US based companies on long term LNG shipments (e.g: with Venture Global in October, with Cheniere in November and Sempra Energy in December), which provide for competitive priced contracts compared to Russian pipeline imports and would contribute to import source diversification[12]. At the end of 2018 LNG imports from the US started to increase measurably in the EU.

[10] According to the data on projects by Bloomberg News Energy Finance, 12 September 2018.
[11] http://europa.eu/rapid/press-release_STATEMENT-18-4687_en.htm - See more in Quarterly Report on European Gas Markets, Vol 11, Issue 2.
[12] See more in ICIS Gas in Focus, 15 November 2018 and https://www.reuters.com/article/sempra-usa-poland/sempra-energy-to-supply-lng-to-poland-idUSL3N1YO3JM

Figure 12. EU LNG imports from the US



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

1.4 Storage

- Figure 13 shows EU stock levels as the 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 1,067 TWh (roughly 100 bcm) on 30 June 2018, 1% less than one year earlier.

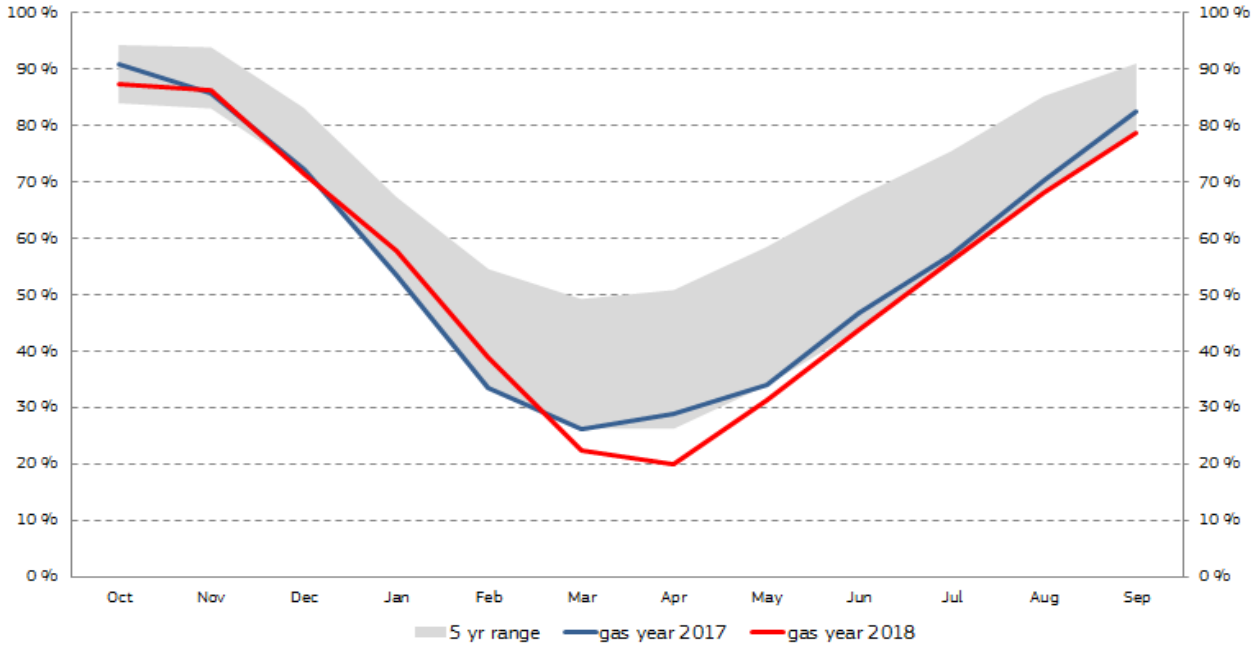
- Because of the late winter cold spell in February and March 2018, the injection season started relatively late. Injections ramped up more quickly in the second quarter of 2018 than in 2017 but, starting from a lower stock level, filling rates remained lower than year-ago levels throughout the second quarter of 2018.

- On average, net injections made during the third quarter of 2018 were equivalent to 33% of storage capacity (similar to 33.4% in the same period of 2017): the average filling rate increased from 49.7% on 30 June 2018 to 82.7% on 30 September 2018. All in all, at the end of September 2018 the average filling rate in the EU was still 1.8 percent less than a year before.

- From spring 2018 until the start of the new gas year on 1 October, the gap between the actual filling rate and the long term average filling values was gradually shrinking, however, there were some factors putting an obstacle to rapid refilling of the storages. First, at the end of winter 2017/18 storage levels were at extreme lows compared to other years in the past. Second, spot natural gas showed a steady increase in parallel with other energy commodities, such as crude oil, coal prices and with increasing carbon emission prices over the second and the third quarter of 2018.

- This resulted in lower than usual premium in the spot gas prices to the gas curve (winter price for 2018-19), which did not give robust incentives to market participants to buy the gas on the spot and inject in the storages.

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

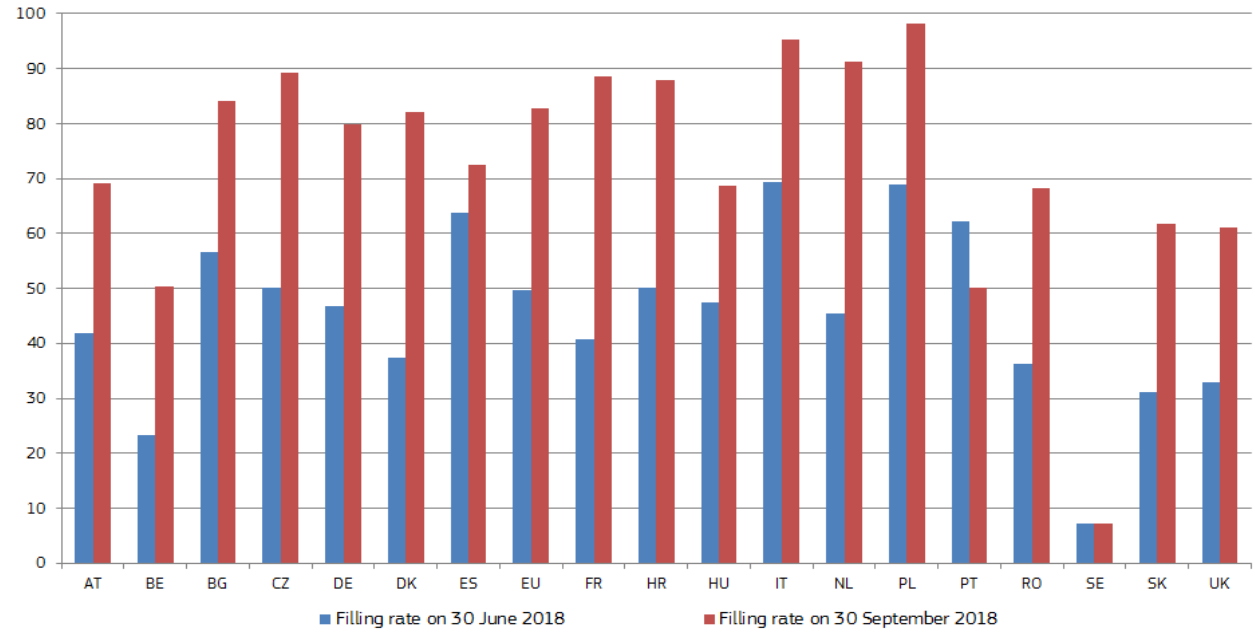


Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 17 December 2018. See explanations on data coverage at https://agsi.gie.eu/#/faq.
The 5-year range reflects stock levels in gas years 2013-2017. The graph shows stock levels on the 15th day of the given month.

- 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 June 2018) and the pace of injections. France and the Netherlands saw the highest rate of injections in this period, with the filling rate increasing respectively by 48 and 46 percentage points. Germany, Czech Republic and Denmark also experienced above-average injections in the third quarter of 2018, with the filling rate increasing by 33-44 percentage points in the three countries.

- Poland and Italy had the highest filling rate at the end of September 2018, more than 95% of the storage capacity. On the other hand, storage levels were barely higher than 50% in Belgium, and only slightly above 60% in Slovakia and the UK. In Belgium and Slovakia filling rates on 30 September 2018 were 25 percent less than a year before.

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



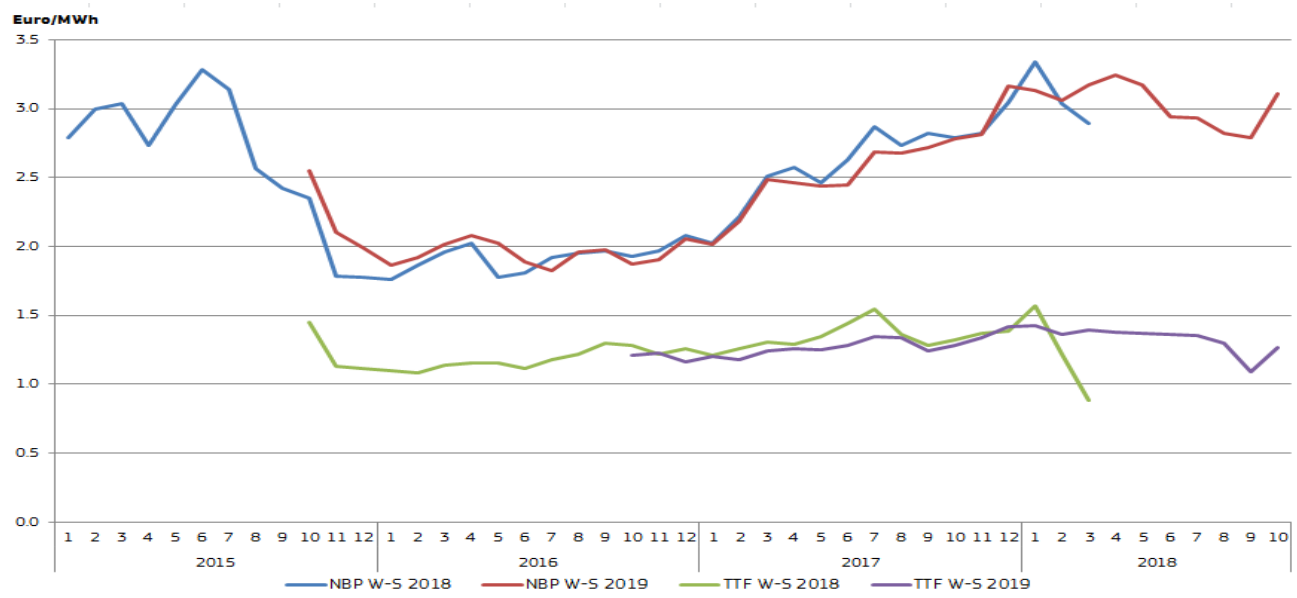
Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 17 December 2018; calculations of DG Energy. See explanations on data coverage at https://agsi.gie.eu/#/faq. Injection level data in Sweden remained practically constant since the first data reporting period in March 2017

- On the NBP, seasonal spreads averaged 2.9 €/MWh in the third quarter of 2018, slightly more (0.2 €/MWh) than in the same period of 2017. On the TTF, the average seasonal spread was 1.3 €/MWh in the third quarter of 2018, practically the same as a year earlier.

- In the UK, seasonal spreads have been clearly on the rise since the beginning of 2017, and in the first nine months of 2018 it reached 3 €/MWh on average, levels were not seen since 2015. This is probably related to the loss of the Rough storage facility in the UK 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 shippers incentivising seasonal storage. In the medium to long term, the gradual decline of Groningen production will reduce further the seasonal flexibility provided by the field. This might be supportive to widening winter-summer price spreads also in the Netherlands.

- On 1 October 2018 the twenty-year long term capacity contracts on the Belgium-UK gas interconnector expired[13], implying that from now on shippers have to pay higher prices to short term capacity and the UK gas market will have to trade with a higher price premium to the continental markets during peak winter periods to attract import volumes.

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



Source: S&P Global Platts
W-S 2018 refers to the difference between the winter 2018-19 price and the summer 2018 price; W-S 2019 refers to the difference between the winter 2019-20 price and the summer 2019 price

[13] See more in ICIS Gas in Focus 28 September 2018

2. Wholesale gas markets

2.1 EU energy commodity markets

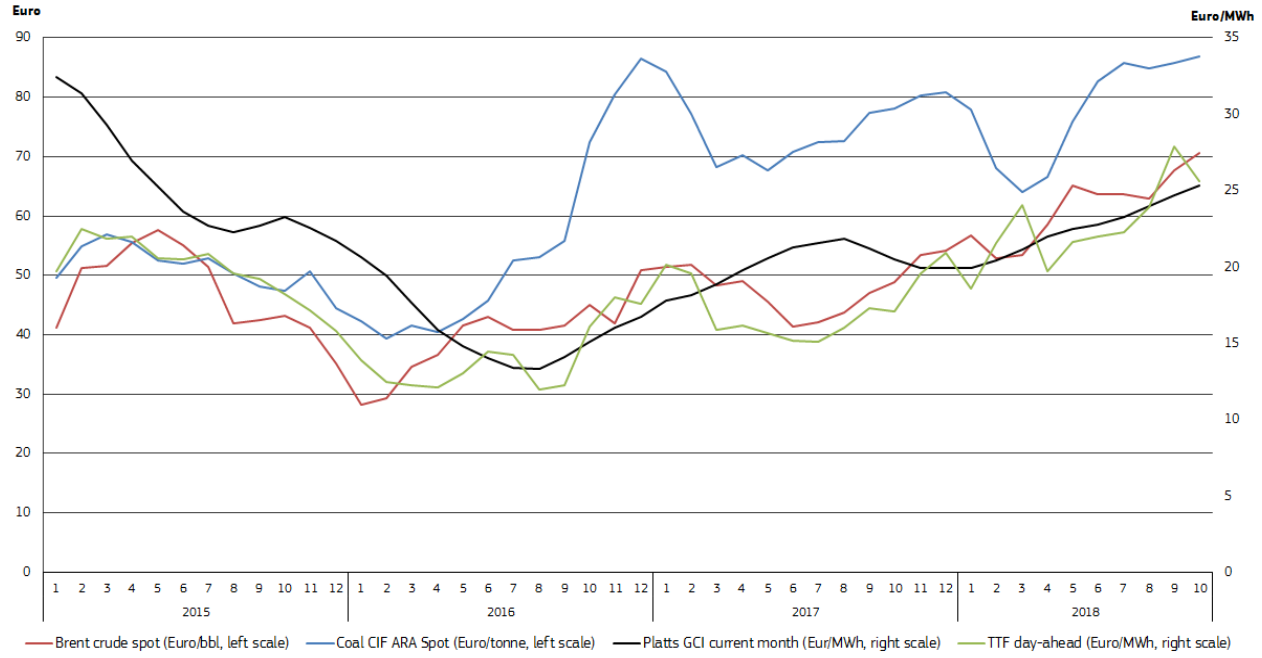
- The price of Brent crude oil has continued to increase in the third quarter of 2018, and by the end of September 2018 it rose to four-year high. Increase in oil prices were supported on the demand side by robust global economic growth. On the supply side the main factor was the anticipation of the impacts of the US withdrawal from the Iran nuclear deal, which resulted already in Q3 2018 in a significant drop in Iranian crude oil exports (by almost 1 million barrel per day between May and September 2018) Crude oil production in Venezuela fell to the lowest in five decades, also putting a strain on global oil supply.

- In September 2018 the TTF spot gas price averaged 27.8 €/MWh, being the highest since the end of 2013. On average in the third quarter of 2018 it reached 26 €/MWh, 53% more than in the same period of 2017. While EU gas consumption decreased year-on-year, rising oil and coal prices, increasing carbon emission allowance prices, decreasing LNG supply in Europe and strong injection demand ahead of the heating season provided support to European hub prices in Q3 2018.

- Crude oi prices in Q3 2018 remained on their upward trajectory that started in mid-2017, increasing since then by more than 60% in euros by September 2018. In line with the typical 6-9 month time lag used in the pricing formula, oil-indexed prices also followed their upward trend since the first quarter of 2018. In the third quarter of 2018 Platt's North West Europe Gas Contract Indicator (GCI), a theoretical index showing what a gas price linked 100% to oil would be, averaged 24 €/MWh, which was slightly lower (0.6 €/MWh) than the spot TTF, owing to the sharp upturn of spot market prices across Europe.

- Coal prices stabilized at 85 €/Mt in the third quarter of 2018, after undergoing a significant increase in the previous quarter. However, in year-on-year comparison, they were up by 15% on average, supported by increasing Chinese and Indian imports and increasing oil prices (which increase transport costs). High coal prices, coupled with the recent increase in the price of European emission allowances, slightly improved the relative competitive advantage of gas vis-a-vis coal in electricity generation.

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



Source: S&P Global Platts

2.2 International gas markets

- Figure 17 displays an international comparison of wholesale gas prices. Over the last two winters (2016-2017 and 2017-2018) this trend was challenged by steep rises in the Asian prices due to the strong seasonal demand. However, in 2018 the Asian price premium remained significant to Europe even during the summer period, which resulted in dwindling LNG shipments to the EU. Gas

prices in Europe and the US increased only slightly in the third quarter of 2018, resulting in a widening gap between regional benchmarks.

- In the second quarter, TTF averaged at 8.4 USD/mmbtu (24.7 €/MWh). The average German border price was somewhat lower (6.6 USD/mmbtu or 19.5 €/MWh).

- Asian prices in September 2018 rose to the highest level in the last four years, impacted by increasing crude oil prices. In Asia the role of oil price escalation in gas contracts is still significant compared to Europe. The average Japanese LNG price was 11.6 USD/mmbtu in September 2018 and in the third quarter as a whole, the price average was 10.7 USD/mmbtu, 77% more than in the same period of 2017. The Japanese premium above the Dutch TTF hub was on average 2.3 USD/mmbtu in the third quarter of 2018. On quarterly average, LNG import prices in China were comparable with their Japanese peers (10. 7 USD/mmbtu).

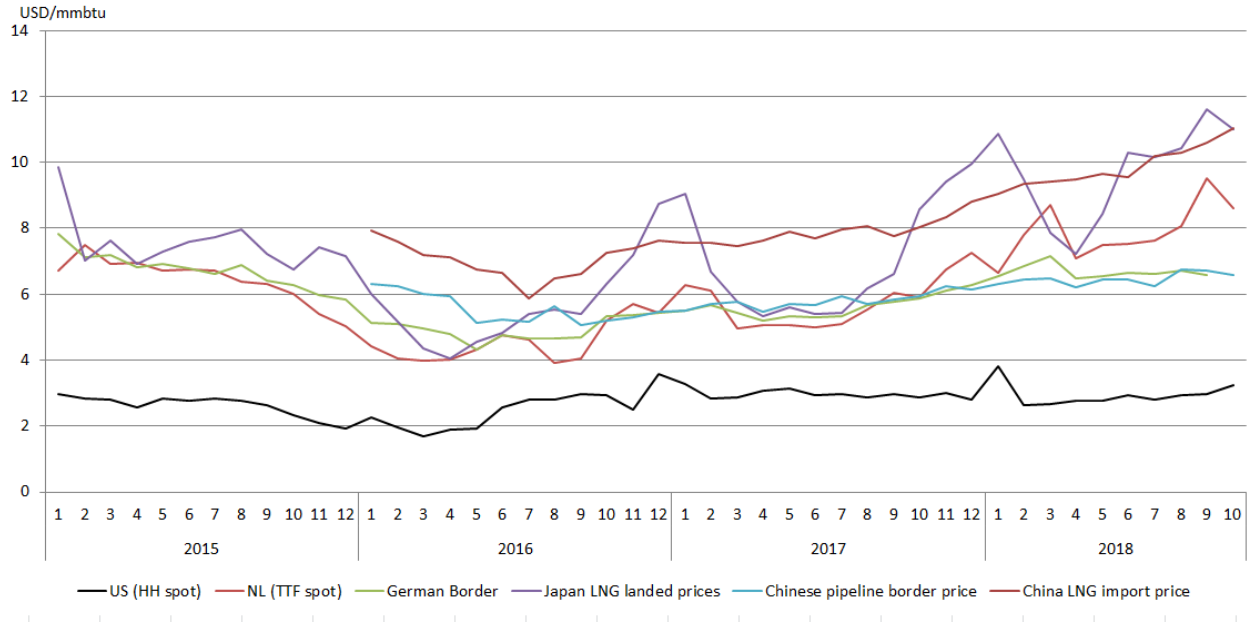
- The average import price of Chinese pipeline imports was 6.6 USD/mmbtu, well below the Asian LNG reference prices.

- The Henry Hub price had been rather stable since February 2017, fluctuating around 3.0 USD/mmbtu, with a small peak in January 2018. In the third quarter of 2018, the average price was 2.9 USD/mmbtu, practically unchanged compared to the same period of 2017. The euro-dollar exchange rate remained practically stable over the third quarter of 2018 (1.15 on average), implying that changes in price differentials between the regions were the result of pure energy market developments.

- While in the third quarter of 2017 the key international gas prices remained well-aligned, this was not the case in the third quarter of 2018: in September 2018 price differentials were even higher than in winter periods over the last few years. The ratio of the Japanese LNG price and US Henry Hub was 3.7 in the third quarter of 2018, up from 3.1 in the second quarter and significantly increasing from 2.1 in Q3 2017.

- The average TTF/Henry Hub ratio increased to 2.9 in the third quarter of 2018 from 1.9 in the same period of 2017. In absolute terms, the price spread between Henry Hub and TTF was 5.5 USD/mmbtu in the third quarter of 2018, up from an average 2.6 USD/mmbtu in the same period of 2017.

Figure 17. International comparison of wholesale gas prices



Sources: S&P Global Platts, Thomson-Reuters, BAFA, CEIC

2.2.1 LNG markets

- In contrast to the usual behaviour during the summer period, Asian prices in the third quarter of 2018 retained their premium over Europe, driven by rising oil prices and the continued strong demand in the region. Coal-to-gas switching, helped by high coal prices, provided support to LNG demand, especially in China and Korea.

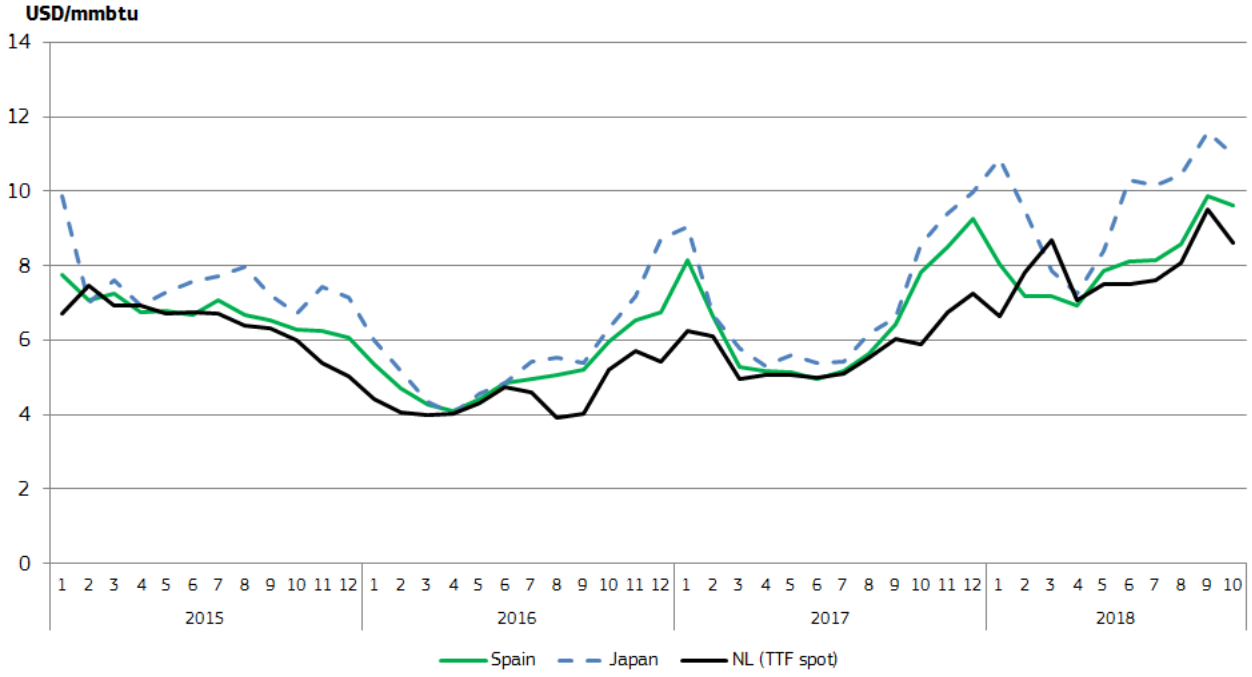
- In the third quarter of 2018, spot prices averaged 8.3 USD/mmbtu in the UK, 8.9 USD/mmbtu in Spain, 10.7 USD/mmbtu in Japan. In September 2018, the difference between the Japanese and UK price reached 2.4 USD/mmbtu.

- JCC, the Japanese benchmark of oil-indexed LNG prices averaged around 10.9 USD/mmbtu in the third quarter of 2018, slightly more than the average spot price (10.7 USD/mmbtu).

- LNG imports in the third quarter of 2018 remained practically the same in China (-0.6% year-on-year) and in Japan (-0.3%), however, in India it increased by 10%, similarly to Korea (+16%).[14]

- Global LNG supply continued to expand in the second quarter of 2018: and LNG trade amounted to 97 bcm, 1.6% more than in the same quarter of 2017.

Figure 18. Spot LNG landed prices in the EU and Asia



Note: Landed prices for LNG
Source: Thomson-Reuters

- 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 NL TTF hub is also presented.

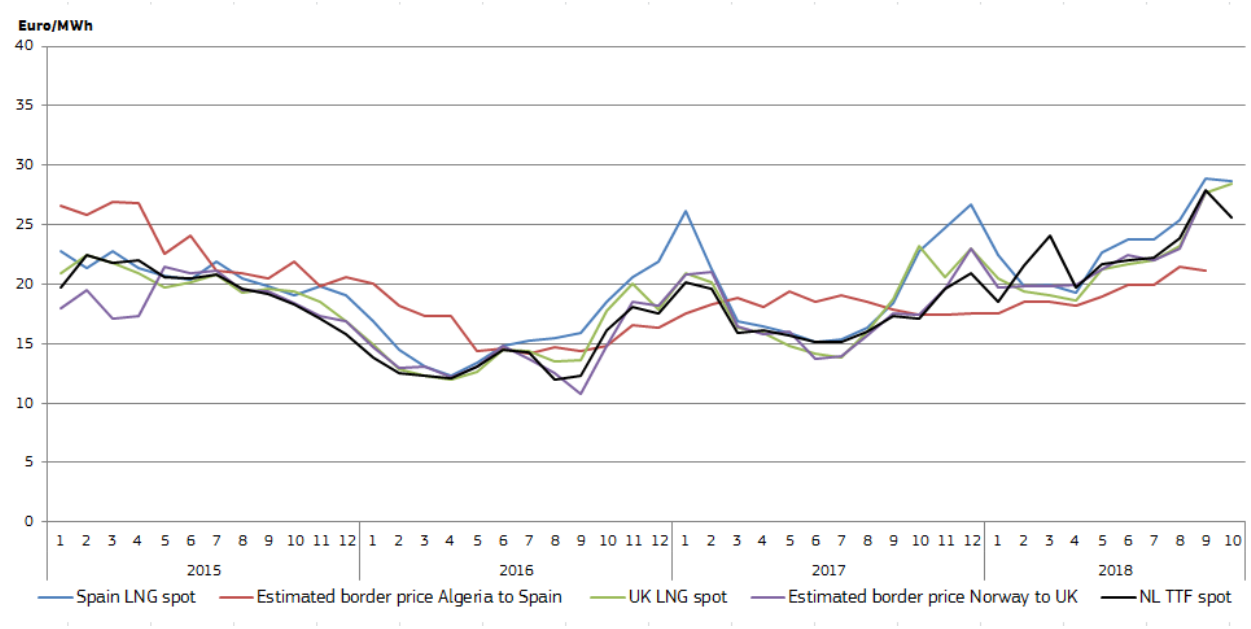
- In the third quarter of 2018, most of estimated border pipeline imports gas prices and LNG prices in the UK and Spain showed a significant increase; with the exception of estimated Algerian pipeline import price in Spain, rising moderately over the last year, the other prices rose by more than 50% in year-on-year comparison. In September 2018, the average spot LNG price in the UK and Spain rose up to 28 €/MWh, which was the highest since December 2013, similarly to the Norwegian import price (27.8 €/MWh).

- Spot LNG prices in Spain and the UK were mainly influenced by the strong demand in Asia, leading to unusually high prices in Europe in this time of the year. In contrast, pipeline gas coming from Algeria is mainly influenced by oil prices. Algerian pipeline supplies are sold under long-term contracts with prices linked to oil. The lagged effect of rising oil prices started to appear in the

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

Algerian import price as of the beginning of 2018, and in the third quarter of the year the price rise continued, in parallel with increasing oil prices. In September 2018 the Algerian import price was up by 18% year-on-year.

Figure 19. Price developments of LNG and pipeline gas in the UK and Spain



Note: Landed prices for LNG. Source: S&P Global Platts, Thomson Reuters, European Commission estimates based on Eurostat COMEXT data

2.3 European gas markets

2.3.1. Wholesale markets in the EU

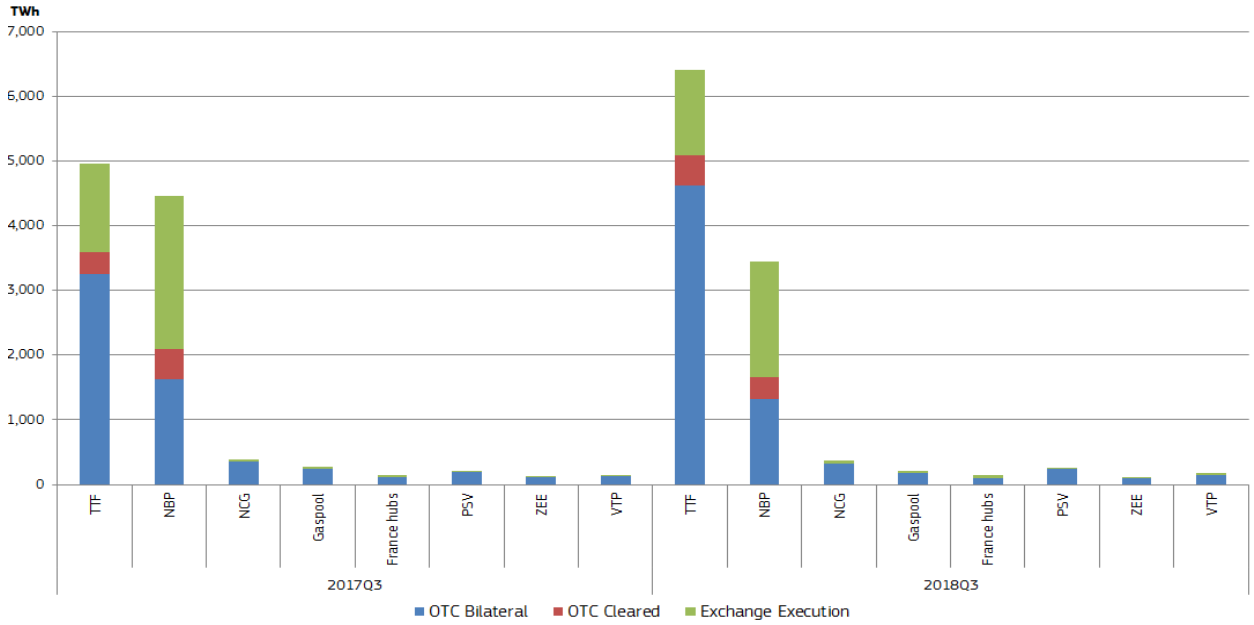
- As figure 20 shows, liquidity on the main European gas hubs increased in the third quarter of 2018: total traded volumes amounted to around 11 120 TWh (equivalent to around 1 060 bcm), 4% more than in the same period of 2017. This was around 23.6 times more than the gas consumption in the seven Member States[15] covered by the analysis in this period. In July traded volume of gas decreased on the European hubs in year-on-year comparison, however in August and September it rose again (by 3% and 10%, respectively). Far-curve trading and storage-backed trading continued to drive liquidity, as before the heating season storages had to be filled up and forward contracts became more attractive owing to high crude oil and spot gas market prices.[16]

- Traded volumes in the third quarter of 2018 increased year-on-year in the Dutch (29%), Italian (21%) and, Austrian (19%) hubs, while in the UK (-23%), Germany (-12%), France (-8%) and Belgium (-12%) gas traded volumes decreased compared to. Q3 2017.

- On the UK NBP hub, 52% total traded volumes were executed directly on an exchange in the third quarter of 2018. This share was 21% on the Dutch TTF hub, 27% at the French hubs, 15% at the German hubs, 17% and only 1% at the Austrian and the Italian hubs. In the Netherlands, the share of exchange trade was markedly lower than a year earlier (-7 percentage points), while it increased in Austria (+5 percentage points).

[15] Netherlands, UK, Germany, France, Italy, Belgium, Austria
[16] ICIS Gas in Focus, 15 October 2018

Figure 20. Traded volumes on the main European gas hubs in the third quarter of 2017 and 2018

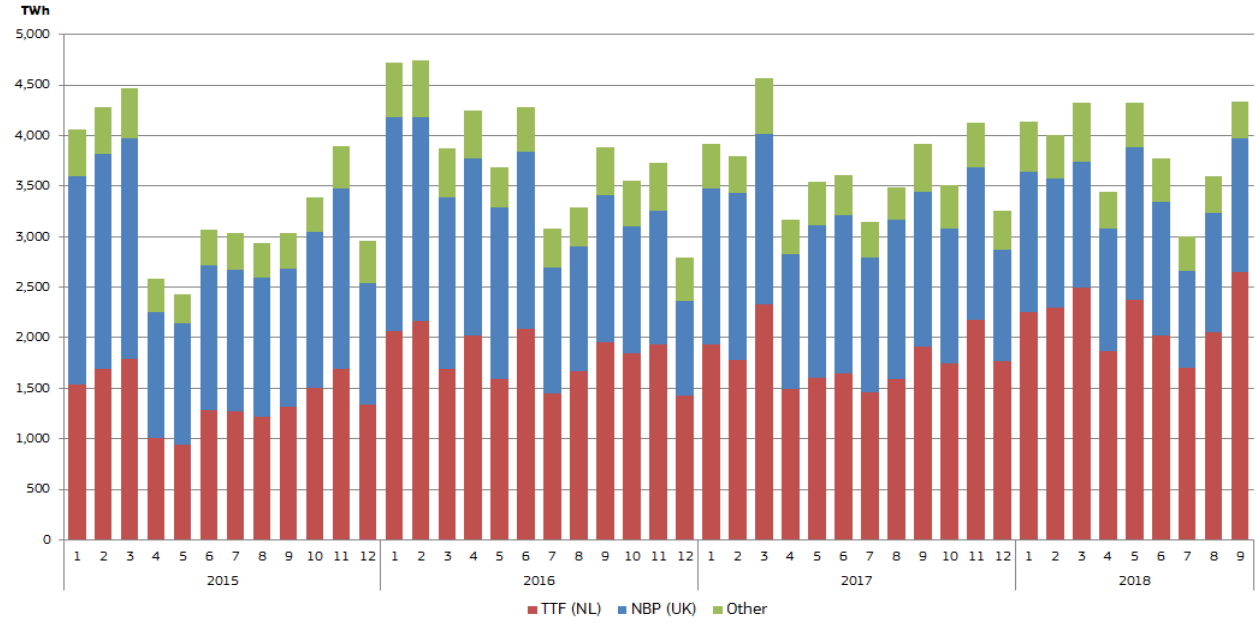


The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point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

- TTF continued to gain ground at the expense of NBP in the third quarter of 2018: compared to the same period of 2017, its share increased from 47% to 58%, while that of NBP fell from 42% to 31%. In September 2018 the share of TTF rose above 60% NBP and TTF continue to overshadow the other European hubs. In the third quarter of 2018, the combined market share of the Belgian, French, German and Italian hubs was 12%, up from 11% a year earlier.

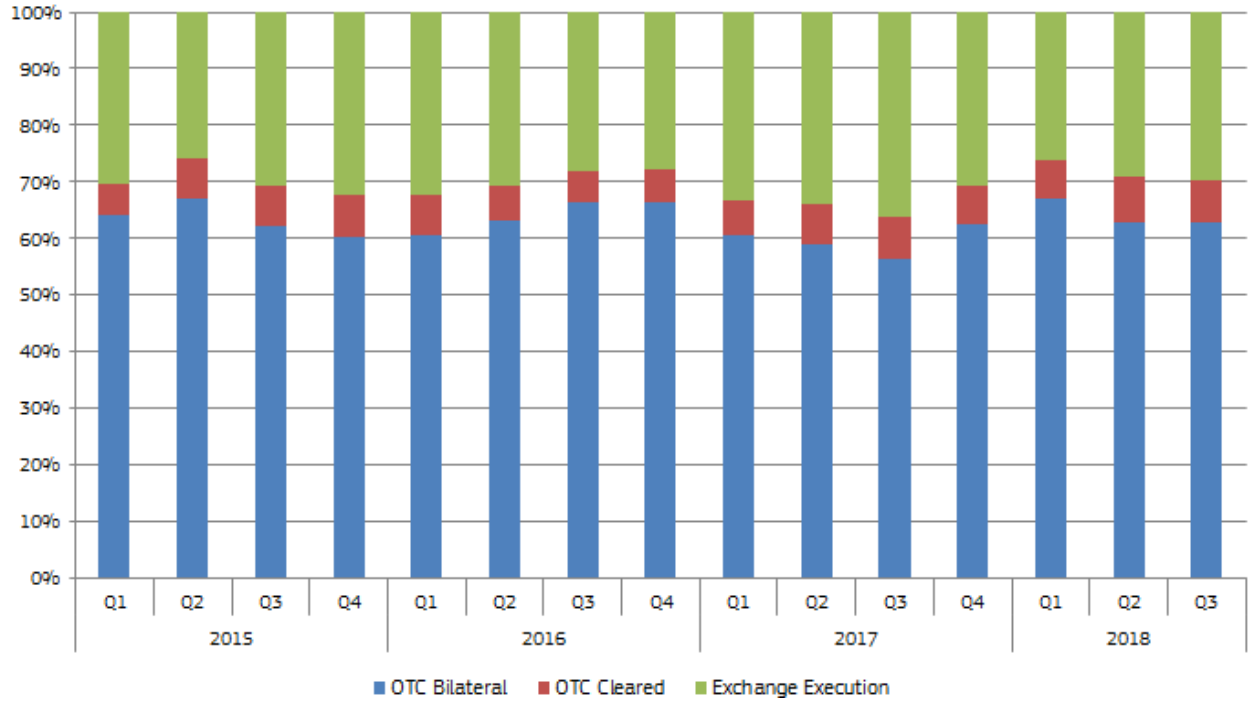
Figure 21. Traded volumes on the main European gas hubs



"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

- At EU level, OTC markets remained the main trading venue and their share actually increased from 56% in the third quarter of 2017 to 63% in the same period of 2018. 7% of OTC volumes were cleared at a clearinghouse in the third quarter of 2018, practically the same share as in Q3 2017. The share of exchange executed trade was slightly lower than 30%, 7 percentage less than in Q3 2017 (36%). The total OTC traded volume (bilateral and cleared) rose by almost 15% in Q3 2018 in year-on-year, actually driving liquidity in the EU gas hubs. Exchange executed volumes decreased by 16% in the same period.

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



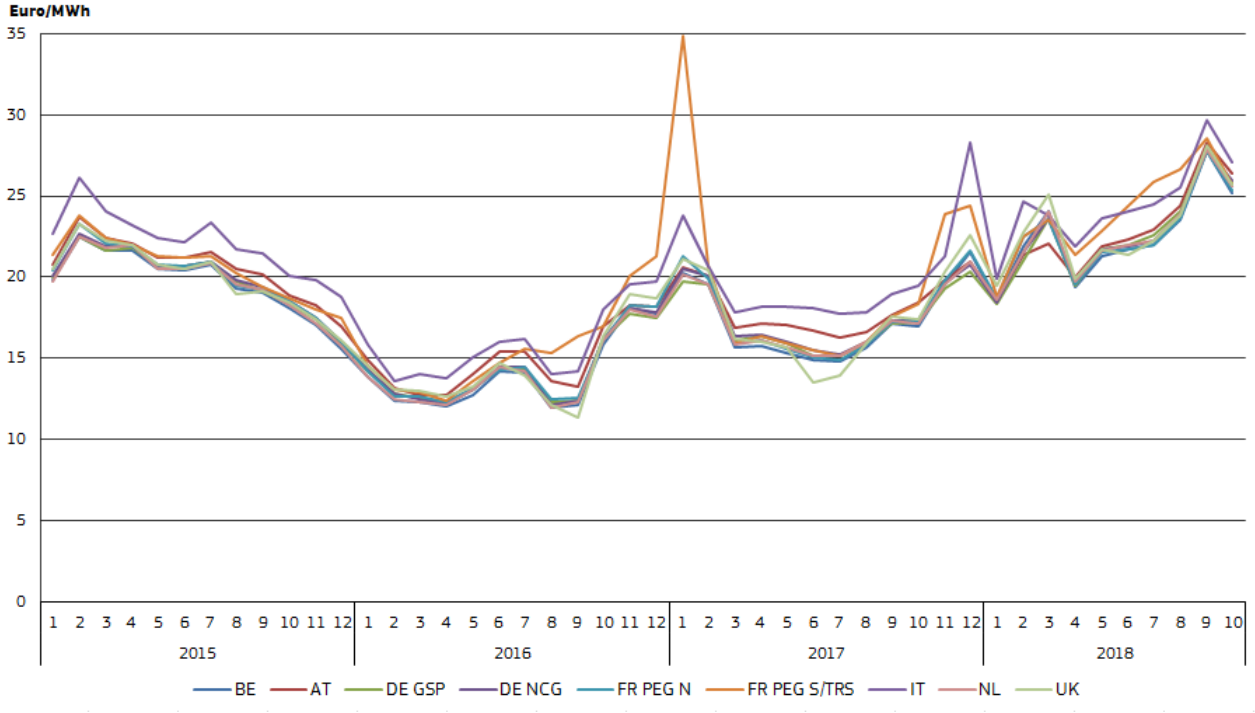
The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point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

2.3.2. Wholesale price developments in the EU

- European hub prices were averaging around 24-26 €/MWh, in the third quarter of 2018. In September 2018 the European monthly average hub prices rose to the range of 27-29 €/MWh, which was the highest since December 2013. In the third quarter of 2018 hub prices were up by 50-60% in year-on-year comparison. The average TTF hub price increased by 53% on Q3 2018, while in September 2018 it was up by 61% compared to the same period of the previous year.

- The main factors providing support to wholesale prices in the third quarter of 2018 were increasing crude oil, coal and carbon prices. The strong injection demand for almost all European storage facilities, following very low levels in the second quarter of 2018, also gave support to gas demand and market prices, as the third quarter of the year is traditionally the injection period ahead of the heating season. Relatively low LNG imports (as higher prices in Asia drew away cargoes from Europe) reduced the gas supply in Europe, also pushing European hub prices upwards.

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



Source: S&P Global Platts

- UK and German benchmarks in the third quarter of 2018 were well aligned with the Dutch TTF, showing only a minor discount (0.1 – 0.2 €/MWh) on quarterly average. The measurable UK discount in June 2018, stemming from the gas oversupply in the country as consequence of the two-week maintenance of the UK-Belgium Interconnector, practically disappeared.

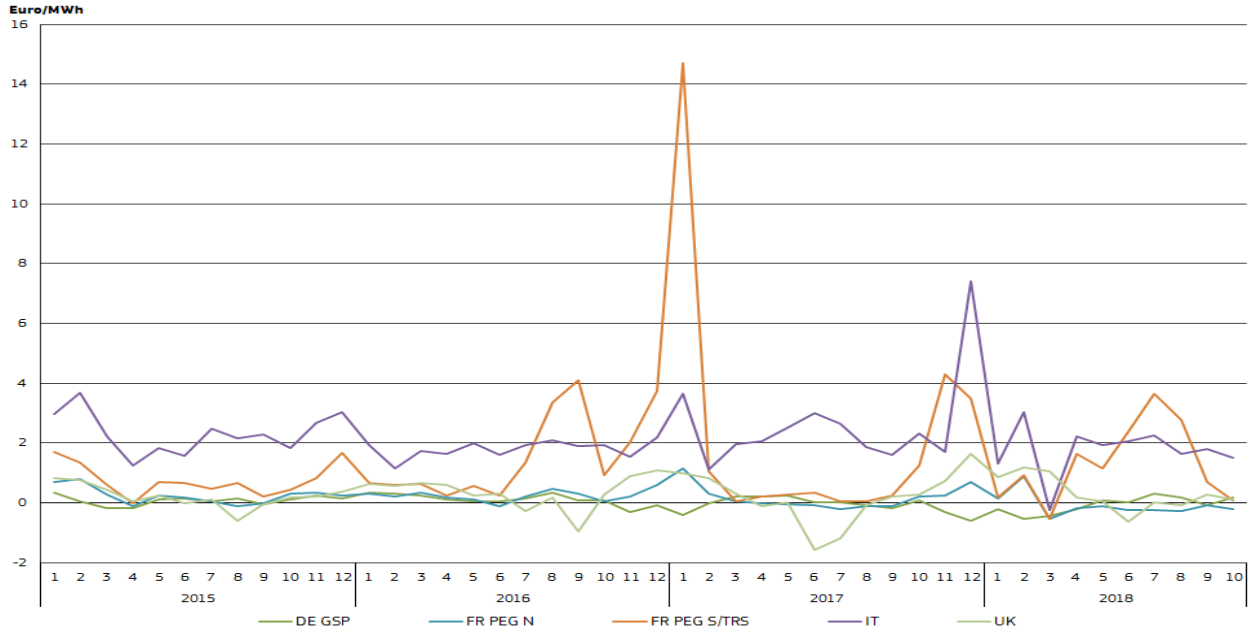
- In the third quarter of 2018, prices at the Italian PSV hub remained on average 2.0 €/MWh higher than at hubs in Northwest Europe. In the first two weeks of July 2018 maintenance works were done on the TAG pipeline between Austria and Italy and on the TENP 2 connecting Italy with North-Western Europe through Switzerland, which supported high gas hub prices at the PSV hub.

- In France, PEG Nord remained closely aligned with other peers in North-Western Europe during the third quarter of 2018. However, hub prices on TRS showed a significant premium (3.6 €/MWh) over TTF in July 2018. This was mainly due to low LNG send-outs from the Fos Cavou terminal (as LNG shipments were redirected to Asia owing to favourable prices there), and intensive storage injection needs. Later in Q3 2018 as storage levels were higher in France, the TRS price premium began to shrink and in September 2018 it fell to 0.72 €/MWh.

- On 24 July 2018 French system operator GRT Gaz confirmed that infrastructure works readying the system for the market's merger were on track for start[17]. The new one market area will be called Trading Region France (TRF). The merger and the creation of a single area actually happened on 1 November 2018.

[17] ICIS Gas in Focus, 31 July 2018, announcement in French:https://france.uniper.energy/blog/2018/11/16/marche-unique-du-gaz-cest-parti/

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

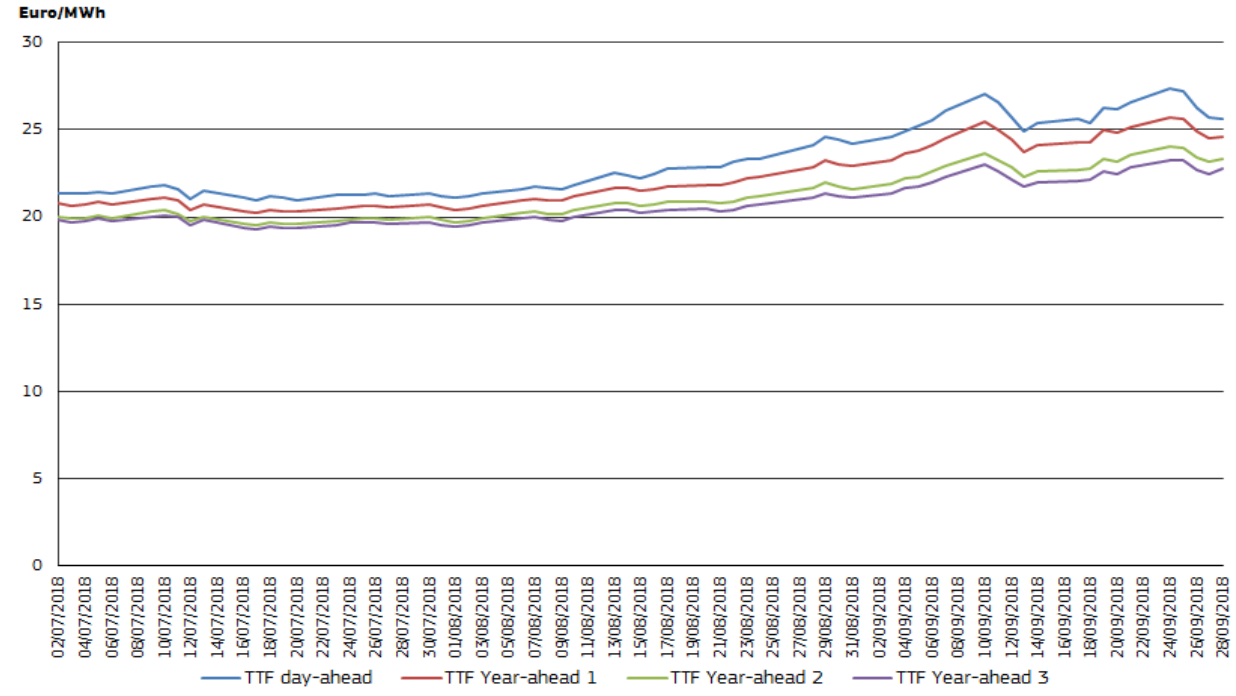


Source: S&P Global Platts

- 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.

- In the third quarter of 2018 spot prices on the TTF hub were higher than forward contracts (otherwise saying, the gas price curve was in backwardation) , owing to strong fundamentals on the energy markets (high crude oil, coal and carbon prices) and to strong storage injection needs over the quarter). At the end of September 2018 the spot TTF gas price (25.6 €/MWh) was 1 €/MWh higher than the year-ahead price and almost 3 €/MWh higher than the three-year ahead contract. In the same quarter of 2017 such significant price differentials could not be observed, as energy prices were lower and storage injection needs were not so intense, owing to higher storage levels at the beginning of the injection period.

Figure 25. Forward gas prices on the Dutch gas hub



Source: S&P Global Platts

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

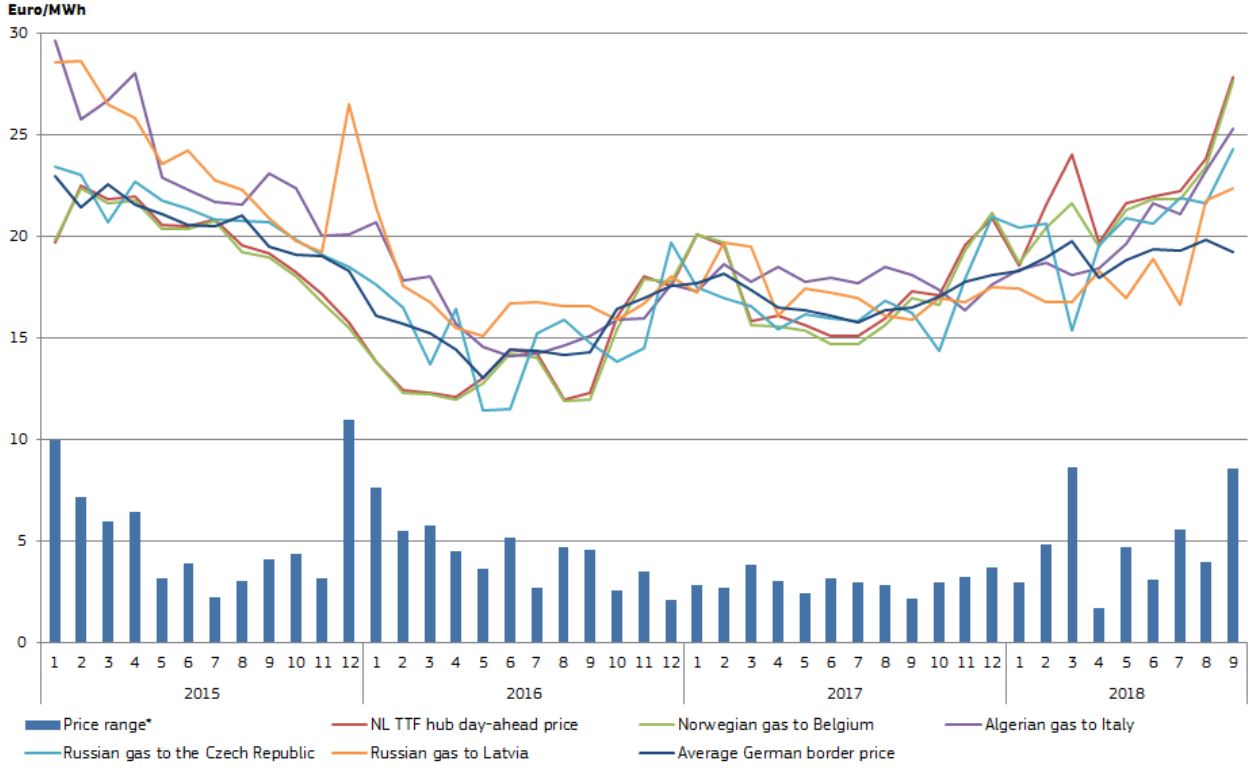
- Figure 26 compares a selection of estimated border prices of gas deliveries from the main exporters to the EU: Russia, Norway, and Algeria. For comparison, the evolution of the day-ahead prices on the Dutch TTF hub is also presented.

- Over the last few 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.

- However, higher wholesale market prices usually go hand in hand with increasing price differentials across Europe. In the third quarter of 2018 most of oil indexed contracts (Russian gas import in Latvia and the Czech Republic and Algerian import in Italy) showed a significant price increase, following the rising oil prices. However, gas market fundamentals (including the aforementioned strong injection need) also gave a support to the price rise of Norwegian import contract and to hub prices as well. Interestingly, reported German border prices remained practically unchanged over Q3 2018, probably owing to the need for a longer time period for filtering-in of the energy market developments in these gas import contracts.

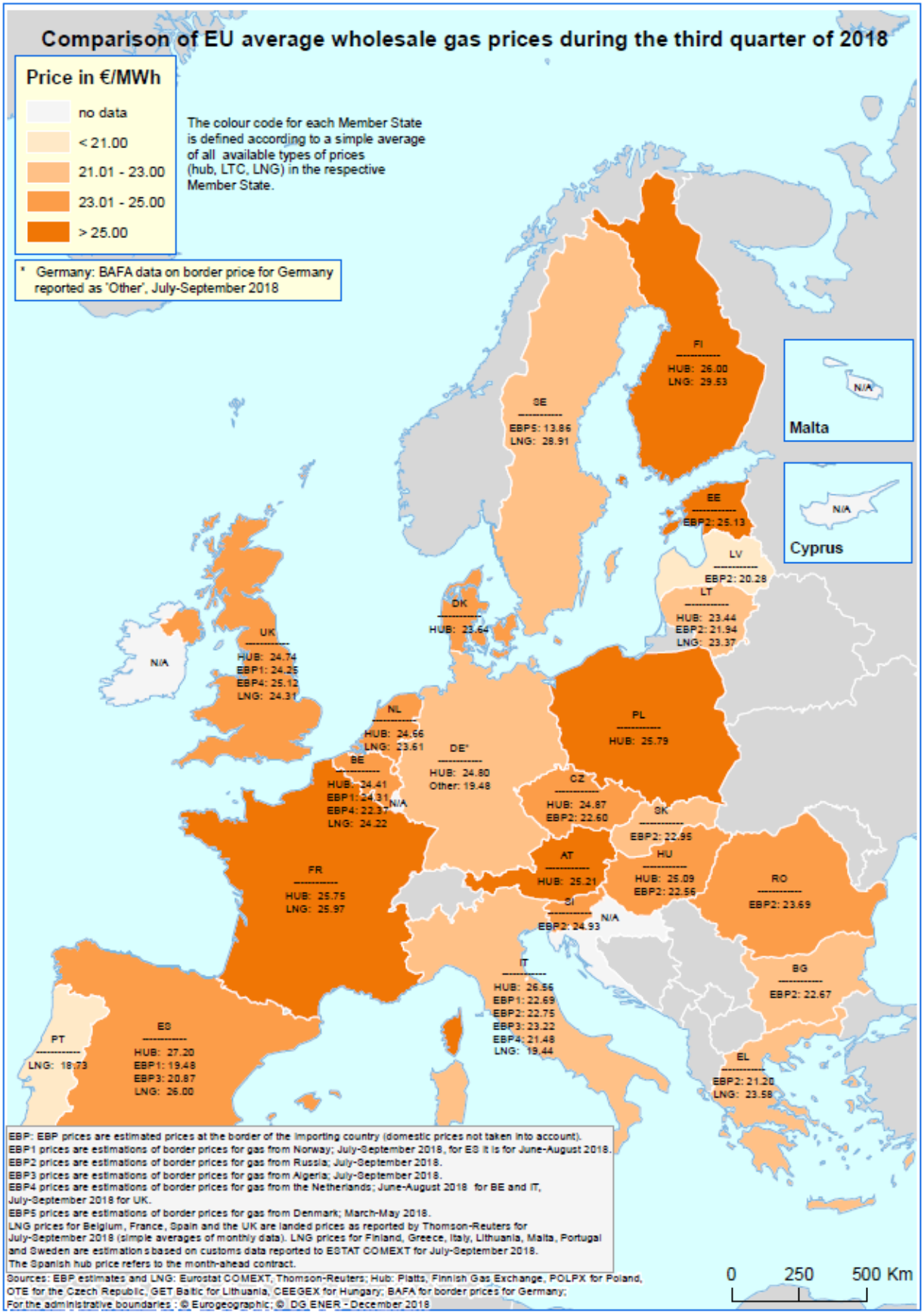
- In September 2018, the difference between the highest and lowest price depicted in Figure 26 rose to 8.6 €/MWh, the highest since March 2018. At the end of Q3 2018 hub prices and gas market price contracts (such as the Norwegian import) were higher than oil-indexed contracts, owing to the short term energy market developments.

Figure 26. Comparison of EU wholesale gas price estimations



Source: Eurostat COMEXT and European Commission estimations, BAFA, S&P Global 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 third quarter of 2018



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

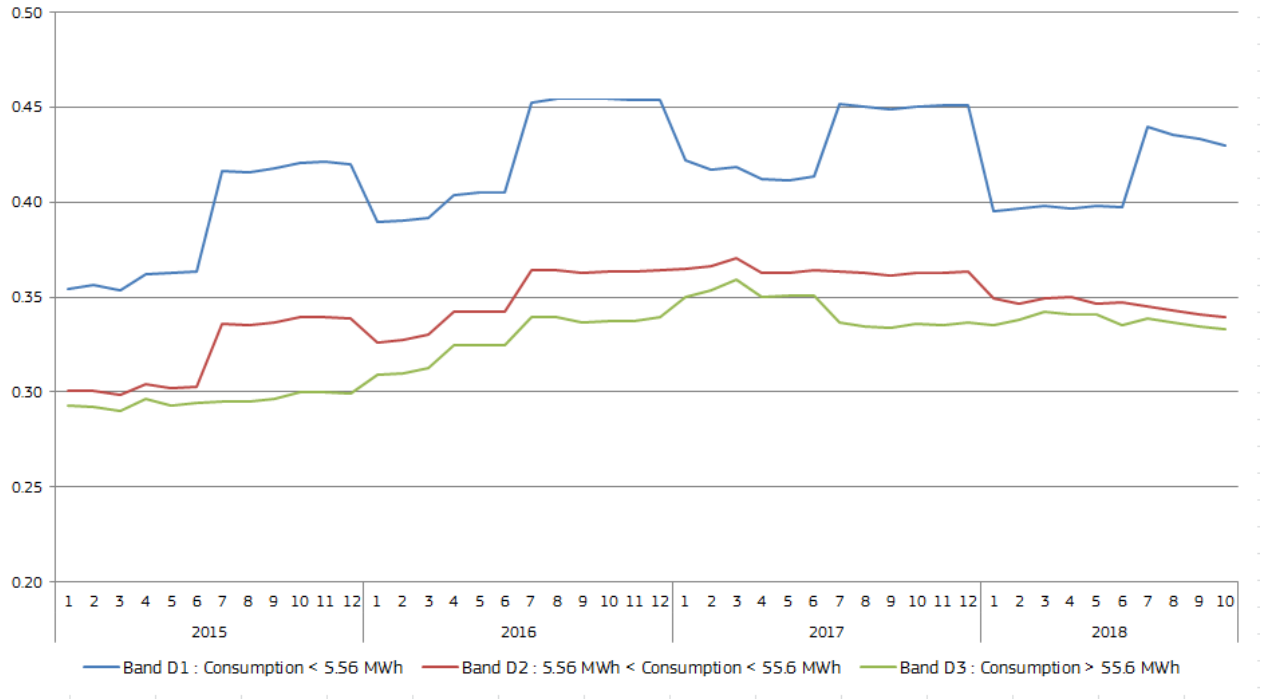
- Figures 27 and 29 show the degree of convergence of retail gas prices for household and industrial consumers, using as a metric the relative standard deviation of the prices in individual Member States. Monthly retail prices are estimated by using half-yearly prices from Eurostat (with the latest available figures relating to the first half of 2018) and Harmonised Consumer Price Indices (HICP) for both the household prices and industrial consumers.

- For household consumers, the estimated average retail price in the EU (including all taxes) showed an increasing trend between 2010 and 2015 and decreased in 2016-2017. In the third quarter of 2018 retail gas prices for household customers were stable in the EU. In the most typical consumption band, D2, the estimated average price (including all taxes) in the third quarter of 2018 was 6.03 Eurocents/kWh. (See the estimated household prices on Map 2).

- Retail prices for households showed an increasingly diverging trend in 2015-2016, as shown by the increase of the relative standard deviation in Figure 27. In 2017-2018, the standard deviations seem to have stabilised, and from summer 2018 the signs of price convergence reappeared. Observed price differences are normally higher for the consumers with lower annual consumption.

- There are still significant differences in retail gas prices across the EU: in the third quarter of 2018, the estimated household price in consumption band D2 varied between 3.45 Eurocent/kWh in Romania and 11.41 Eurocent/kWh in Sweden, resulting in a price differential ratio of 3.3 between the cheapest and the most expensive Member State. This ratio gradually decreased since the second quarter of 2012 when it reached 4.8.

Figure 27. 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 28 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in September 2018. On average, 45% of the price covered the energy component, while the rest covered distribution/storage costs (29%), energy taxes (9%) and VAT (17%).[18]

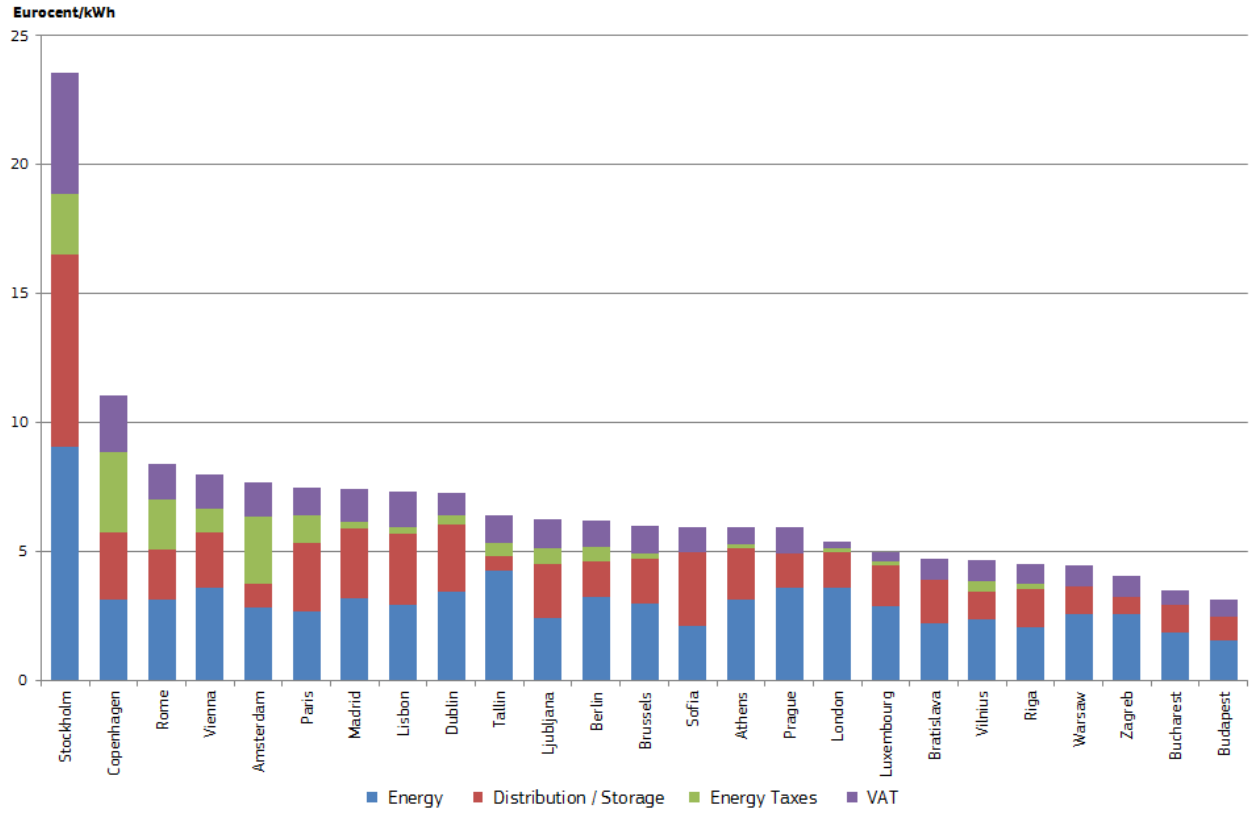
- There are significant differences across Member States, with the share of energy cost ranging from 28% to 67%, the share of distribution/storage costs ranging from 8% to 47% and the share of taxes ranging from 7% to 51%. In Amsterdam and Copenhagen, taxes make up around half of the price while in London and Luxembourg their share is respectively 7% and 10%. For

[18] Note that these are arithmetic averages.

7 of the 25 capitals covered, the price does not include an energy tax component. While there are significant differences across Member States in network costs and taxes, Figure 28 also shows that even the energy component is very variable: it was 5.9 times higher in Stockholm than in Budapest in September 2018.

- In 14 of the 25 capitals, prices were higher in June 2018 than a year earlier, with the biggest increase in Bucharest (21%), driven by a 42% growth of the energy component. In September 2018 Budapest was the cheapest capital in the EU in terms of gas prices for household consumers, which underwent a more than 6% decrease year-on-year, primarily owing to the depreciation of the national currency vis-à-vis the euro. Prices also decreased by 6% in Lisbon.

Figure 28. The breakdown of gas price paid by typical household customers in European capitals, June 2018



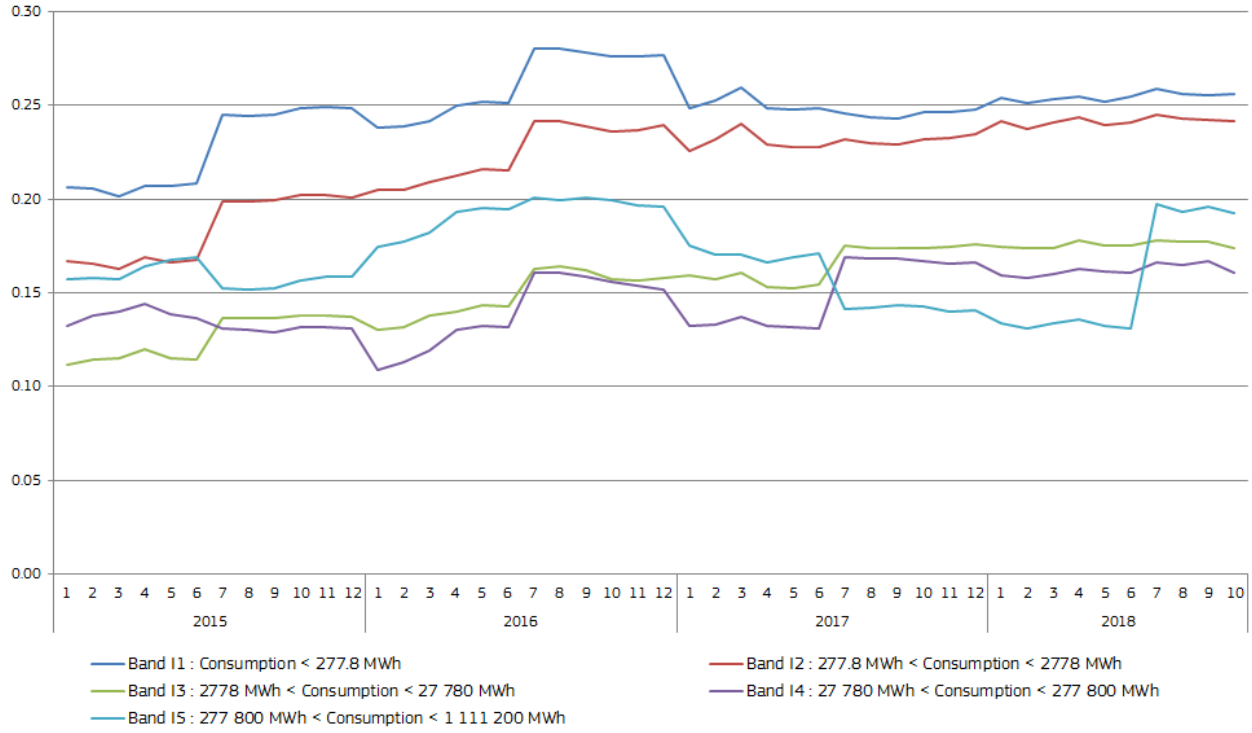
Source: VaasaETT

- Estimated retail industrial gas prices started to decrease already in 2014, and the trend continued until mid-2017 During the twelve-month period preceding June 2018 prices were fairly stable, however, in the third quarter of 2018 they started to increase again. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.54 Eurocent/kWh in the third quarter of 2018, 10% more than in the same period of 2017. (See the estimated industrial prices on Map 3.) Prices increased in Q3 2018 year-on-year in most of the EU Member States. It seems that the impact of increasing gas wholesale market prices is also reflected in increasing retail prices for industrial customers.

- Figure 29 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. In most consumption bands the standard deviation grew in 2015-2016, implying that price differences increased in this period. As of 2017, relative standard deviations stabilised, however, in July 2018 prices started to diverge more in Band I5. Higher the gas annual consumption normally translates into the lower observed price differentials.

- In the third quarter of 2018, Bulgaria had the lowest estimated industrial price in consumption band I4 (2.12 Eurocent/kWh), while the highest price was observed in Sweden (4.2 Eurocent/kWh), resulting in a ratio of 2. The price differential ratio between the cheapest and the most expensive Member State has been fluctuating between 1.6 and 2.4 since the beginning of 2008.

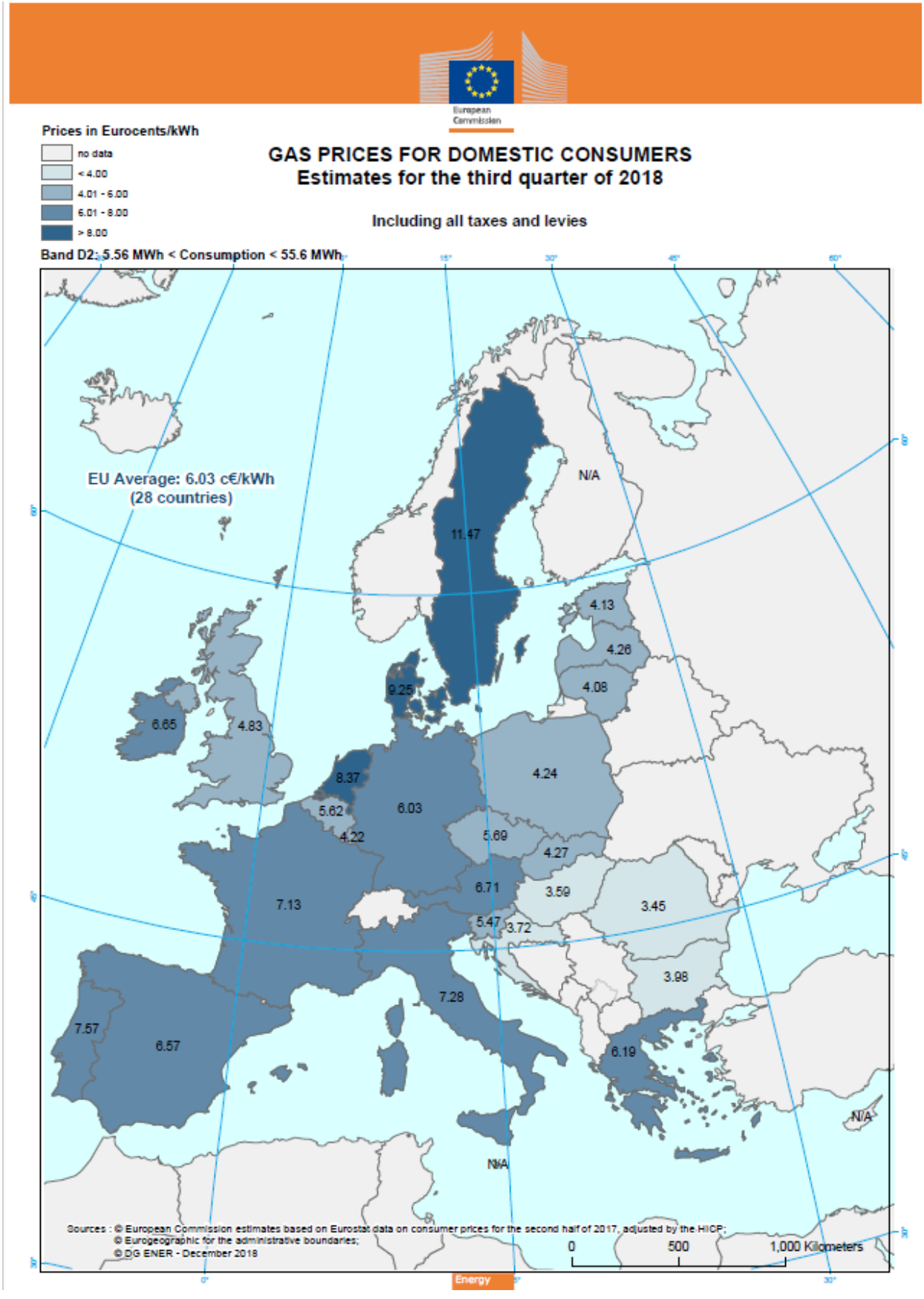
Figure 29. Relative standard deviation of gas prices paid by industrial consumers in EU Member States



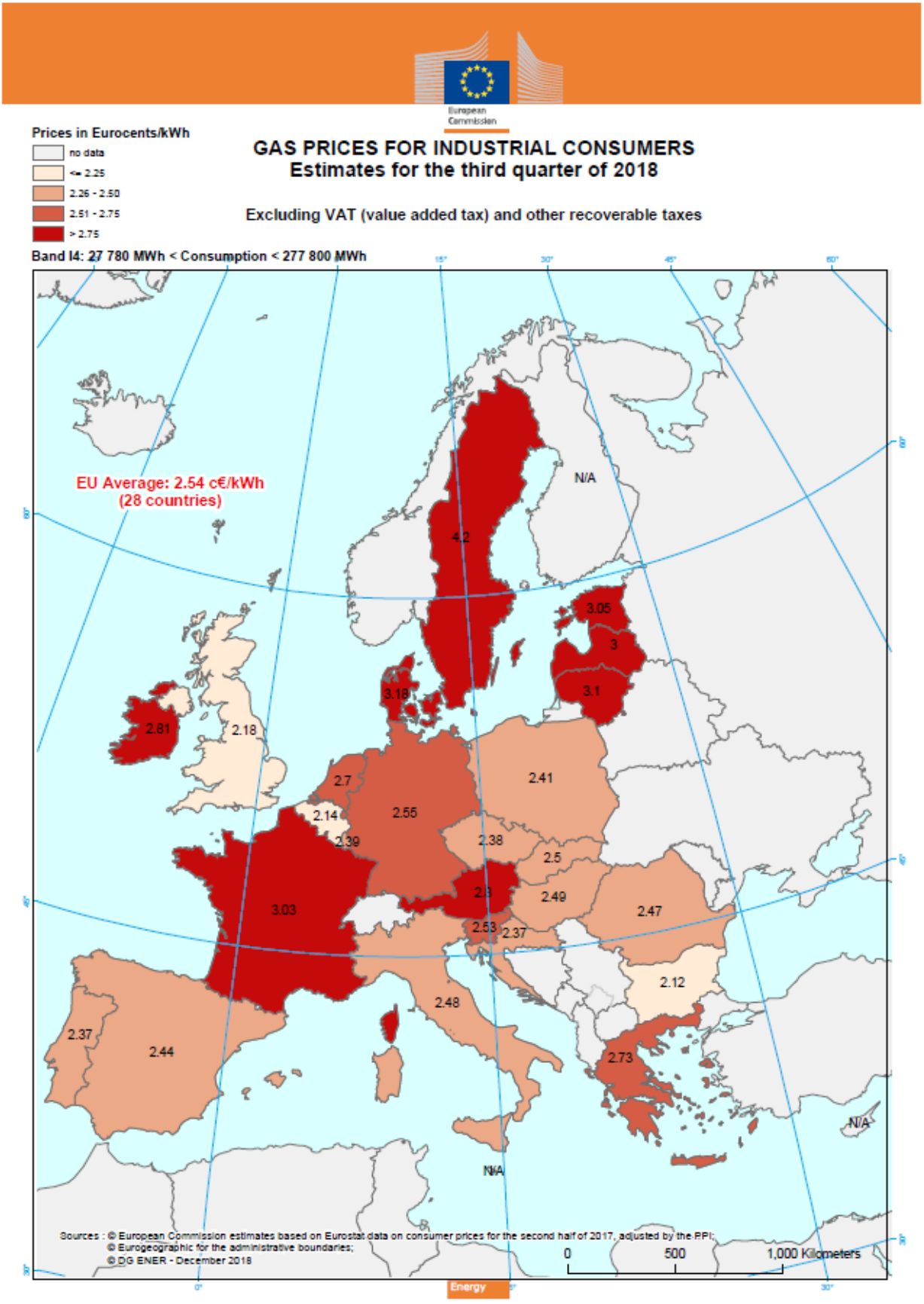
Note: Excluding VAT and other recoverable taxes.
Source of data: European Commission estimates based on Eurostat data on industrial prices adjusted by the PPI

- Maps 2 and 3 show the estimated retail gas prices paid by households and industrial customers in the third quarter of 2018.

Map 2. Retail gas price estimates for households in the EU – Third quarter of 2018



Map 3. Retail gas price estimates for industrial consumers in the EU – Third quarter of 2018



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 S&P Global Platts.

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

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

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

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

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

Long-term average for HDD comparisons: In the case of the heating degree days, actual temperature conditions are expressed as the deviation from the long-term temperature values (average of 1975-2016) in a given period.

Monthly estimated retail gas prices: Twice-yearly Eurostat retail gas price data and the gas component of the monthly Harmonised Index for Consumer Prices (HICP) for each EU Member States to estimate monthly retail gas prices for each consumption band. The estimated quarterly average retail gas prices on the maps for households and industrial customers are computed as the simple arithmetic mean of the three months in each quarter.

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.