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Quarterly Report on European Gas Markets

Market Observatory for Energy

DG Energy

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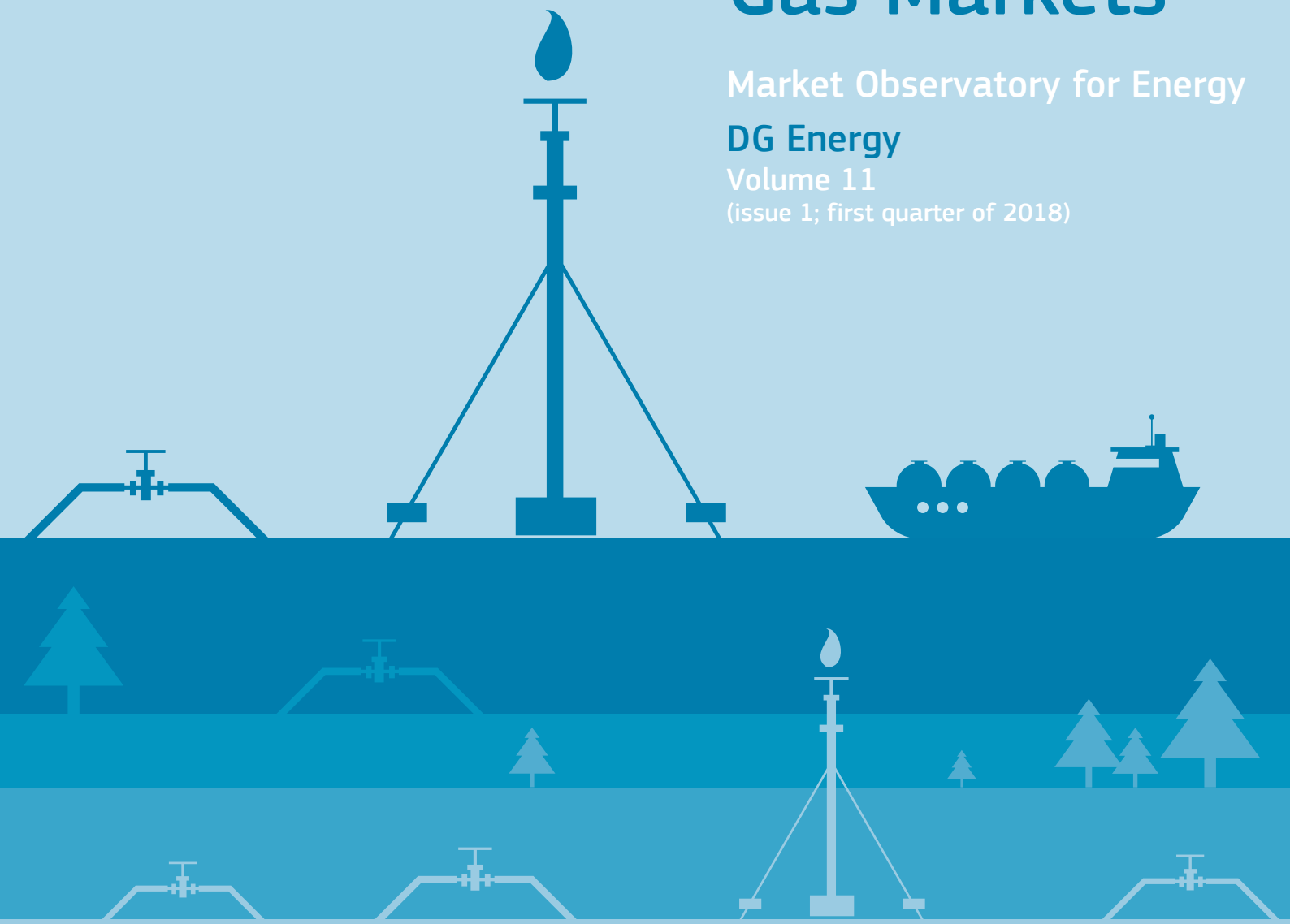

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CONTENT

HIGHLIGHTS OF THE REPORT

- **In the first quarter of 2018, EU gas consumption increased by 4% year-on-year, driven by unusually low temperatures in February and March. Gas use in the power sector was lower than a year earlier but this was more than offset by the rising use of gas for heating.**

- **A heavy earthquake at the Groningen area cast doubt about the future of the field. As a response, the Dutch government decided to reduce further the field's output and gradually terminate production by 2030, thereby removing a key source of seasonal flexibility in Northwest Europe.**

- **Imports fell by 2% year-on-year in the first quarter of 2018, implying a high dependence on storage withdrawals in this period. Apart from Algeria, all import sources (Russia, Norway, Libya and LNG) registered a slight year-on-year decrease. The EU's estimated gas import bill was around 22 billion euros, 8% more than a year earlier.**

- **In the first quarter of 2018, Nord Stream became the main supply route of Russian gas delivered to the EU, marginally overtaking the Ukraine transit.**

- **High prices in Asia driven by surging Chinese demand made Europe a less attractive destination for LNG supplies and EU LNG imports decreased by 13% year-on-year in the first quarter of 2018. LNG imports from Russia's new Yamal facility exceeded those coming from the US which were well below year-ago levels.**

- **High winter demand and relatively low imports contributed to record withdrawals, with storage levels falling to 18% of capacity, well below the 5-year range. Low stock levels at the end of winter should mean strong injection demand during the summer of 2018.**

- **A late-winter cold spell, coupled with dwindling stock levels, tightened the supply-demand balance in Northwest Europe and hub prices reached unprecedented levels at the beginning of March. Rising prices provided the right signal to market participants and gas supplies were not interrupted but the extent of the price rise seems to point toward the inflexibility of demand.**

EXECUTIVE SUMMARY

- **EU gas consumption was 168 bcm in the first quarter of 2018, 4% more than in the same period of 2017**. With the exception of the last quarter of 2017, EU gas consumption has shown a consistent year-on-year growth for two years, since the first quarter of 2016. Although gas use in the power sector decreased year-on-year, this was more than offset by the higher gas demand for space heating and for industrial activity. A colder-than-average winter, with a particularly strong cold spell in late February and early March, was instrumental in increasing gas use for heating.

- EU gas **production fell by 2%** year-on-year in the first quarter of 2018. Although Dutch output slightly increased in this period, a strong earthquake hitting the Groningen area triggered renewed calls to reduce or even halt production at Europe's largest onshore gas field. In March, the Dutch government decided to reduce the field's output below 12 bcm by October 2022 and terminate production by 2030. This will remove a key source of seasonal flexibility in Northwest Europe.

- In the first quarter of 2018, EU gas **imports were 2% lower than a year earlier**. Imports decreased slightly from all sources except Algeria. **Russian pipeline supplies remained the main source of EU imports**, covering 41% of extra-EU imports, followed by Norwegian pipeline imports (35%), pipeline supplies from North Africa (12%) and LNG imports (12%). Increasing consumption and falling indigenous production indicate a high dependence on storage withdrawals in this period. Despite the lower volumes, the EU's estimated gas import bill was around 22 billion euros in the first quarter of 2018, 8% more than a year earlier.

- In the first quarter of 2018, **Nord Stream became the main supply route of Russian gas delivered to the EU** (36% of total supplies), marginally overtaking the Ukraine transit (34%), traditionally the main supply route of Russian gas. Gas supplies via Slovakia dropped back considerably in January and February, partly driven by the falling import needs of Italy which relied more on other sources in this period.

- **Capacity agreements had been signed for the proposed Baltic Pipe project** linking Denmark and Poland, thereby completing the open season procedure started in 2017. The final investment decision is to be taken in 2018.

- **EU LNG imports decreased by 13%** year-on-year in the first quarter of 2018 as high spot prices in Asia made Europe a less attractive destination for LNG cargoes. Deliveries to Northwest Europe were particularly low: the combined share of the UK, Belgium and the Netherlands from total EU LNG imports was only 9% in this period. LNG imports from Russia's new Yamal plant exceeded those coming from the US which were well below year-ago levels, in spite of the commissioning of a new export facility (Cove Point). In this period, US cargoes were diverted to the high-priced Asian market.

- **High winter demand and relatively low imports contributed to record withdrawals** in the first quarter of 2018, with storage levels falling to 18% of capacity, well below the 5-year range. Spiking day-ahead prices helped withdrawals to reach record level during the late-winter cold spell By the end of the gas winter, stock levels dropped below 10% of capacity in a couple of countries in Northwest Europe (Belgium, France and the Netherlands) where high gas demand from the UK contributed to strong withdrawals this winter.

- **Spot prices at European gas hubs** were very much driven by the weather: they dropped in January but increased in February and March, **reaching unprecedented level at the beginning of March**, driven by a late-winter cold spell amid dwindling gas stocks. In the first quarter of 2018 as a whole, hub prices were roughly 10% higher than a year earlier. **Oil-indexed prices** increased to a lesser extent and **become increasingly competitive with hub prices**

- After strong convergence in mid-2017, **international gas prices diverged** during the 2017-2018 winter. Asian LNG prices spiked as a result of strong seasonal demand and a robust growth of Chinese LNG imports. European prices grew to a smaller degree but the gap between European and US prices increased as the Henry Hub price remained remarkably stable, with only a modest seasonal increase in January.

- **Liquidity on European gas hubs increased** in the first quarter of 2018 by 2% year-on-year. The Dutch and UK hubs continued to dominate trading, with TTF developing a growing lead ahead of NBP. Within total traded volumes, OTC trade gained ground at the expense of exchanges.

- 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.

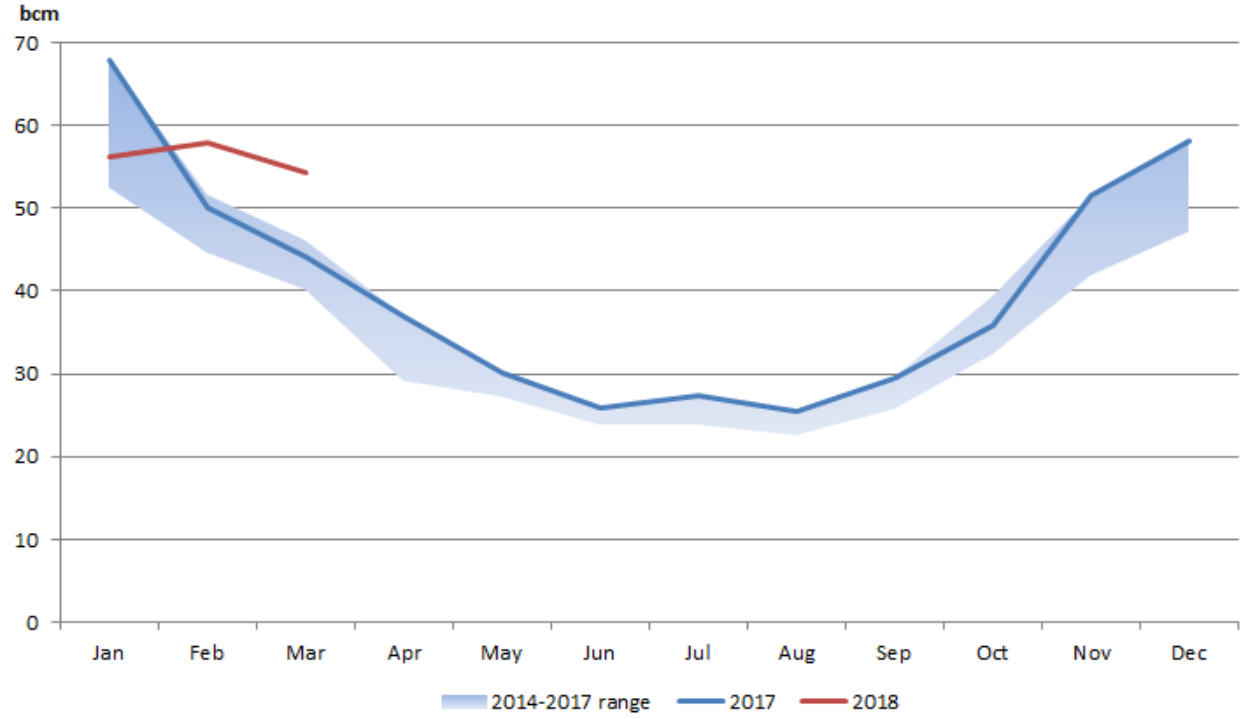
1. Gas market fundamentals

1.1 Consumption

- After the 4% annual growth seen in 2017, EU gas consumption continued to be on the rise in the first quarter of 2018: consumption was 4% higher than in the same period of 2017. The increase was largely driven by low temperatures in February and March which boosted gas use for space heating while gas use in power generation decreased year-on-year. In absolute level, the consumption in the first quarter of 2018 amounted to around 168 bcm which is the highest quarterly level since the first quarter of 2013.

- In April 2018, the Netherlands has significantly revised down its 2017 gas consumption (in the monthly data series nrg_103m), from 51.2 bcm to 43.3 bcm. This revision had a tangible impact on EU consumption in 2017: while in the previous report we reported an annual consumption of 491 bcm, 6% more than in 2016, with the new, revised Dutch data EU consumption was 483 bcm, "only" 4% more than a year earlier.

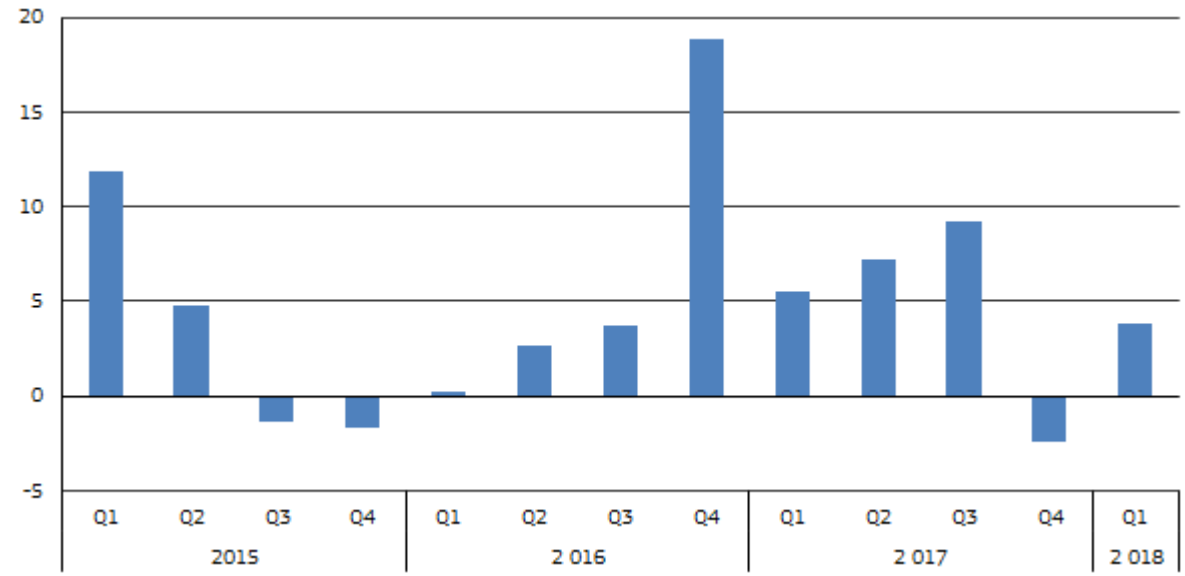
Figure 1. EU gas consumption



Source: Eurostat, data as of 14 June 2018 from data series nrg_103m

- With the exception of the last quarter of 2017, EU gas consumption has shown a consistent year-on-year growth since the first quarter of 2016.

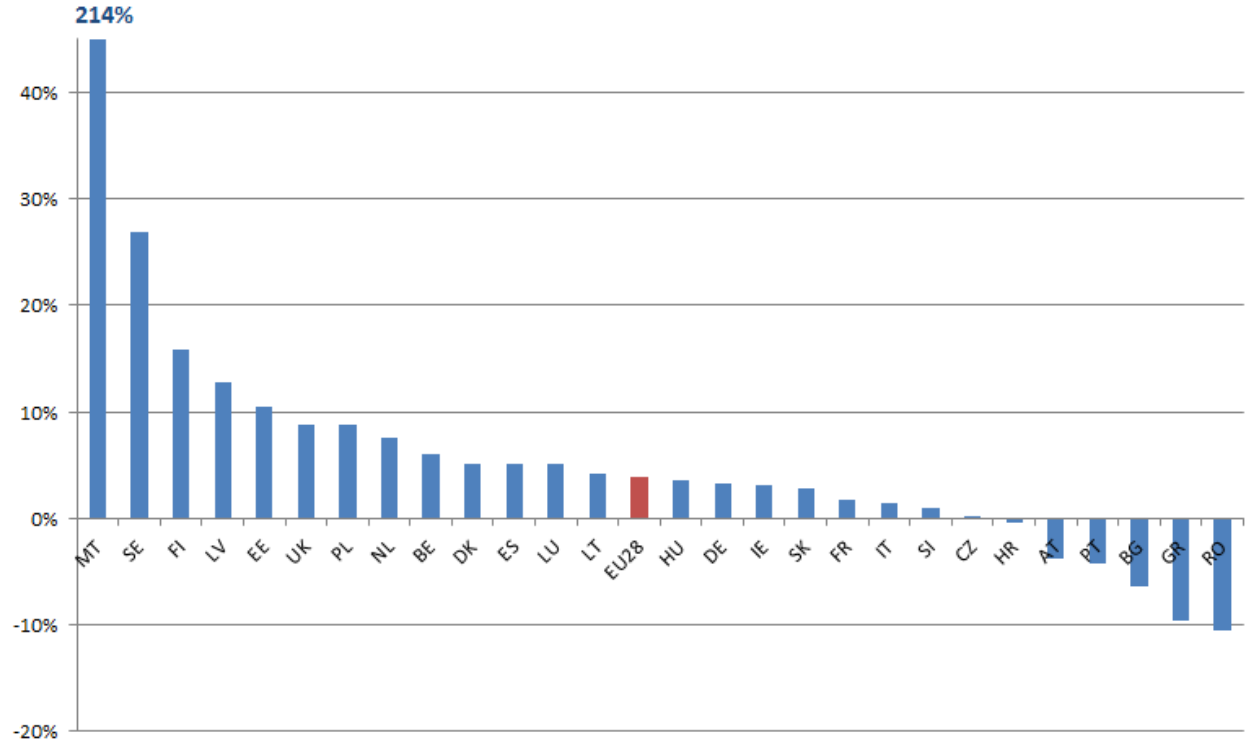
Figure 2. EU gas consumption Q/Q-4 change (%)



Source: Eurostat, data as of 14 June 2018 from data series nrg_103m; calculations of DG Energy (based on consumption measured in bcm).

- In the first quarter of 2018, consumption increased in the majority of the Member States. The biggest year-on-year growth rate was observed in Malta (214%) which started to consume gas only recently, in January 2017, after the commissioning of a new gas-fired power plant. The absolute volume (0.07 bcm in the first quarter of 2018) was still modest but represents a significant increase compared to the same period of 2017. Scandinavian and Baltic Member States also experienced above-average growth rates, reflecting lower-than-usual temperatures in this region. On the other hand, a relatively mild winter in Southeast Europe meant that gas demand in Bulgaria, Greece and Romania was lower than a year earlier. The demand of the two largest consumers, Germany and the UK, increased by 3% and 9%, respectively.

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

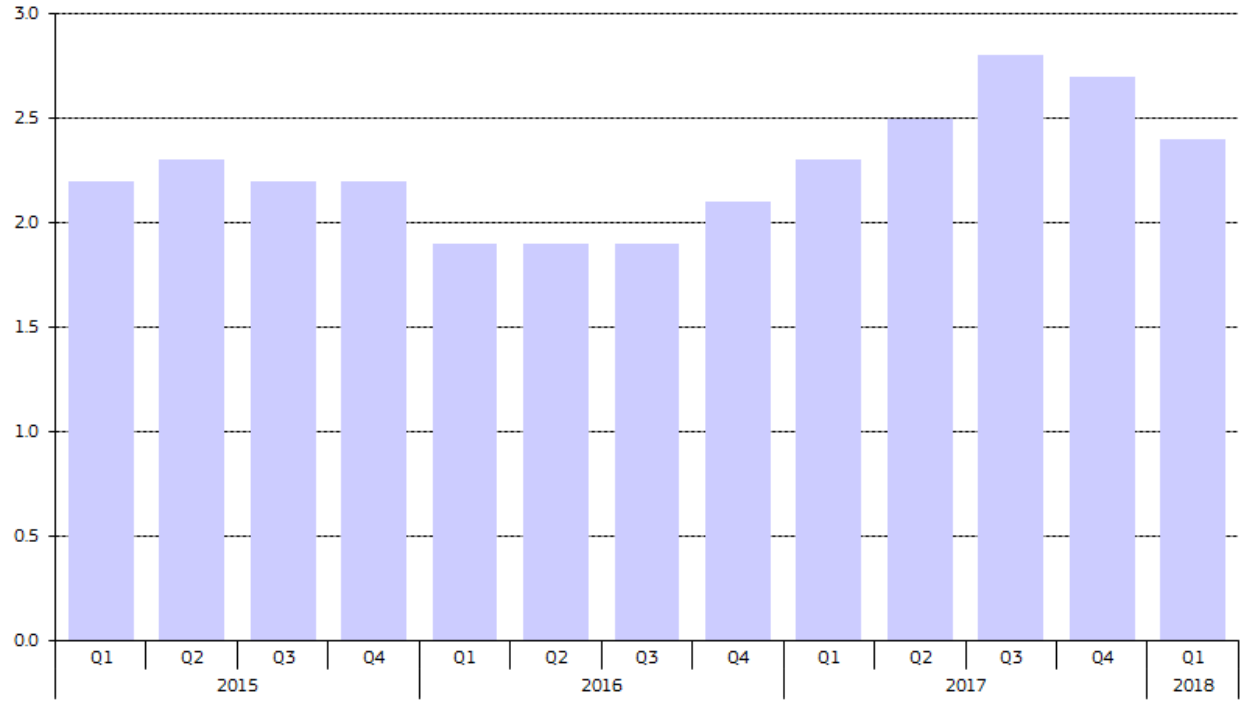


Source: Eurostat, data as of 14 June 2018 from data series nrg_103m; calculations of DG Energy (based on consumption measured in bcm).

- Compared to the same quarter of the previous year, seasonally adjusted gross domestic product (GDP) rose by 2.4% in the first quarter of 2018. This is 0.3 percentage points lower than in the previous quarter but still represents a robust increase compared to the growth rates seen in 2012-2016. 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 the last two years.

- Industrial activity is also on the rise: the gross value added in the manufacturing sector was 3.7% higher in the first quarter of 2018 than a year earlier.[1]

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



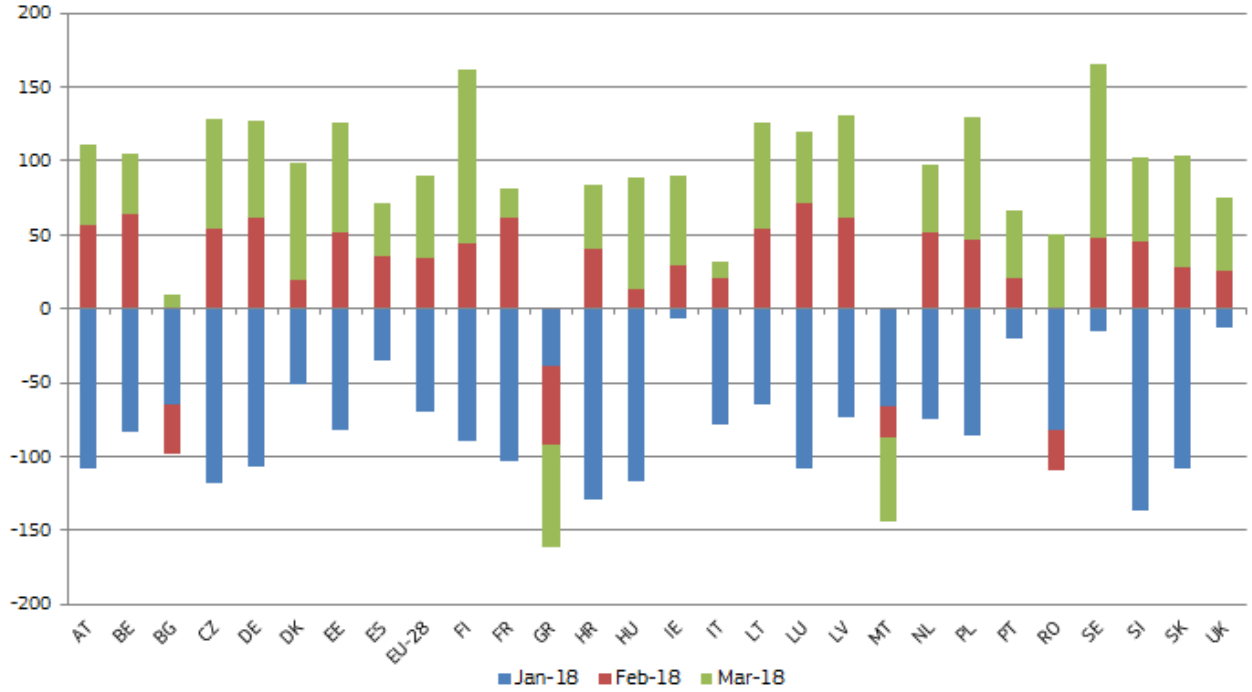
Source: Eurostat, data as of 14 June 2018 from data series namq_10_gdp
Seasonally and calendar adjusted data

- Figure 5 shows the deviation of actual heating degree days (HDDs) from the long-term average in individual EU Member States in the first quarter of 2018. In January, temperatures were higher than the long-term average across Europe. However, February and March was colder than usual in most of the Member States, resulting in a high gas demand for space heating in this period.

- During a cold snap arriving at the end of winter, in late February/early March, temperatures dropped around 10^{o}C below the seasonal average across parts of Europe, boosting gas demand for heating.

[1] Source: Eurostat, data as of 13 June 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 first quarter of 2018



Source: Joint Research Centre (JRC), European Commission

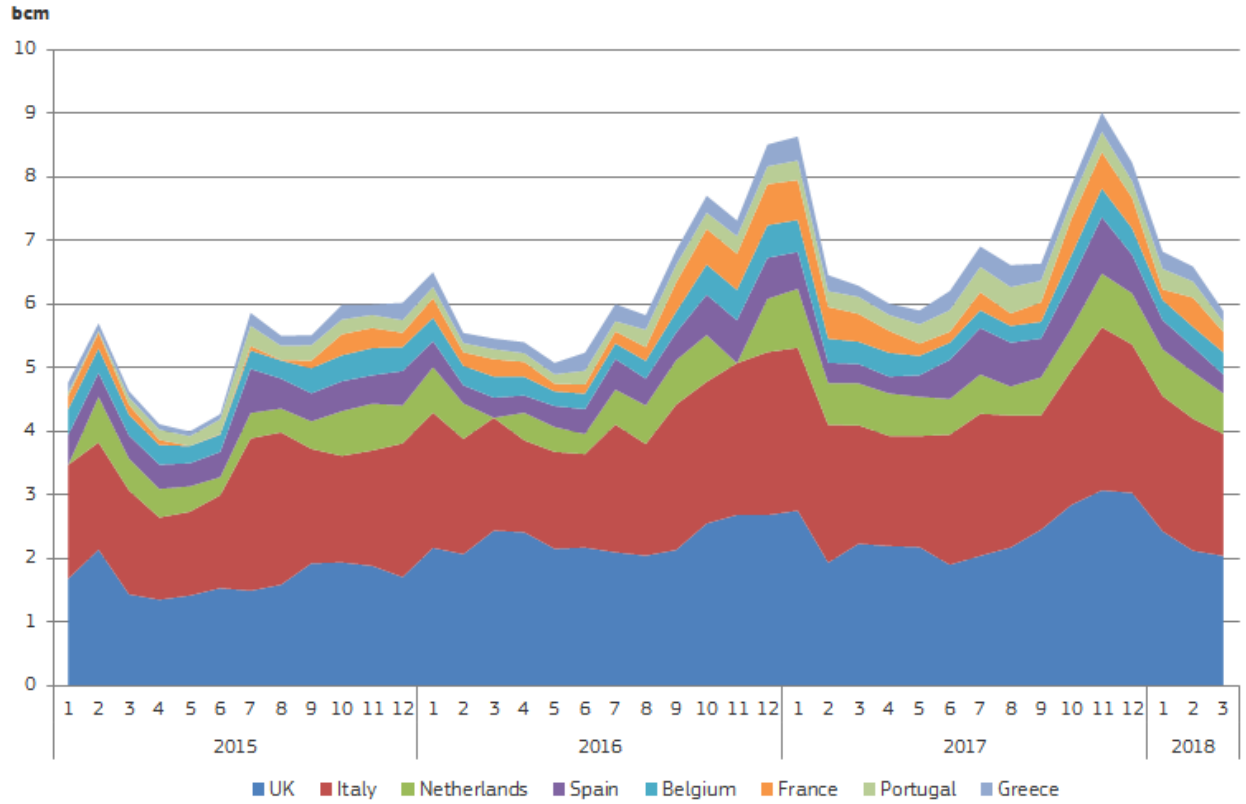
- In the eight markets[2] reported in Figure 6, gas deliveries to power generation decreased by 10% in the first quarter of 2018 year-on-year. Volumes decreased in all these countries: by 39% in France, by 20% in Belgium, by 16% in Greece, by 11% in Portugal, by 7% in Italy, by 6% in the Netherlands, by 5% in the UK and by 4% in Spain. Volumes were surprisingly low in January 2018 (-21% in these eight Member States) which is presumably related to the mild weather and robust wind generation in this period, as well as a very strong gas use in the base period. In France, an improvement in the availability of nuclear capacity while in Greece strong hydro generation also contributed to the moderate gas use in the power sector. The deteriorating profitability of gas-fired generation was another factor conducive to the lower gas use in the sector.

- UK clean spark spreads – measuring the profitability of gas-fired generation – averaged 6 Euro/MWh in the first quarter of 2018. This is the lowest quarterly average level since 2015 but, helped by the carbon price support mechanism, gas-fired generation remained profitable. The share of gas in power generation was 40% in 2017, 2 percentage points less than in 2016 but still the second highest annual share since 2011. Coal's share fell from 9% to 7%, mainly at the benefit of renewables.[3] The low share of coal suggests that the potential for further coal-to-gas switching is minimal.

- Clean spark spreads in Germany averaged -7 Euro/MWh in the first quarter of 2018; this is the lowest quarterly average since the second quarter of 2015.[4] In line with the worsening profitability of gas-fired generation, the share of gas in the power sector decreased in the first quarter of 2018: it was 14.2%, compared to 15.3% in the same period of 2017.[5]

[2] Germany is not included because of gaps in reporting.
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712458/Energy_Trends_March_2018.pdf
[4] Charts of clean spark spreads in Germany and the UK can be found in the Quarterly Report of European Electricity Markets
[5] 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 14 June 2018 from data series nrg_103m; Germany is not included because of gaps in reporting.

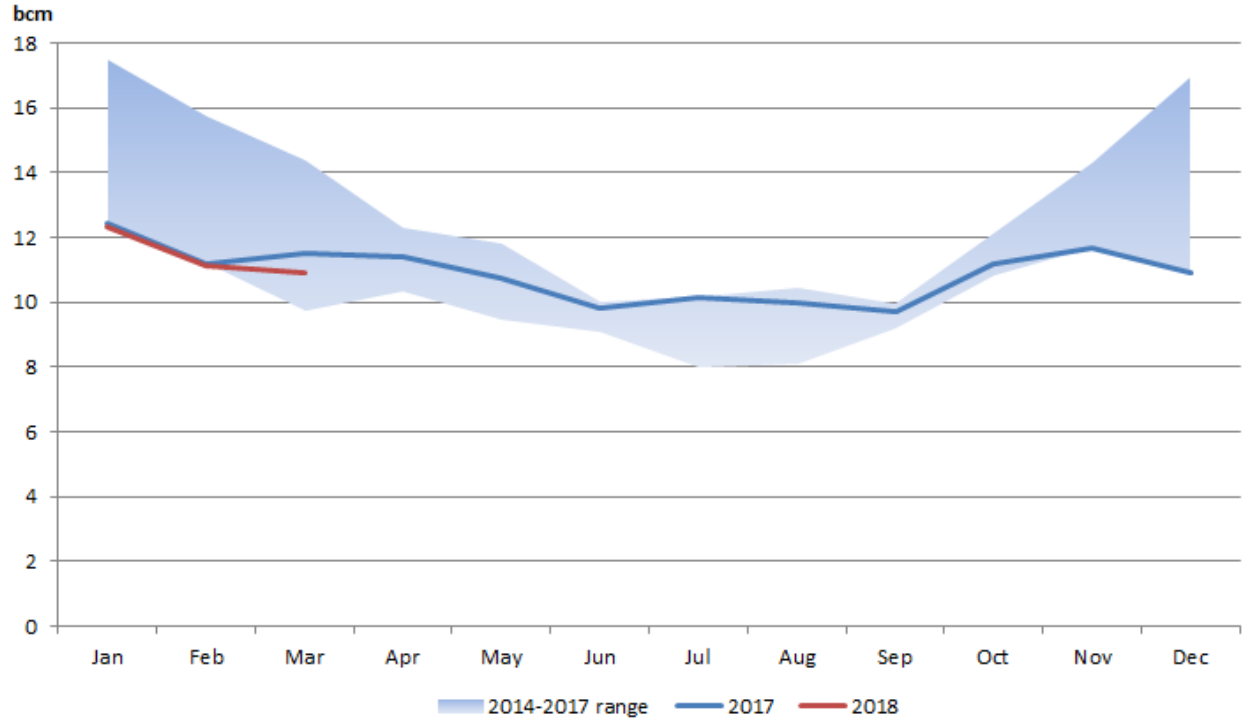
1.2 Production

- In the first quarter of 2018, EU gas production was 34 bcm, 2% less than in the same period of 2017. Looking at the seven largest producers, gas output decreased in Germany (-14%), Italy (-8%), Poland (-2%), Romania (-3%) and the UK (-3%), was flat in Denmark and slightly increased in the Netherlands (1%).

- On 8 January 2018, the Groningen area was hit by an earthquake with a magnitude of 3.4 on the Richter scale, the strongest since 2012. The tremor triggered renewed calls to reduce or even halt production at Europe's largest onshore gas field. In March, the Dutch government decided to reduce the field's output below 12 bcm by October 2022, possibly one year sooner. This would represent a 44% cut from the production cap of the field for gas year 2017 (21.6 bcm). By 2030, production at the Groningen field would gradually be terminated, thereby removing a key source of seasonal flexibility in Northwest Europe.[6]

[6] https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/news/2018/03/29/dutch-cabinet-termination-of-natural-gas-extraction-in-groningen

Figure 7. EU gas production



Source: Eurostat, data as of 30 May 2018 from data series nrg_103m (until February 2018) and nrg_ind_343m (March 2018 for all Member States and February 2018 for Croatia and the Netherlands)

1.3 Imports

- While EU consumption increased by 4% and indigenous production decreased by 2% in the first quarter of 2018, Eurostat data show that net imports in this period were practically the same as a year earlier, implying a high dependence on storage withdrawals in this period.[7]

- As a result of rising consumption and falling output, the net imports of the UK were 3.2 bcm higher than a year earlier, an increase of 23%. The net exports of the Netherlands decreased by 1.1 bcm (-21%). Among the other big EU gas markets, the net imports of Germany, France and Italy decreased by 5%, 4% and 1%, respectively.

- According to ENTSO-G data, imports amounted to 1070 TWh in the first quarter of 2018, 2% less than a year earlier. Imports decreased slightly from all sources except Algeria. Imports decreased the most in January when above-average temperatures reduced gas demand across Europe.

- In the first quarter of 2018, imports from Russia were 1% lower than in the same period of 2017. In January and February 2018, oil-indexed prices were comparable to hub prices in Northwest Europe, but in March hub prices peaked because of the cold spell, thereby supporting the competitiveness of Russian supplies that are still oil-indexed. Russia remained the top supplier of the EU in the first quarter of 2018, covering 41% of total extra-EU imports, unchanged from the same period of 2017.

- Imports from Russia were boosted during the cold spell at the end of the winter. Gazprom reported that, for 10 consecutive days, it broke new records for daily exports to Europe, with deliveries reaching an absolute record on 2 March 2018 (713 million cubic meters).[8]

- In February 2018, Gazprom announced the restructuring of its export activities, including marketing and trading. The new business model sets up an Integrated International Marketing Division, which will be responsible for supplies, trading and marketing within

[7] Net imports equal imports minus exports and do not account for stock changes.
[8] http://www.gazprom.com/press/news/2018/march/article411844/

the entire export portfolio of Gazprom.[9] The company will also cut hundreds of jobs at its overseas trading and export offices and move them to its headquarter in St Petersburg,[10]

- Imports from Norway, the EU's second gas supplier, decreased by 3% year-on-year in the first quarter of 2018 but the country's market share remained 35%.[11] In the first quarter of 2018, Norwegian gas production amounted to 32.4 bcm, 1% less than in the same period of the previous year.[12]

- Gaz-System and Energinet, the Polish and Danish transmission system operators said in January 2018 that capacity agreements had been signed for the proposed Baltic Pipe project, thereby completing the open season procedure started in 2017. The pipeline would carry up to 10 bcm/year of Norwegian gas from Demark to Poland. The final investment decision is to be taken in 2018 and the pipeline is planned to be operational in October 2022.[13]

- Imports from Algeria grew by 3% in the first quarter of 2018 while imports from Libya decreased by 3% year-on-year. Algerian supplies to Spain and Portugal increased by 10%, partly offset by a decrease of deliveries to Italy (-3%). The combined share of Algeria and Libya from total extra-EU imports was 12% in the first quarter of 2018, unchanged from the same period of 2017.

- Imports of LNG slightly decreased in the first quarter of 2018 and covered 12% of total extra-EU gas imports, exactly the same as one year earlier (see further details below).

- The EU's estimated gas import bill was around 22 billion euros in the first quarter of 2018, 8% more than a year earlier. Import volumes (1070 TWh) were slightly lower than in the same period of 2017 but this was more than offset by a 10% increase in the estimated average import price (from 18.6 Euro/MWh to 20.5 Euro/MWh).

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

Source: Based on data from the ENTSO-G Transparency Platform, data as of 16 May 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.

[9] http://www.gazprom.com/press/news/2018/february/article404634/
[10] https://www.reuters.com/article/us-gazprom-trading-exclusive/exclusive-gazprom-to-cut-hundreds-of-traders-as-kremlin-retreats-from-west-idUSKCN1GQ1UD?il=0
[11] Note that Norway to UK flows reported by ENTSO-G include some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.
[12] http://www.npd.no/Global/Norsk/1-Aktuelt/Produksjonstall/P2018/April-2018/Data-april-2018.xlsx
[13] http://en.gaz-system.pl/press-centre/news/information-for-the-media/artykul/202684/

- 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 first quarter of 2018 Nord Stream became the main supply route of Russian gas coming to the EU, overtaking Ukraine, traditionally the main supply route of Russian gas to the EU; gas flows via this pipeline represented 36% of total EU pipeline imports from Russia. In absolute terms, volumes were 16% higher than in the same period of 2017 and the utilisation was practically 100%.

- Nord Stream volumes increased at the expense of Ukraine, implying that Gazprom rerouted some of the gas flows which previously transited Ukraine. In the first quarter of 2018, the volume of Russian imports transiting Ukraine decreased by 19% compared to the same period of 2017. There was a particularly strong year-on-year decrease in January (-41%) and February (-29%) while volumes in March were 26% higher than a year earlier. Volumes in January were the lowest since March 2015. The decrease in January and February deliveries are partly explained by the low Italian demand in this period: mild weather, high storage withdrawals and robust imports from other sources reduced demand for Russian gas. In the first quarter as a whole Ukrainian transit volumes covered 34% of total Russian pipeline flows coming to the EU.

- Gas supplies transiting Belarus increased by 3% in the first quarter of 2018 compared to the same period of 2016 and covered 27% of total EU pipeline imports from Russia.

- At the beginning of March 2018, Ukrainian authorities reported continuous low and varying pressure in gas supply from Russia to Ukraine for transit to the EU. Gas transit via Ukraine to the EU was not affected and all concerned EU parties received nominated gas volumes. The European Commission called on all parties concerned to find solutions to the issue. The Commission also reiterated that it stands ready to steer a trilateral process which in the past has already proven to be effective in situations of disagreement.[14]

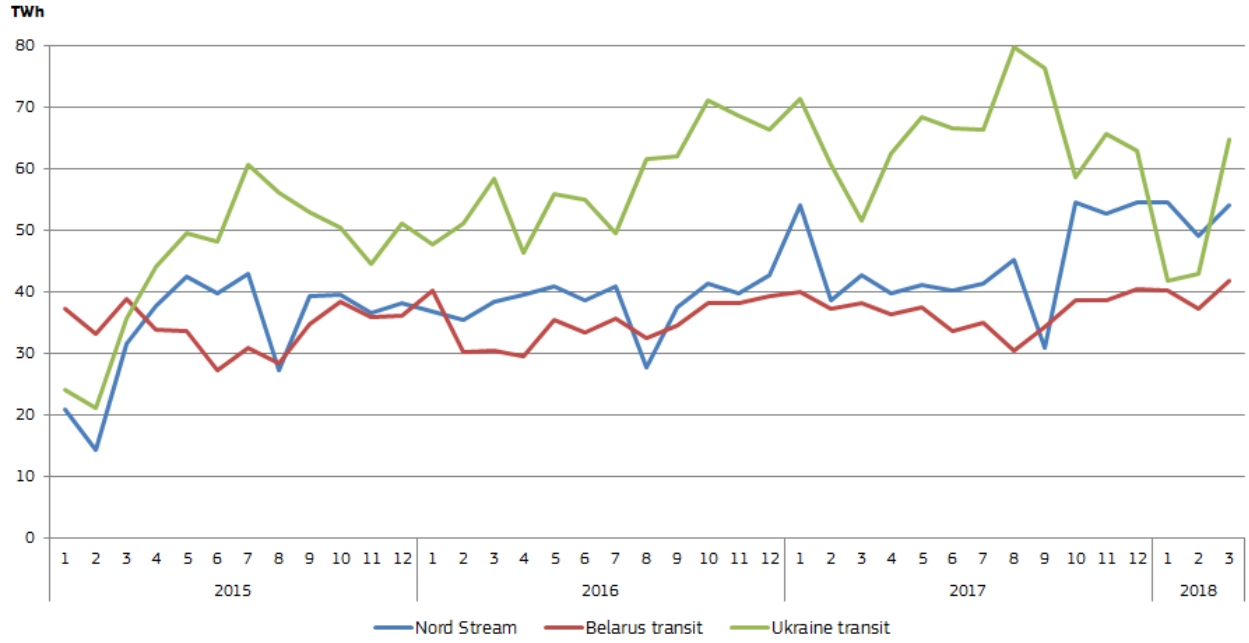
- In the first quarter of 2018, Ukraine continued to rely on imports from the EU. Gas flows coming from Hungary, Poland and Slovakia reached about 1.8 bcm in this period, 57% less than in the same period of 2017.[15] Relatively high storage levels allowed the country to reduce imports compared to same period of 2017. The country has not purchased gas from Gazprom since November 2015 which means that the country pulled through three consecutive winters without supplies from Gazprom.

- Ukrtransgaz, the Ukrainian transmission system operator launched a non-binding market demand assessment in March 2018 for entry capacities from Romania to Ukraine via the Trans-Balkan pipeline. This pipeline could provide an additional supply route for Ukrainian imports, potentially giving access to gas flows from Turkey, Greek LNG and Romanian offshore production.[16]

- On 28 February 2018, the Stockholm Court of Arbitration ruled on the gas transit contract between Naftogaz and Gazprom and ordered Gazprom to pay USD 4.63 billion.[17] Taken together with the amounts awarded to Gazprom as a result of the December 2017 award on the gas supply contract, Gazprom was ordered to pay to Naftogaz USD 2.56 billion. However, in spite of prepayment by Naftogaz, direct deliveries by Gazprom have not resumed; instead, Gazprom initiated the termination of the supply and transit contracts.[18]

[14] http://europa.eu/rapid/press-release_STATEMENT-18-1505_en.htm
[15] Based on data from the ENTSO-G Transparency Platform, data as of 14 June 2018
[16] http://utg.ua/en/utg/media/news/2018/ukrtransgaz-launches-the-market-demand-assessment-for-entry-capacities-to-ukraine-from-romania.html
[17] https://naftogaz-europe.com/article/en/winfornaftogazinthegastransitarbitration
[18] http://www.gazprom.com/press/news/2018/march/article411844/

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 16 May 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 12% increase observed in the course of 2017, in the first quarter of 2018 EU LNG imports decreased by 13% year-on-year. Imports decreased in Belgium (-12%), Greece (-58%), Lithuania (-24%), the Netherlands (-100%), Portugal (-5%), Spain (-20%) and the UK (-55%), which was partly offset by increases in France (11%), Italy (15%) and Poland (30%). Deliveries to Northwest Europe remained rather low; the combined share of the UK, Belgium and the Netherlands from total EU imports was only 9% in this period, compared to 16% a year earlier. In fact, the Netherlands imported no LNG in the first quarter of 2018.

- For more than a year now, EU LNG imports have been showing a counter-seasonal behaviour: volumes peak during summer and ebb in winter. In February 2018, imports amounted to only 2.8 bcm (of gas equivalent), the lowest monthly level in the last three years. The reason is that high spot prices in Asia in winter (see Figures 17 and 18) make Europe a less attractive destination for spot LNG cargoes. The price gap between Asia and Europe largely disappears during summer, resulting in a rebound of European LNG imports.

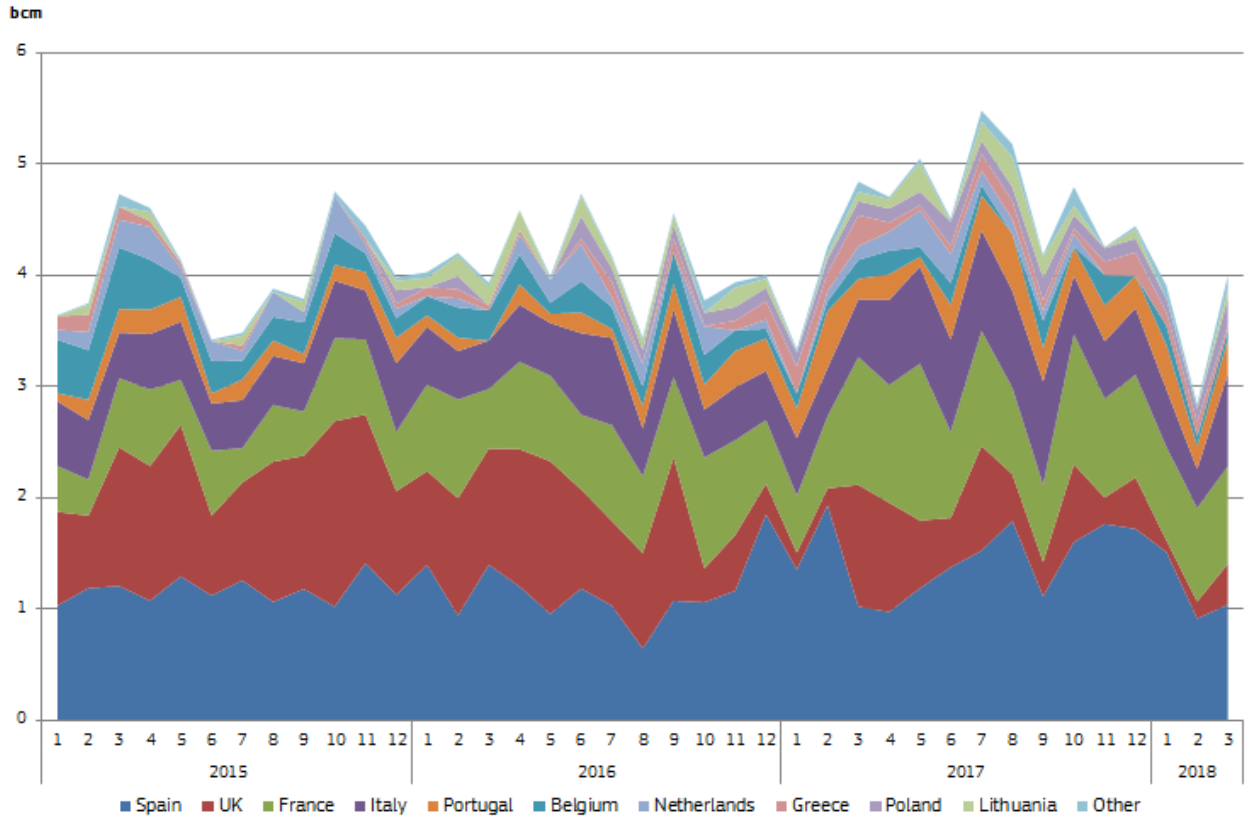
- The sizeable Asian price premium triggered a number of reloads (re-exports) destined to the Asian market, including Korea, China, India and Japan. Most reloads occurred in France, with smaller numbers in the UK, the Netherlands and Spain.

- Similarly to the previous year, LNG played a limited role in the UK gas supply during the 2017-2018 winter, in spite of the outage of the Rough storage facility. Instead, the country was relying more on pipeline imports from Norway and the continent.

- In January 2018, German LNG Terminal GmbH, a company planning to build and operate Germany's first LNG terminal, launched an open season to determine market interest and identify potential customers. According to the announcement of the company, the market responded positively to the open season. A final investment decision is to be taken by the end of 2019 and the terminal, which can supply around 10% of the German gas market, would be operational by the end of 2022.[19]

[19] https://germanlng.com/wp-content/uploads/2018/05/Press-Release_Market-responds-positively-to-first-German-LNG-import-terminal_3may2018.pdf

Figure 10. LNG imports to the EU by Member State

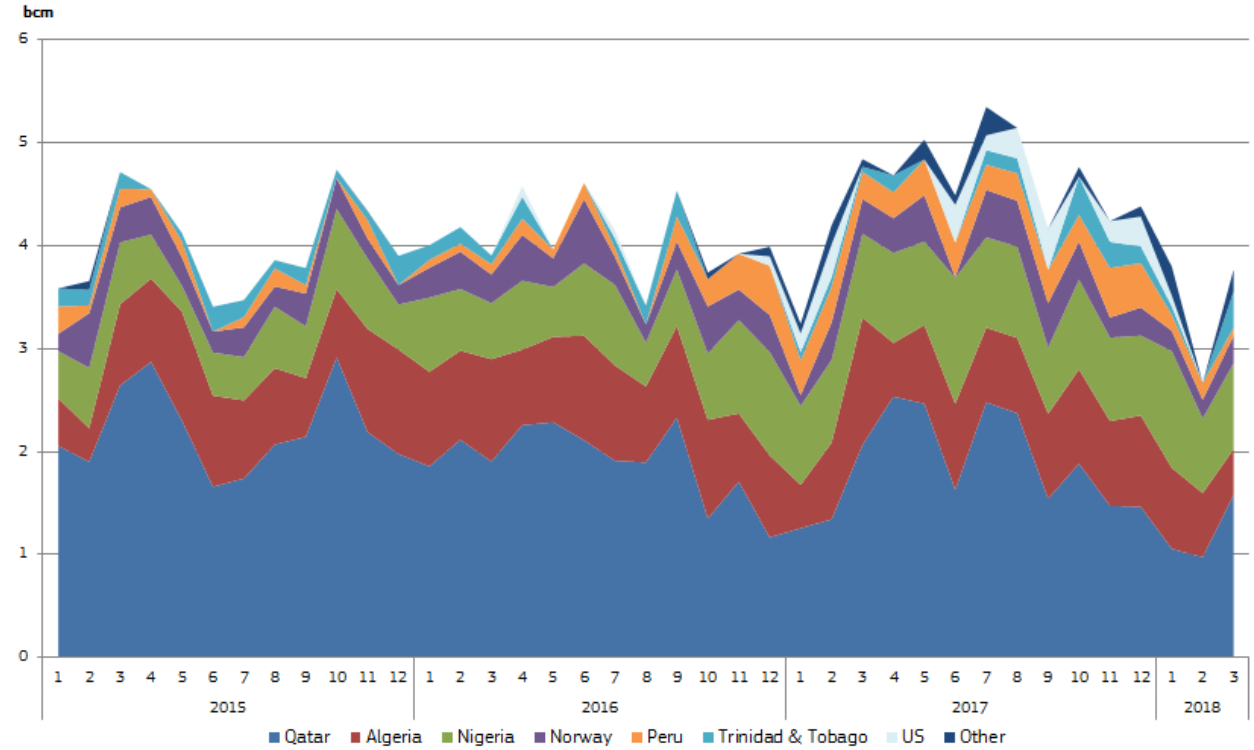


Source: Commission calculations based on tanker movements reported by Thomson Reuters
"Other" includes Finland, Malta and Sweden

- In the first quarter of 2018, Qatar remained the main LNG supplier of the EU but, like in the previous quarter, its market share remained below 40% (35%) as an increasing share of Qatari exports was directed to the high-priced Asian market. Qatar was followed by Nigeria (26%), Algeria (18%), Norway (6%), Trinidad and Tobago (4%) and Peru (4%). The share of the US was only 1%, compared to 6% in the same period of 2017. The US was overtaken by Russia (3%) which started supplying LNG to Europe only in December 2017.

- In the first quarter of 2018, Qatar had a dominant role in the Belgian (84%), Italian (92%), Polish (100%) and UK (68%) LNG markets. Algeria was the largest LNG supplier of France (34%) and Greece (69%) while Portugal's main supplier was Nigeria (77%). Norway was the sole LNG supplier of Lithuania. Spain had the most diversified portfolio: it received LNG from seven extra-EU suppliers, with Nigeria having the biggest market share (33%).

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

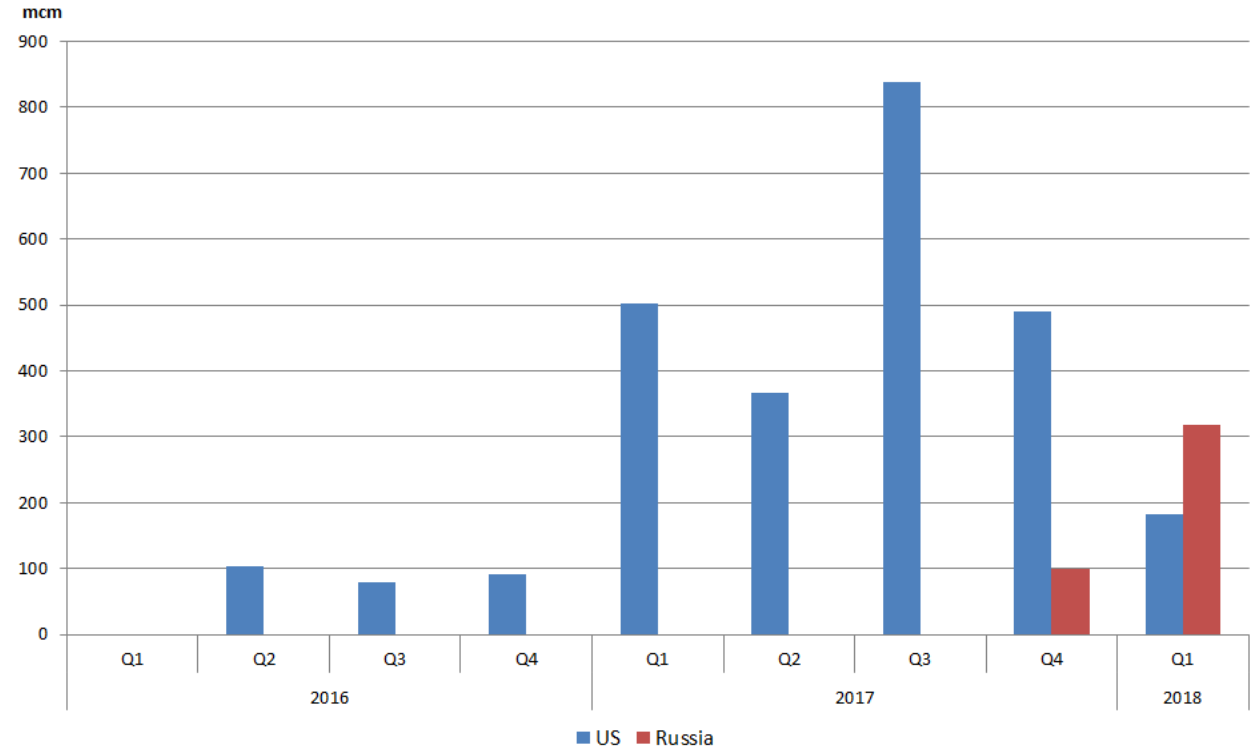
- The EU received more than 20 LNG cargoes from the US during 2017 but in the first quarter of 2018 only two cargoes arrived, unloading in Portugal and the UK, respectively. The volume (0.2 bcm of gas equivalent) was 64% lower than in the same period of 2017 and represented less than 3% of total US LNG exports in this period. Total US LNG exports were up by 49% compared to the first quarter of 2017 and the majority of supplies went to the high-priced Asian (69%) and Latin American (19%) market.[20]

- Dominion Energy's Cove Point LNG facility in Maryland started producing LNG in January 2018 and the first commissioning cargo departed from the terminal on 1 March 2018, destined to the UK. 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.[21]

- In contrast to falling imports from the US, LNG supplies coming from Russia to the EU are ramping up. France, Spain and the UK each received a cargo from the Yamal facility in the first quarter of 2018.[22] The total volume of 0.3 bcm (of gas equivalent) represented 3% of EU LNG imports in the first quarter of 2018. In addition, a couple of cargoes arriving from the Yamal plant were transferred to other ships in European terminals for delivery to Asia. Fewer cargoes are expected to arrive from Yamal to Europe in summer when Asian customers can be accessed via the northern sea route.

[20] Commission calculations based on tanker movements reported by Thomson Reuters
[21] https://dominionenergy.mediaroom.com/2018-03-02-First-LNG-Commissioning-Cargo-Departs-From-Dominion-Energy-Cove-Point-Terminal
[22] Source: tanker movements reported by Thomson Reuters

Figure 12. EU LNG imports from the US and Russia



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 1,020 TWh (roughly 100 bcm) on 31 March 2018.

- Before the 2017-2018 winter season, injections lasted longer than usual: the quantity of stored gas in the EU peaked on 29 October 2017 at nearly 949 TWh, equivalent to 89% of storage capacity. In the fourth quarter of 2017, withdrawals were lower than in the same period of 2016, driven by milder temperatures. By 31 December 2017, the average filling rate fell to 65%, 1 percentage point higher than a year earlier but close to the lower end of the 5-year range.

- January 2018 was warmer than the long-term average, but February and March were unusually cold in most of Europe, boosting gas demand, prompt prices and storage withdrawals. Relatively low imports also contributed to a greater reliance on stocks. EU stock levels bottomed out on 28 March, at 18% of storage capacity, well below the 5-year range. In fact, this is the lowest level on record.[23] To compare, at the end of the previous (2016-2017) winter stock levels bottomed out at 26% of capacity.

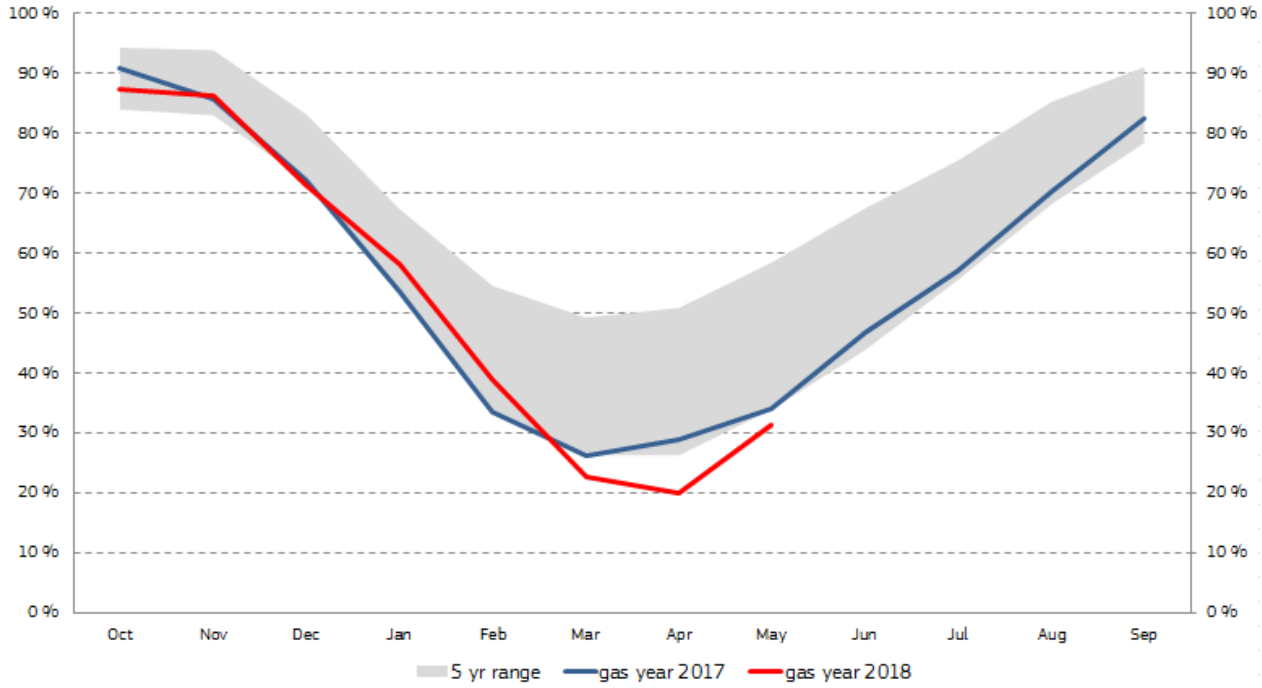
- Driven by a late cold snap, storage withdrawals peaked on 28 February at 11.4 TWh (nearly 1.1 bcm), reaching the highest daily rate on record.

- On 31 March 2018, the average filling rate was 19%, compared to 26% a year earlier and 35% in 2016. Low stock levels at the end of winter should mean higher injection demand during the summer of 2018.

- On 31 December 2017, the filling rate in Ukraine was 47%, 8 percentage points higher than a year earlier. As a result of the cold weather and the modest imports, withdrawals in the first quarter of 2018 were much stronger than in the same period of 2017: by 31 March, the filling rate dropped to 25%, 2 percentage points lower than a year earlier.

[23] Gas Storage Europe reports storage data from 1 January 2011

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 May 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.

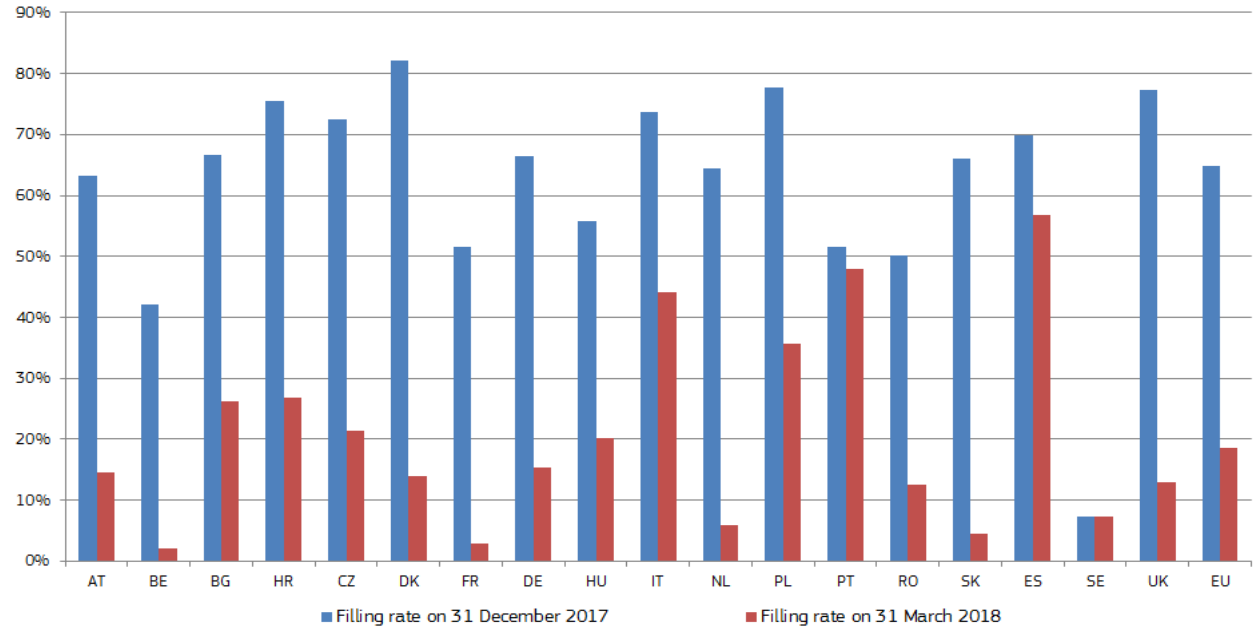
- On average, net withdrawals made during the first quarter of 2018 were equivalent to 46% of storage capacity (compared to 38% in the same period of 2017): the average filling rate decreased from 65% on 31 December 2017 to 19% on 31 March 2018. However, as Figure 14 shows, there was significant variation among Member States in terms of both the starting position (the filling rate at the end of 2017) and the pace of withdrawals.

- Denmark saw the highest rate of withdrawals in this period, with the filling rate falling from 82% to 14%. The Netherlands, Slovakia and the UK also experienced above-average withdrawals in the first quarter of 2018, with the filling rate decreasing by around 30 percentage points.

- On 31 March 2018, four Member States had particularly low storage levels, with a filling rate of less than 10%: Belgium, France, the Netherlands and Slovakia. For all these countries, filling rates were significantly lower than a year earlier (by 9-17 percentage points). In case of Belgian and Dutch facilities, high gas demand from the UK contributed to strong withdrawals this winter. In fact, British shippers increasingly use storage sites in the continent for volumes previously stored at the now decommissioned Rough facility.[24] In Italy, where withdrawals are capped by the government, the filling rate was 44% at the end of March, well above the EU average.

[24] ICIS Heren European Gas Markets, 15 January 2018

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



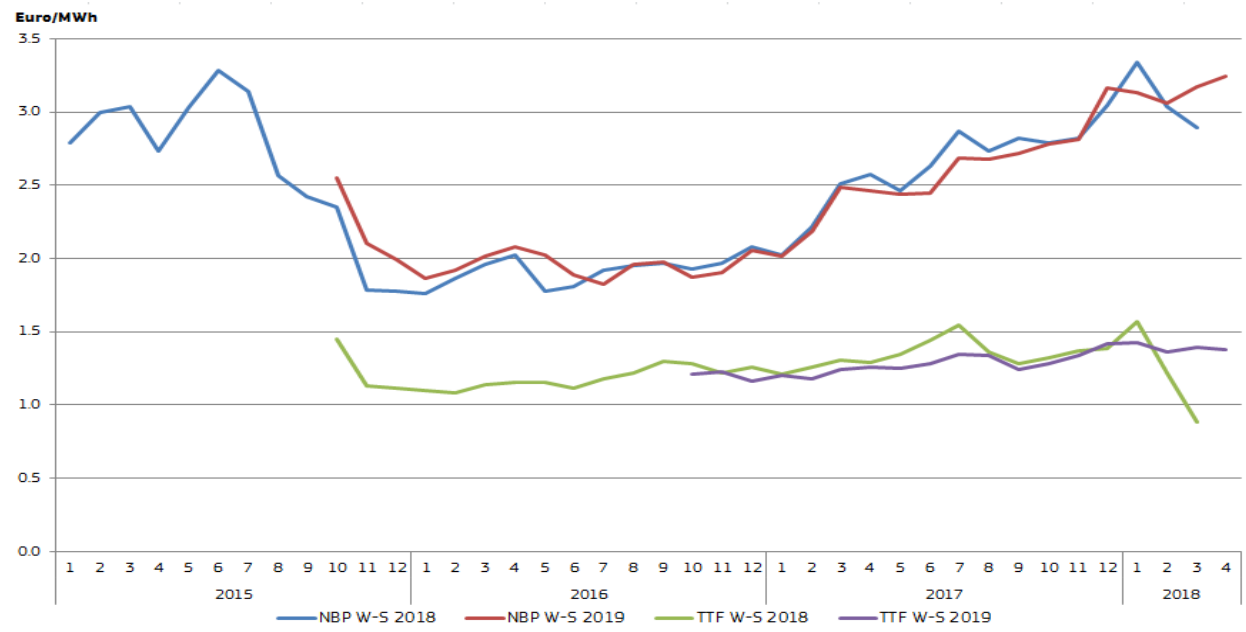
Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 17 May 2018; calculations of DG Energy. See explanations on data coverage at https://agsi.gie.eu/#/faq.

- On the NBP, seasonal spreads averaged 3.1 Euro/MWh in the first quarter of 2018, around 0.9 Euro/MWh more than in the same period of 2017. On the TTF, the average seasonal spread was 1.3 Euro/MWh in the first quarter of 2018, 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.

- 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.

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



Source: 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

2. Wholesale gas markets

2.1 EU energy commodity markets

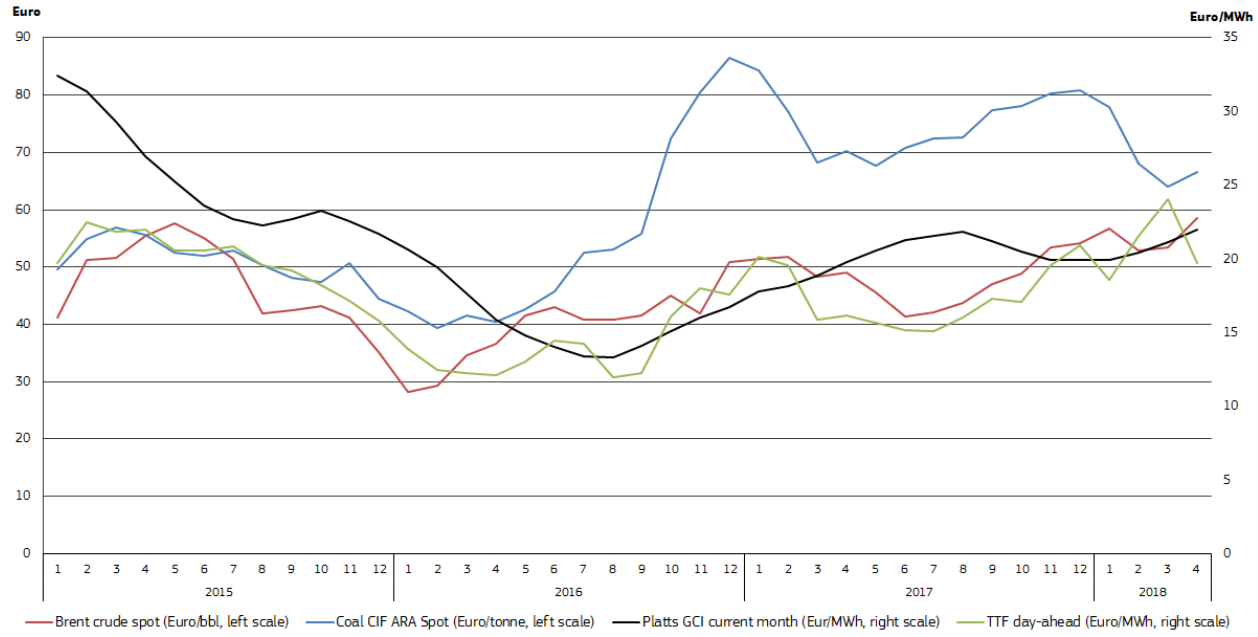
- Since dropping below 45 USD/bbl in June 2017, the price of Brent oil has been on the rise, driven by robust global demand growth, Middle East tensions, concerns over the impact of a return to US sanctions on Iranian oil, sliding output in Venezuela and the continued OPEC-led output cuts. By January 2018, Brent gradually increased to 70 USD/bbl, the highest level in three years. Prices receded in early February as the market remained well supplied, but the price rise resumed afterwards as growing tensions in Syria and the expectation of the US withdrawal from the Joint Comprehensive Plan of Action (the Iran nuclear deal) raised concerns about future oil supplies. The increase of US shale oil output should limit the potential for a significant price rise in 2018, but – with a more balanced demand and supply situation and lower level of stocks – any supply disruption would have the potential to increase prices further.

- The TTF spot gas price started to increase in mid-2017 and averaged 21.4 Euro/MWh in the first quarter of 2018, 16% more than in the same period of 2017. Rising oil prices and high seasonal demand, provided support to European hub prices in this period. In the wake of a late-winter cold spell, TTF (along with other European hub prices) reached unprecedented levels in early March, resulting in a monthly average price of 24.0 Euro/MWh, the highest level observed since January 2014.

- In spite of the recovery of oil prices since mid-2017, oil-indexed prices decreased in the second half of 2017 because of the typical 6-9 month time lag used in the pricing formulas, but started to rise in the first quarter of 2018. In this period, Platt's North West Europe Gas Contract Indicator (GCI), a theoretical index showing what a gas price linked 100% to oil would be, averaged 20.5 Euro/MWh, 0.9 Euro/MWh less than the TTF. Over the period, oil-indexed prices have become increasingly competitive with hub prices, especially in March when hub prices spiked because of a cold spell.

- Driven by market tightness in Asia after China introduced measures restricting domestic coal output, coal prices increased significantly in the second half of 2016. Prices receded after a peak in December 2016 and more recently at the beginning of 2018. The CIF ARA spot price averaged 70.0 Euro/ton in the first quarter of 2018, 9% less than a year earlier but 71% more than in the same period of 2016. With increasing gas prices and falling coal prices, the relative competitive advantage of gas vis-a-vis coal observed in the last one and a half years has decreased although this was partly offset by the recent increase in the price of European emission allowances.

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.

- Driven by strong seasonal demand in Asia and the robust growth of Chinese demand, in the first quarter of 2018 Japanese landed prices averaged 9.4 USD/mmbtu, even more than in the same period of 2017 (7.2 USD/mmbtu), In this period, the average premium over TTF was 1.7 USD/mmbtu. In January, the average Japanese spot price reached 10.9 USD/mmbtu, the highest level since late 2014, resulting in a premium of 4.2 USD/mmbtu above TTF. In March, however, TTF actually traded above Japanese spot LNG prices in the wake of a late cold spell in Europe.

- European gas prices started to rise from August 2017, helped by a combination of factors, including strong seasonal demand. In the first quarter, TTF averaged 7.7 USD/mmbtu (21.4 Euro/MWh). The average German border price was lower (6.9 USD/mmbtu or 19.0 Euro/MWh), especially in February and March, when hub prices increased much faster due to strong seasonal demand.

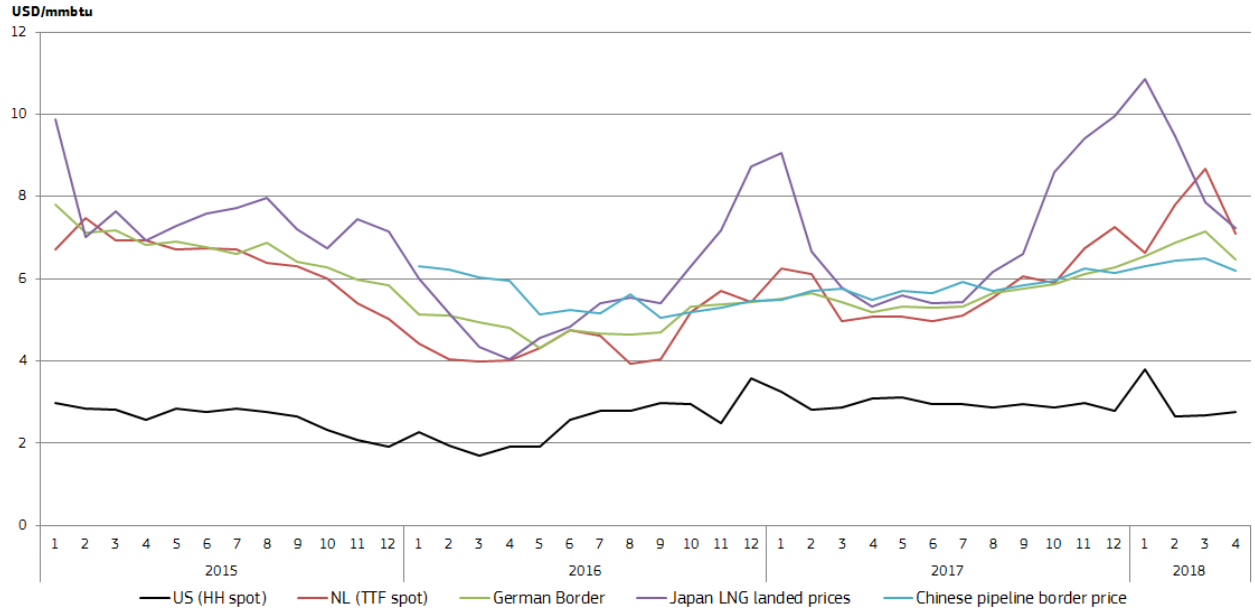
- The Henry Hub price had been rather stable since February 2017, fluctuating around 3.0 USD/mmbtu, but a small peak appeared in January 2018 when the monthly average price was 3.8 USD/mmbtu. In the first quarter of 2018, the average price was 3.0 USD/mmbtu, barely more than in the same period of 2017.

- 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 was 3.1 in the first quarter of 2018, compared to 1.8 in the second quarter of 2017. The average TTF/Henry Hub ratio increased to 2.7 in the first quarter of 2018 from 1.7 in the second quarter of 2017. In March, the ratio reached 3.3, the highest level since 2012. In absolute terms, the price spread between Henry Hub and TTF increased to 4.7 USD/mmbtu in the first quarter of 2018, up from an average 2.0 USD/mmbtu in the second quarter of 2017.

- Since the beginning of 2017, the Euro has considerably strengthened compared to the US dollar: The exchange rate increased from 1.05 on 2 January 2017 to 1.23 on 29 March 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, CEIC

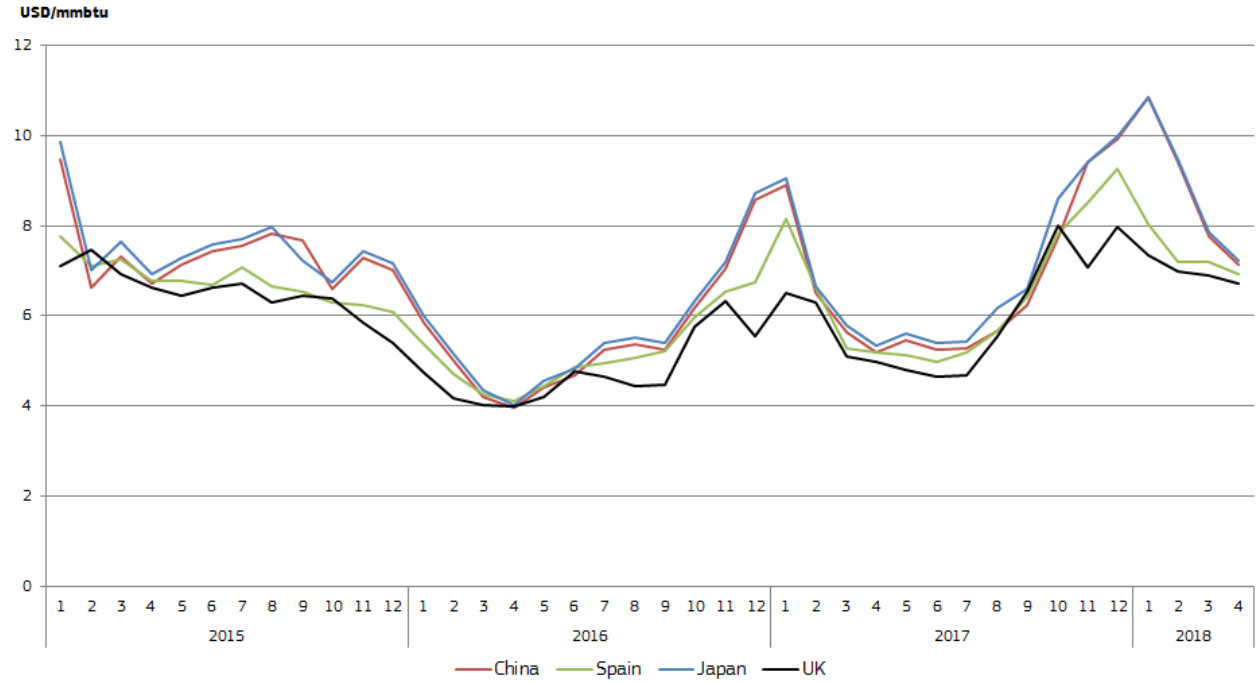
2.2.1 LNG markets

- 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 regional benchmarks. 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 first quarter of 2018, spot prices averaged 7.1 USD/mmbtu in the UK, 7.5 USD/mmbtu in Spain, 9.4 USD/mmbtu in Japan and 9.3 USD/mmbtu in China. In January, the difference between the Japanese and UK price reached 3.5 USD/mmbtu, the highest level since 2014.

- JCC, the Japanese benchmark of oil-indexed LNG prices averaged around 8.0-8.5 USD/mmbtu in the first quarter of 2018 which means that, in this period of strong seasonal demand, spot buyers had to pay a premium.

- LNG imports continued to expand in the first quarter of 2018 in China (+49% year-on-year), India (+20%) and Korea (8%) but slightly decreased in Japan (-2%) and Latin America (-2%).[25] 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.

Figure 18. Spot LNG prices in the EU and Asia



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

- Figure 19 displays the evolution of spot LNG prices paid in the UK and Spain and estimated border prices for pipeline imports from Norway and Algeria, which account for the major part of pipeline imports in the UK and Spain, respectively. The evolution of the day-ahead prices on the UK NBP hub is also presented.

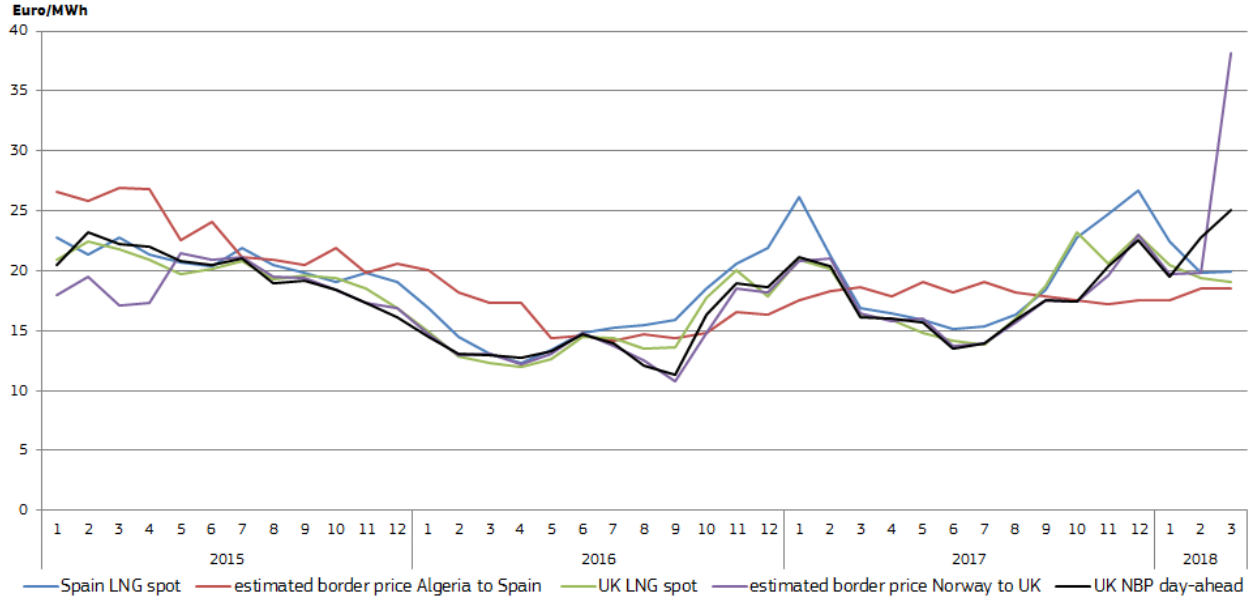
- In the UK, spot LNG prices closely follow the NBP price although in October 2017 an unusual gap appeared: the average LNG price was 5.8 Euro/MWh above the average NBP price. In March 2018, on the contrary, spot LNG prices did not follow the rising NBP and were on average 6.0 Euro/MWh cheaper. Since 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 March 2018, however, estimated Norwegian prices increased even faster than NBP, developing a premium of 13.0 Euro/MWh.

- 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. Oil-

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

indexed prices receded in the second half of 2017 but were on the rise again at the beginning of 2018, in line with the oil price rise seen since mid-2017. In the first quarter of 2018, LNG prices were on average still 2.6 Euro/MWh higher than the estimated price of Algerian gas. 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 and the first quarter of 2018. From the EU's four pipeline suppliers, only Algeria increased deliveries in the first three months of 2018 year-on-year.

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

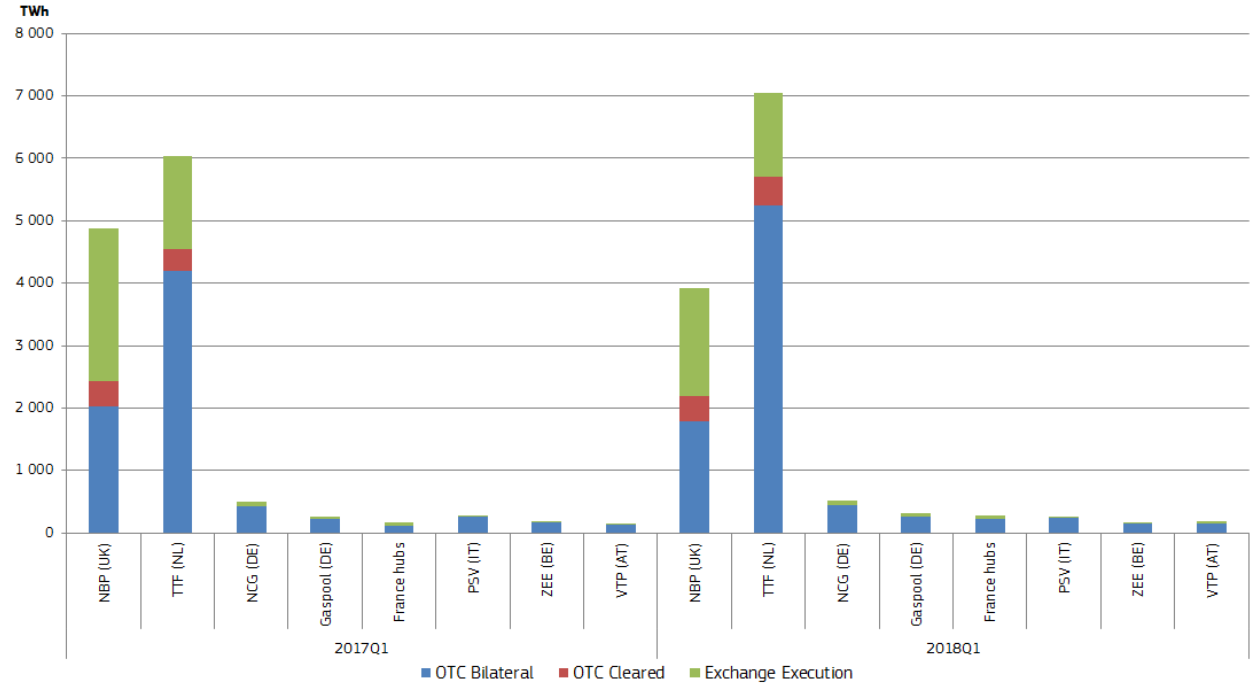
- As figure 20 shows, liquidity on the main European gas hubs slightly increased in the first quarter of 2018: total traded volumes amounted to around 12,600 TWh (equivalent to nearly 1200 bcm), 2% more than in the same period of 2017. This is around 9 times more than the gas consumption of the seven Member States covered by the analysis in this period. Traded volumes increased year-on-year in the Dutch (17%), German (10%) French (69%) and Austrian (19%) hubs which was partly offset by decreases in the UK (-20%), Italian (-7%) and Belgian (-12%) hubs. Issues at the Groningen field provided support to volatility and trading activity on the Dutch TTF hub while liquidity at the NBP decreased mainly because of falling volumes at the ICE exchange.

- While liquidity increased year-on-year in January and February, traded volumes in March were lower than a year earlier, despite the boost of gas demand driven by the late-winter cold spell experienced in this month.

- On the UK NBP hub, 44% total traded volumes were executed directly on an exchange in the first quarter of 2018. This share was 19% on the Dutch TTF hub, 20% at the French hubs, 17% at the German hubs, 17% at the Austrian hub but only 2% at the Italian hub and 1% at the Belgian hub. In the UK, the Netherlands and France, the share of exchange trade was markedly lower than a year earlier (a decrease of 6, 6 and 10 percentage points, respectively).

- At EU level, OTC markets remained the main trading venue and their share increased from 67% in the first quarter of 2017 to 74% in the same period of 2018. 9% of OTC volumes were cleared at a clearinghouse in the first quarter of 2018, unchanged from the same period of the previous year.

Figure 20. Traded volumes on the main European gas hubs in the first 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). Liquidity at NBP recovered to some degree in 2017 but since the second half of the year trading volumes at the TTF have been clearly exceeding those at the NBP.

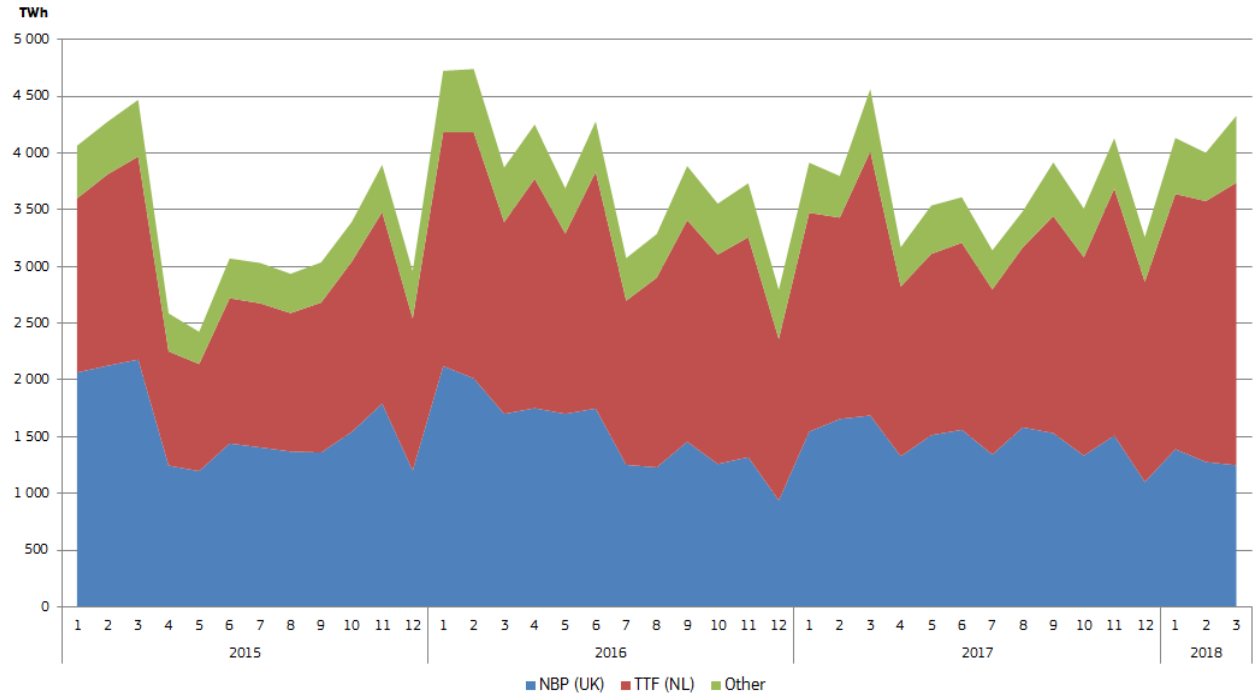
- TTF continued to gain ground at the expense of NBP in the first three months of 2018: compared to the same period of 2017, its share increased from 49% to 56%, while that of NBP fell from 40% to 31%.

- NBP and TTF continue to overshadow the other European hubs. In the first quarter of 2018, the combined market share of the Belgian, French, German and Italian hubs was 12%, up from 11% a year earlier, helped mainly by the growing share of French hubs.

- From 1 January 2018, the TTF market area was merged with the BBL pipeline connecting the Netherlands and the UK which may boost traded volumes in the coming years.[26]

[26] ICS Heren European Gas Markets, 15 January 2018

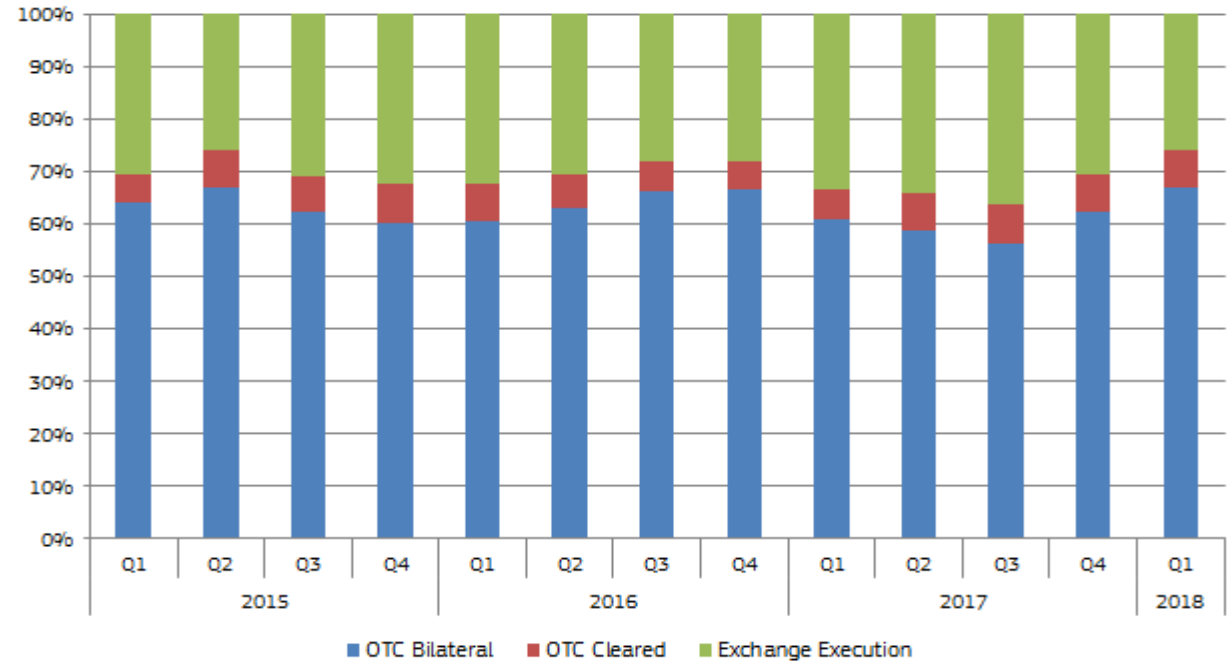
Figure 21. Traded volumes on the main European gas hubs



"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

- In the last three years, there has been a clear trend of exchange trade gaining ground but in the last two quarters this trend seems to have turned. In the first quarter of 2018, the share of total traded volumes executed directly on an exchange was 26%, 10 percentage points less than in the third quarter of 2017. The share of cleared OTC volumes was 7% of total traded volumes in the first quarter of 2018, up from 6% a year earlier.

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



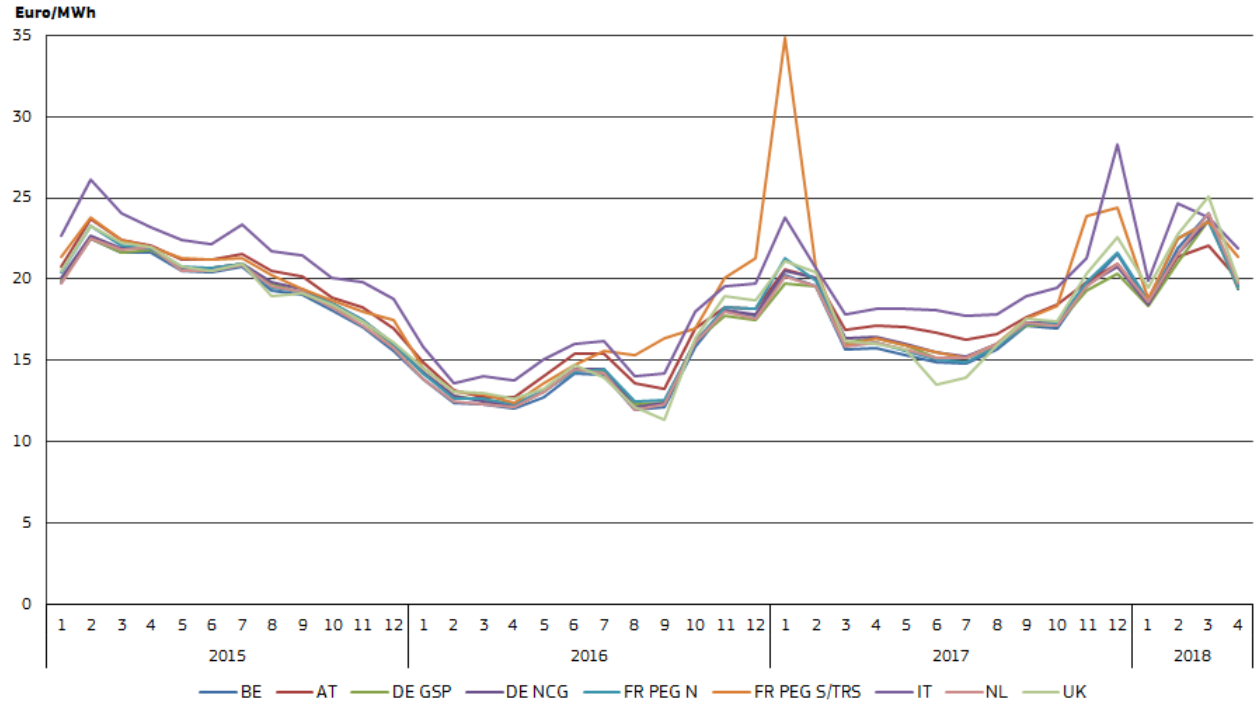
The chart covers the following trading hubs: UK: NBP (National Balancing Point); Netherlands: TTF (Title Transfer Facility); Germany: NCG (NetConnect Germany) and Gaspool; France: PEG (Point d'Echange Gaz); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach, Austria: Virtual Trading Point (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 January 2018, Western European hub prices decreased due to the relatively warm weather and the return of supply from the Forties pipeline system. In February and March, however, low temperatures and recurring concerns about Groningen provided additional support to prices. In the first quarter of 2018, hub prices averaged around 21-22 Euro/MWh, roughly 10% more than in the same period of 2017. Unusually, prices were highest in March, driven by a late cold spell which triggered an unprecedented price rise at the beginning of that month.

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



Source: Platts

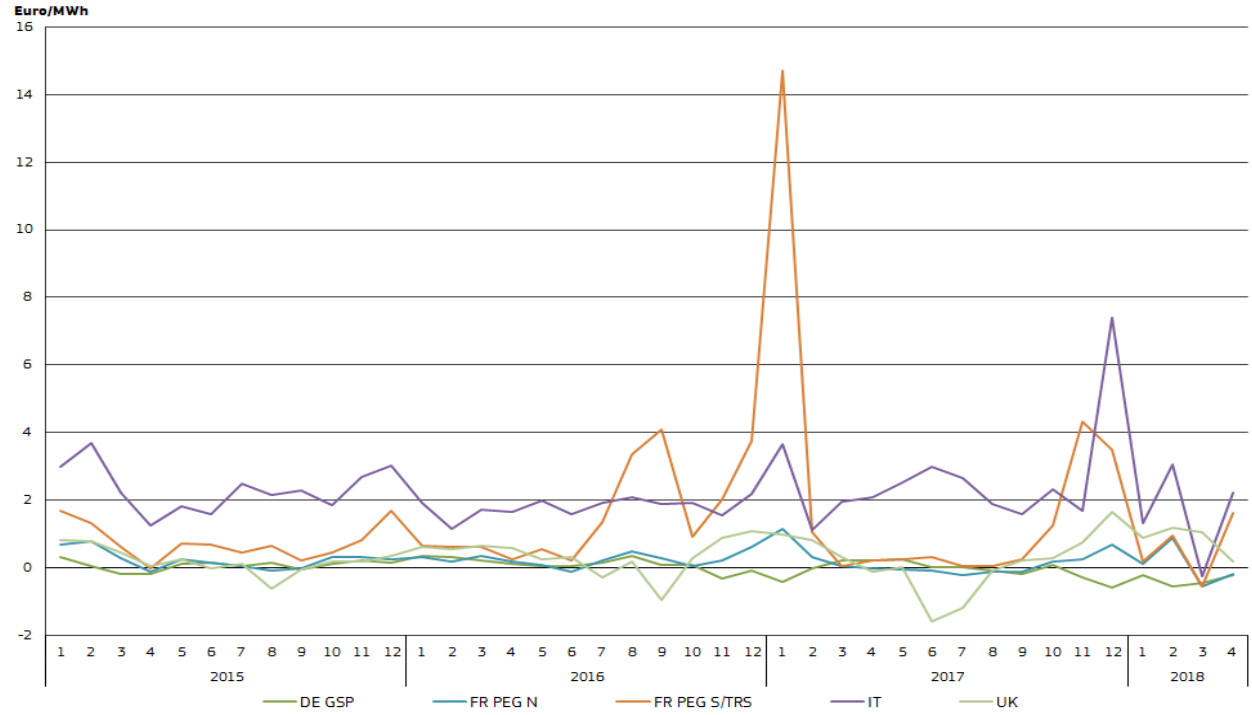
- Since 2016, prices at the UK gas hub are increasingly disconnected from mainland hubs, showing a distinct seasonality. With no injection demand at Rough, the UK market is oversupplied in summer, putting pressure on day-ahead prices and increasing flows to the continent on the Belgium-UK Interconnector. During winter, in turn, low domestic stock levels after the outage of the Rough site and low LNG imports cause supply tightness in the UK and the country has to rely more on pipeline imports from Norway and mainland Europe. These increased import flows are fostered by the relatively high prices in the UK. During December 2017 the tightness was exacerbated by the outage of the Forties pipeline system which reduced UK gas production. In the first quarter of 2018, NBP had an average 1.0 Euro/MWh premium over TTF. Looking ahead, the planned further reduction of Groningen output is likely to exacerbate this trend.

- In the past, the spread between the day-ahead price at Gaspool (Germany) and TTF had been typically positive, i.e. Gaspool exhibiting a premium above TTF. During the last two winters, however, the spread turned negative, with Gaspool trading below TTF. As production at the Groningen field dwindles, the country has to import more gas; as a result prices at TTF had to increase compared to neighbouring countries in order to attract supplies. Lower Gaspool prices also support flows from Germany to the UK in winter.

- 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. In March, however, PSV traded slightly below TTF because Italy was affected by the cold spell in early March to a lesser extent than Northwest Europe and the market was in oversupply, partly due to imports arriving under long-term contracts, with take-or-pay obligations. The premium of PSV was also lower than usual in January when strong storage withdrawals put pressure on Italian prices.

- In France, PEG Nord and TRS traded at parity during the first quarter of 2018; the exceptional levels seen a year earlier, in January 2017, did not occur this time. Among other factors, steady LNG imports in the South, low storage levels in the North and the improving availability of the French nuclear fleet helped to annul the premium of TRS in this period.

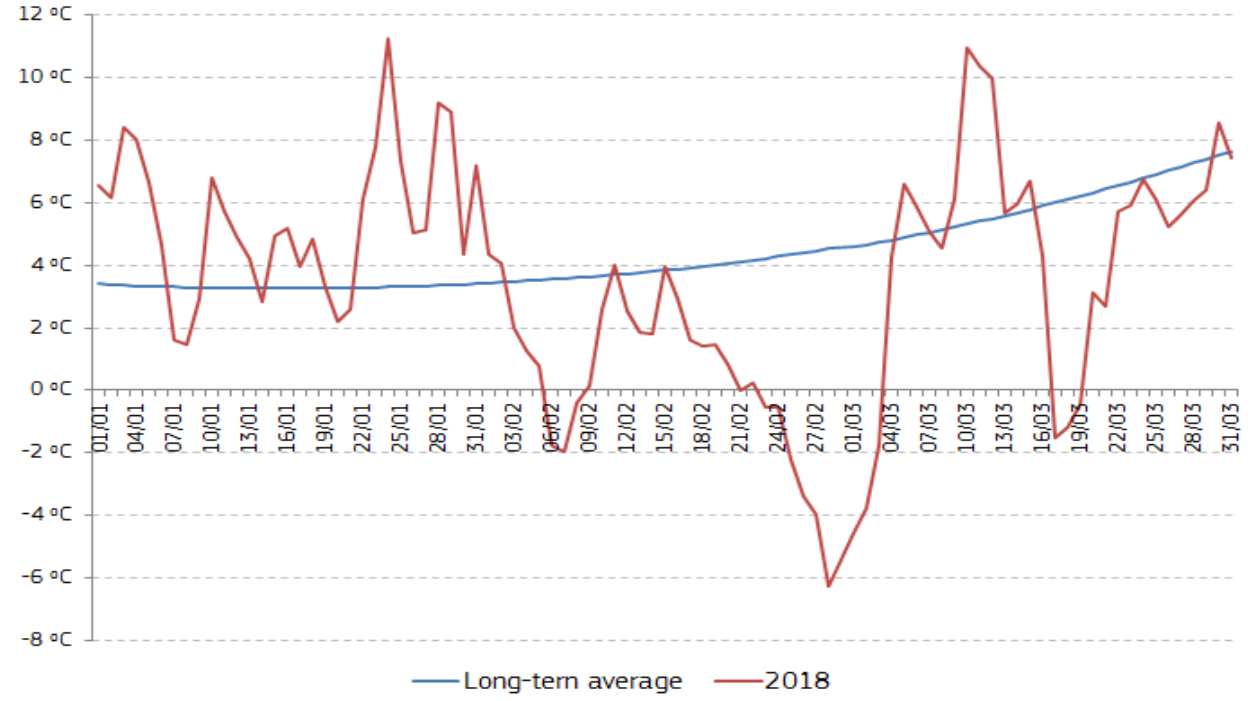
Figure 24. The premium of wholesale day-ahead gas prices at selected hubs compared to TTF



Source: Platts

- During the late-winter cold snap of late February/early March, temperatures dropped around 10°C below the seasonal average in most of Europe, causing a significant price spike. Another shorter cold spell in mid-March had only a modest impact on hub prices. As an example, Figure 25 depicts daily temperatures in the Netherlands in the first quarter of 2018, compared to the long-term average.

Figure 25. Average daily temperatures in the Netherlands in the first quarter of 2018

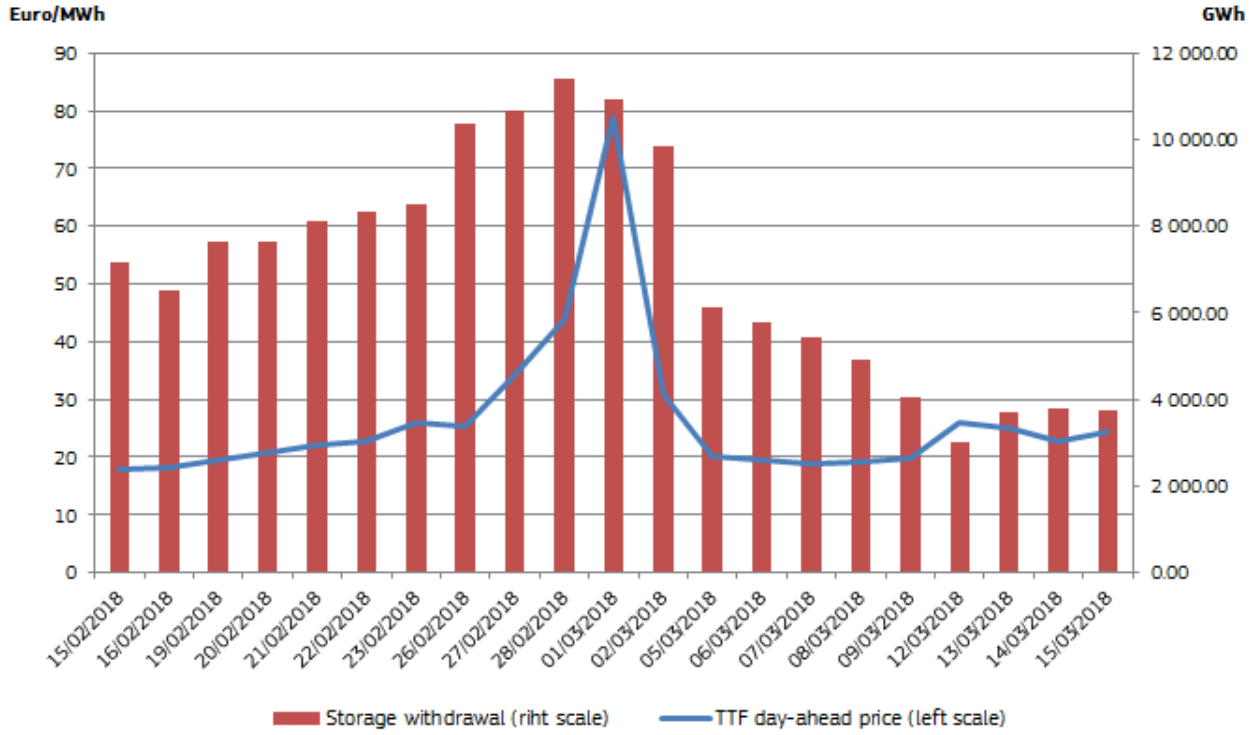


Source: Thomson-Reuters, Point Carbon

- The cold spell triggered record gas consumption in a number of Member States and tightened the supply-demand balance in Europe. The cold spell arrived at a time when gas storage levels were already rather low (especially in Northwest Europe), increasing the impact on day-ahead prices. Hub prices in Western Europe reached unprecedented levels, with TTF and NBP closing at 79.0 Euro/MWh and 88.4 Euro/MWh, respectively on 1 March 2018. Because of the tight supply-demand balance, National Grid, the UK transmission system operator issued a gas deficit warning for 1 March 2018 and called on industrial users to reduce consumption.[27] Rising prices provided the right signal to market participants and gas supplies were not interrupted but the extent of the price rise seems to point toward the inflexibility of demand.

- Storage withdrawals typically tail off in February but this was not the case in 2018. Skyrocketing spot prices provided a boost to withdrawals which was a key source of gas supply during the cold spell. On 28 February, withdrawals reached 11.4 TWh (nearly 1.1 bcm), the highest daily rate on record. On the other hand, the price spike did not last long enough to attract additional LNG supplies: LNG imports remained below 2017 levels in both February and March 2018.

Figure 26. Storage withdrawals in the EU and the day-ahead price at the Dutch hub between 15 February and 15 March 2018



Source: Platts (price); Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 17 May 2018 (withdrawals)
Note: only weekdays are depicted.

- Figure 27 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.

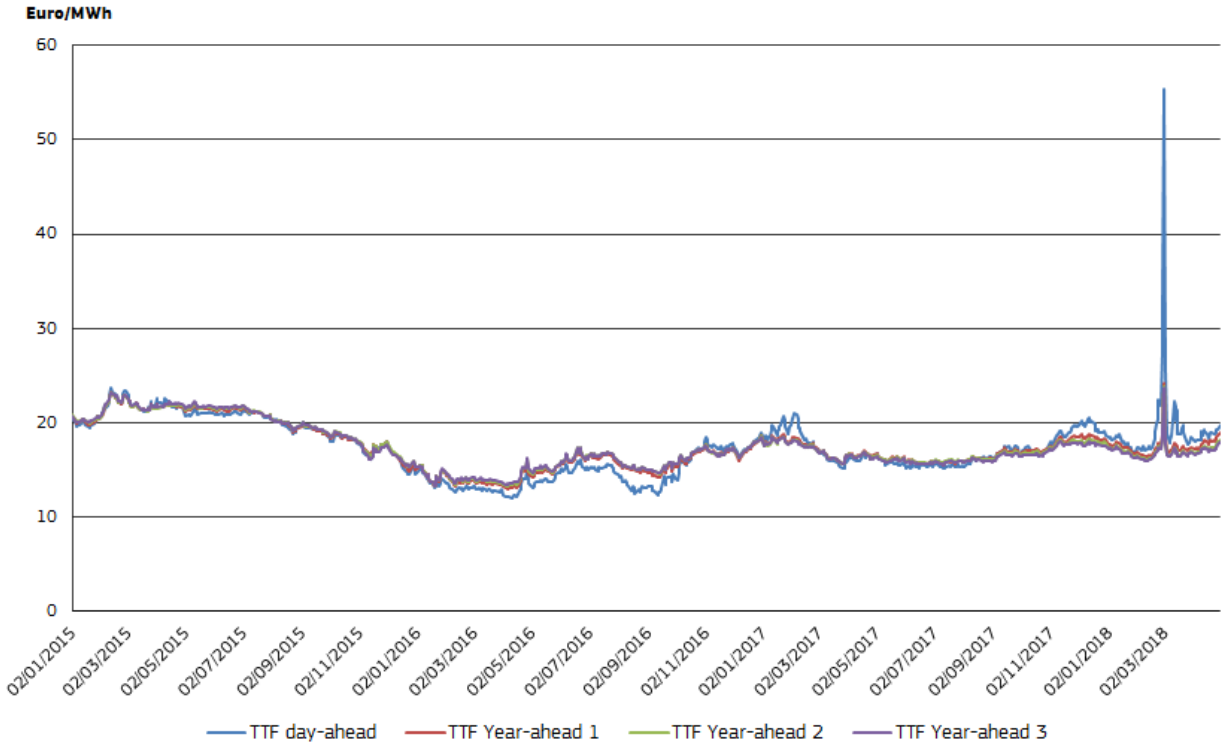
- In the last quarter of 2016, this premium of forward prices over day-ahead prices have practically disappeared. In fact, from mid-October 2016 to mid-February 2017, day-ahead prices have been consistently higher than year-ahead prices. In January-February 2017, the difference averaged 1.0 Euro/MWh 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 pracically disappeared.

- In late 2017 and early 2018, spot prices in European hubs spiked because of some specific events: in December, the Baumgarten explosion and the closure of the Forties pipeline system, while in March 2018 the cold spell triggered a rising gap between spot and

[27] https://www.platts.com/latest-news/natural-gas/london/uk-national-grid-issues-natural-gas-deficit-warning-26900974

forward prices. In the first quarter of 2018, day-ahead prices at the TTF were on average 2.1 Euro/MWh higher than year-ahead prices.

Figure 27. Forward gas prices on the Dutch gas hub



Source: Platts

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

- Figure 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.

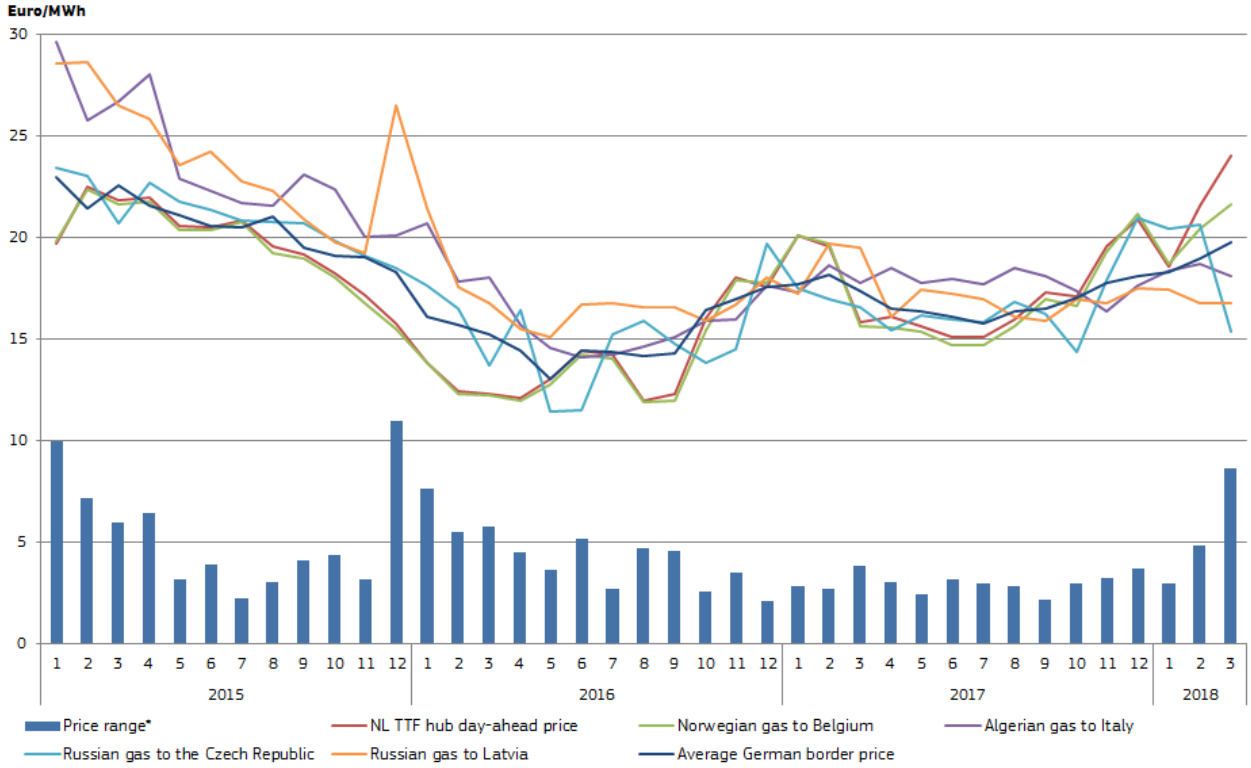
- Over the last three years, there has been a gradual price convergence, helped by the significantly falling oil prices in the second half of 2014 and in 2015 and the lagged impact on oil-indexed prices. Moving towards more competitive pricing by certain producers (e.g. introducing a hub element into 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.

- In the first quarter of 2018, hub prices significantly increased, especially in March in the wake of a late cold spell. Oil-indexed prices, in turn, remained relatively stable as the lagged impact of the oil price rise has not yet materialized.

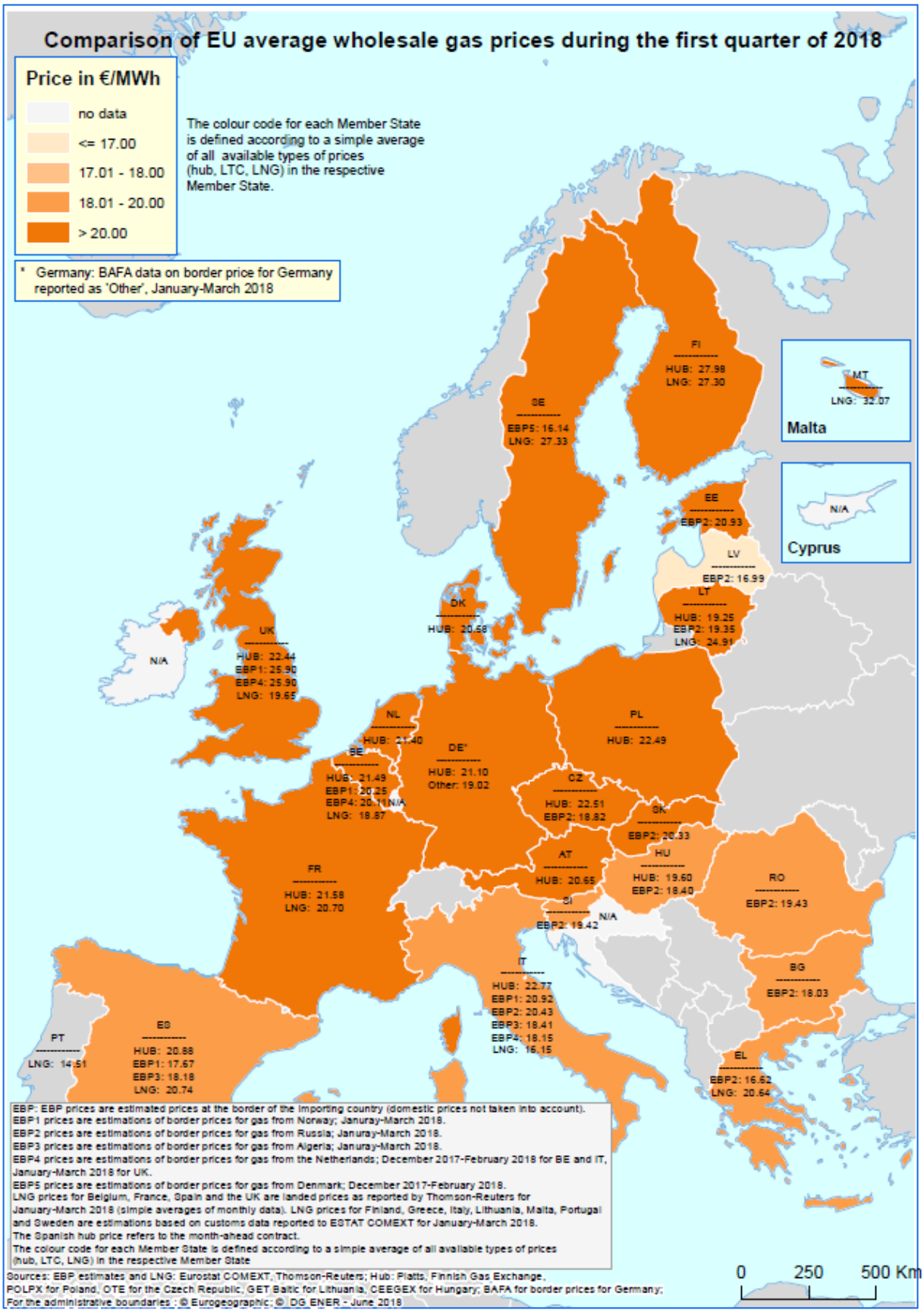
- The difference between the highest and lowest price depicted in Figure 28 decreased to 2.2 Euro/MWh in September 2017. As a result of diverging prices, however, this difference increased to 8.7 Euro/MWh in March 2018, the highest level in more than two years.

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 first 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 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 second half of 2017) and Harmonised Consumer Price Indices (HICP) for the household prices and Producer Price Indices (PPI) for industrial consumers.

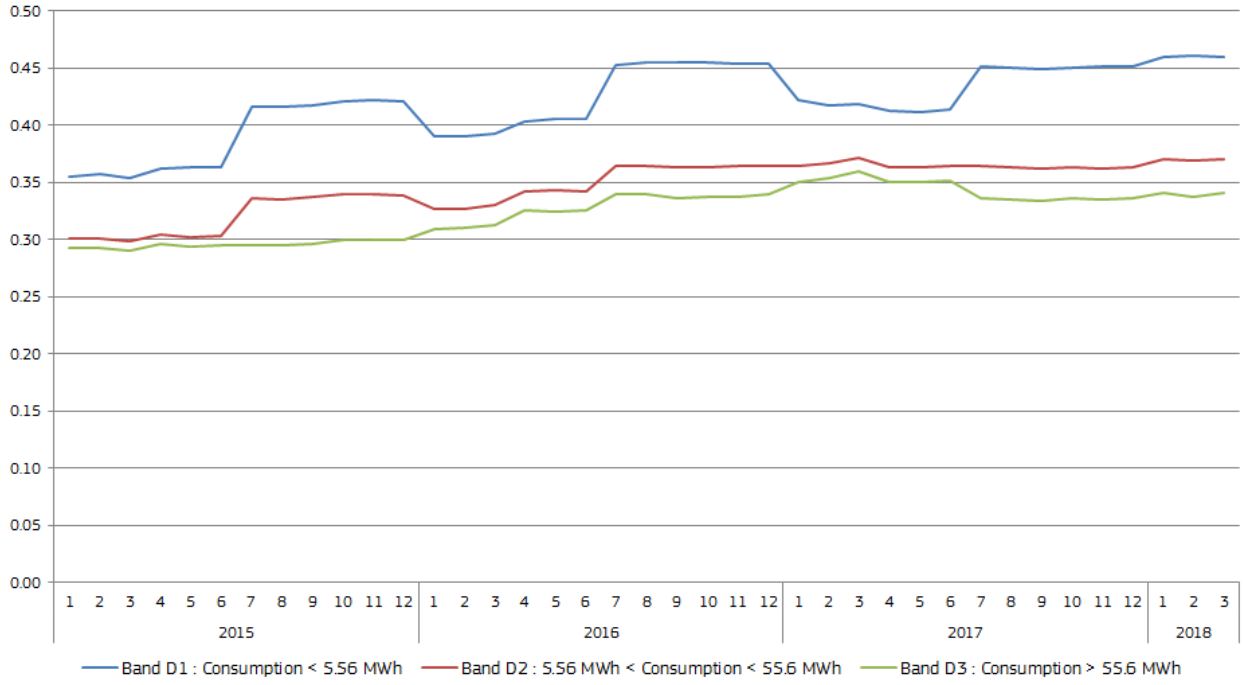
- For household consumers, the estimated average retail price (including all taxes) showed an increasing trend between 2010 and 2014-2015 and decreased in 2015-2017. In the most typical consumption band, D2, the estimated average price (including all taxes) in the first quarter 2018 was 6.52 Eurocents/kWh. (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 seem to have stabilised, indicating that the diverging trend has come to an end. Observed price differences are higher for the consumers with lower annual consumption.

- There are still significant differences in retail gas prices across the EU: in the first quarter of 2018, the estimated household price in consumption band D2 varied between 3.23 Eurocent/kWh in Romania and 11.31 Eurocent/kWh in Sweden, resulting in a price differential ratio of 3.5 between the cheapest and the most expensive Member State. This ratio gradually decreased since from March 2012 when it reached 4.8.

- In Romania, the lowest-price market, regulated prices for households were increased by 8.4% from 10 January 2018 but suppliers claim the new price is still insufficient to cover costs.[28]

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 March 2018. On average, 45% of the price covered the energy component, while the rest covered distribution/storage costs (29%), energy taxes (10%) and VAT (17%).[29]

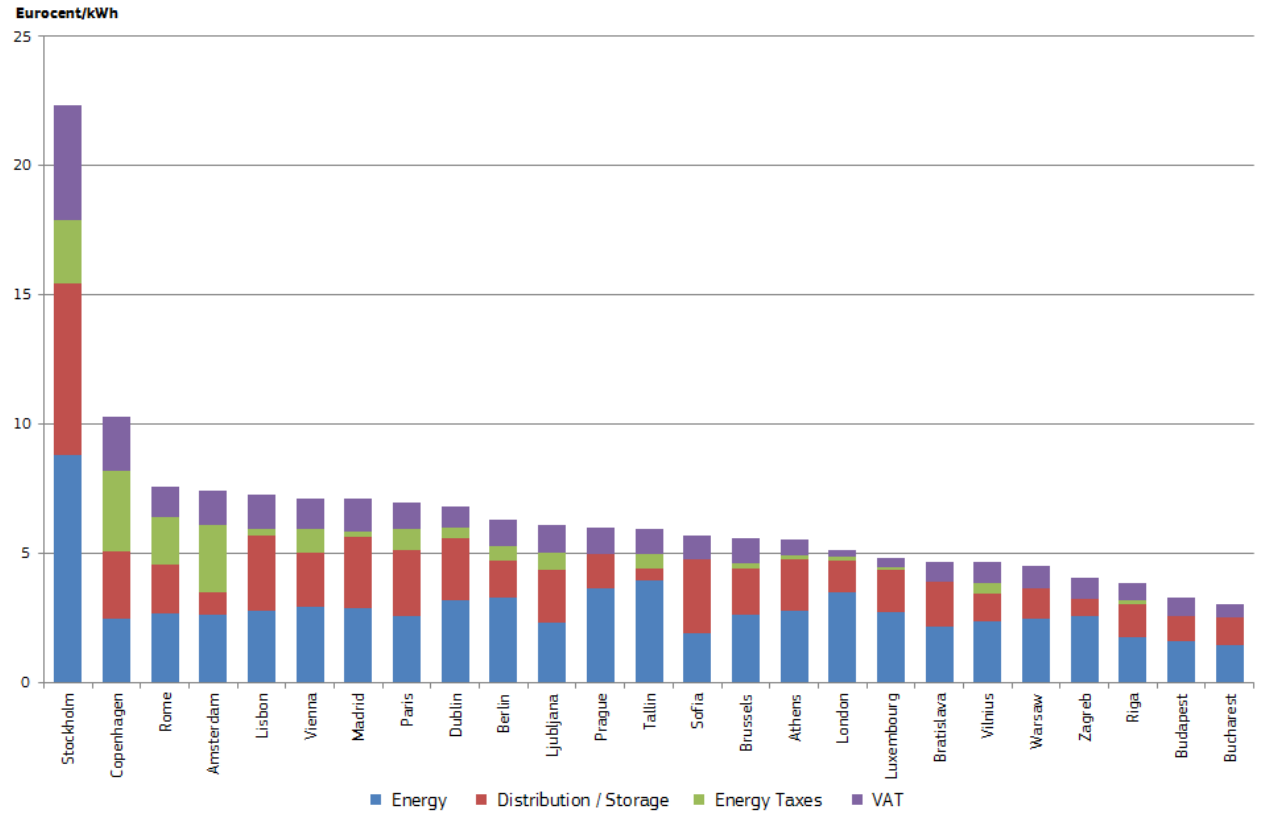
- There are significant differences across Member States, with the share of energy cost ranging from 24 to 68%, the share of distribution/storage costs ranging from 8 to 50% and the share of taxes ranging from 8 to 53%. In Amsterdam and Copenhagen, taxes make up more than half of the price while in London and Luxembourg their share is less than 10%. For 7 of the 25 capitals

[28] ICIS Heren European Gas Markets, 15 January 2018
[29] Note that these are arithmetic averages.

covered, the price does not include an energy tax component. 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.

- In 13 of the 25 capitals, prices were higher in March 2018 than a year earlier, with the biggest increases in Tallinn (11%), Luxembourg (8%) and Sofia (8%). At the other end of the spectrum, prices decreased by 20% in Athens, driven by a decline in the energy component.

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



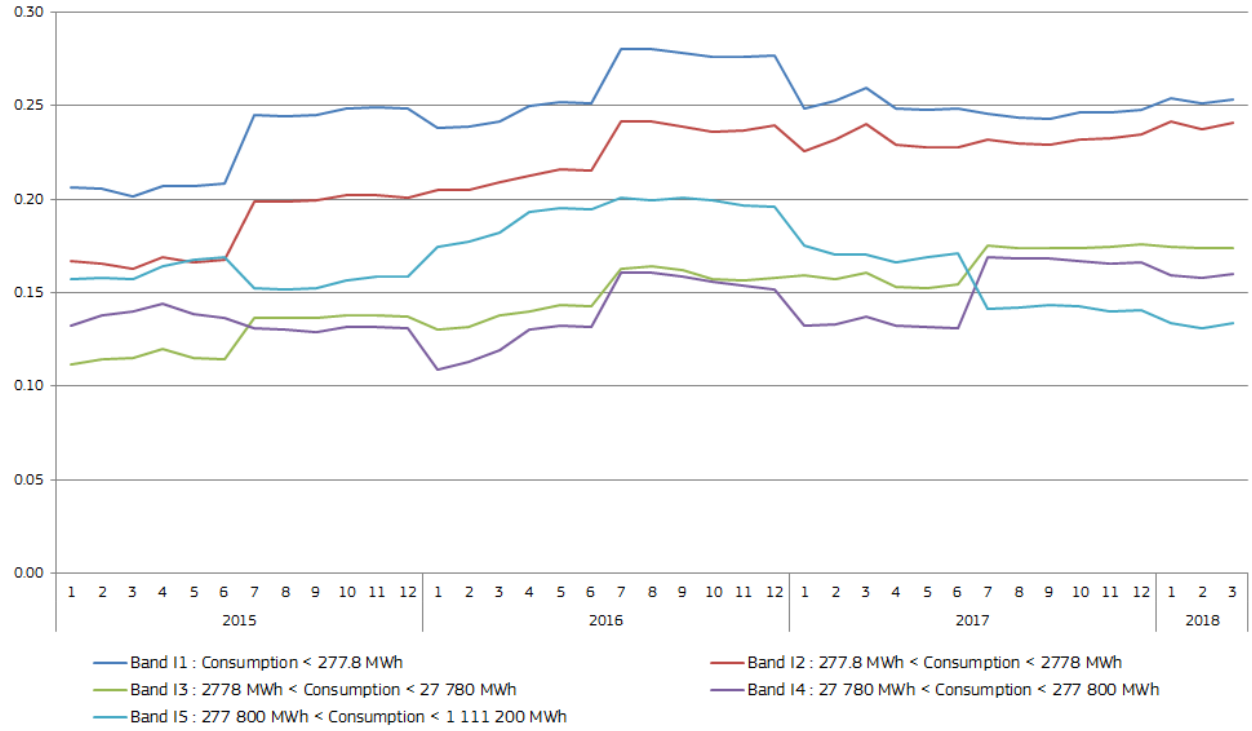
Source: VaasaETT

- Estimated industrial prices started to decrease already in 2014, and the trend continued in 2015-2016. In 2017-2018, industrial prices seem to have stabilised. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.38 Eurocent/kWh in the first quarter of 2018, 1% less than a year earlier. Prices decreased in this period in around half of the Member States but the decrease was never more than 7%. Lithuanian (34%), Bulgarian (25%) and Swedish (17%) industrial consumers had to cope with a double-digit increase. (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 stabilised in the second half of 2017. The higher the annual consumption, the lower the observed price differences are.

- In the first quarter of 2018, the UK had the lowest estimated industrial price in consumption band I4 (1.81 Eurocent/kWh), while the highest price was observed in Sweden (3.91 Eurocent/kWh), resulting in a ratio of 2.2. The price differential ratio between the cheapest and the most expensive Member State has been fluctuating between 1.6 and 2.4 in 2015-2018.

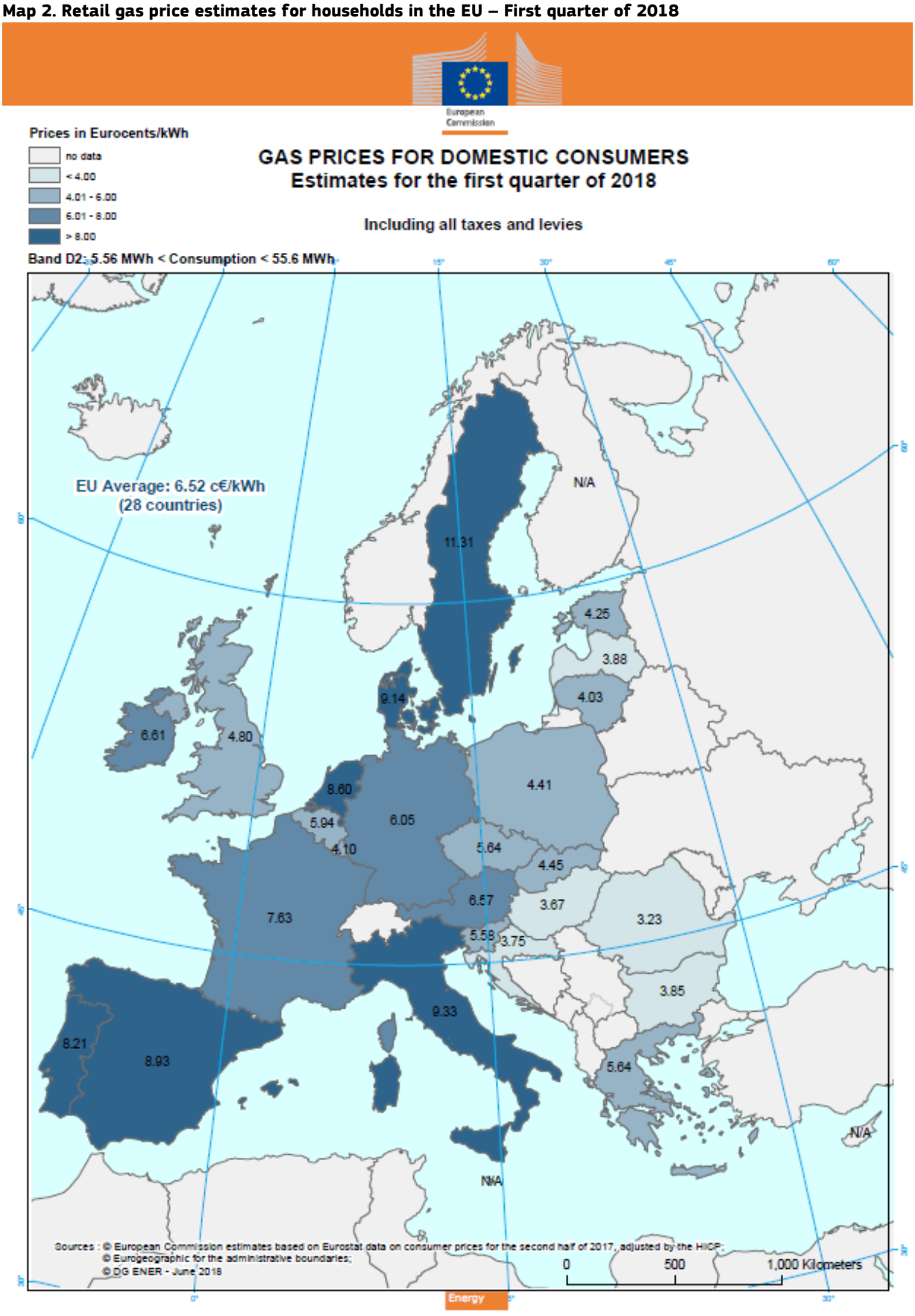
Figure 31. Relative standard deviation of gas prices paid by industrial consumers in EU Member States



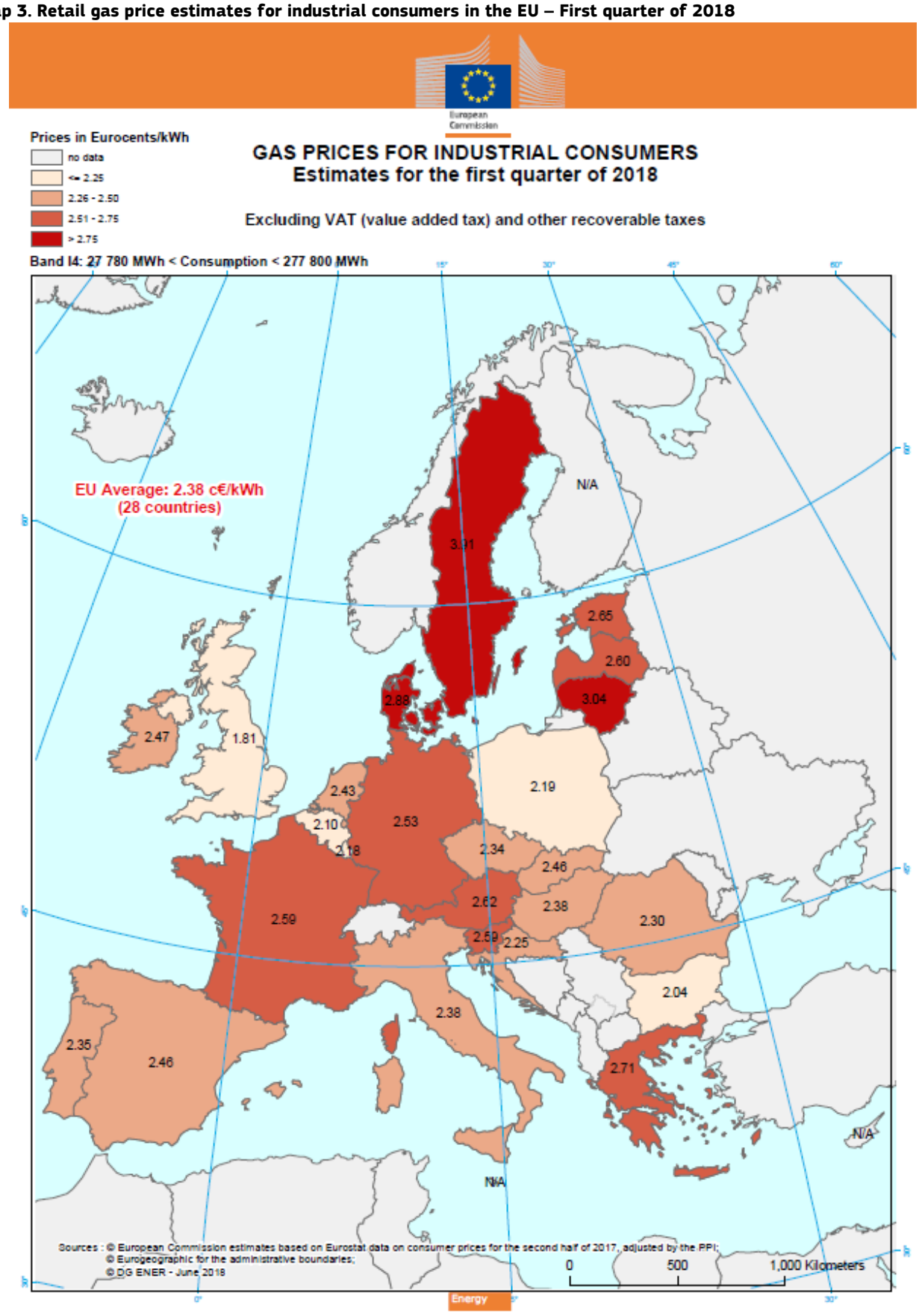
Note: Excluding VAT and other recoverable taxes.
Source of data: European Commission estimates based on Eurostat data on industrial prices adjusted by the PPI

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

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



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