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HIGHLIGHTS OF THE REPORT

- In the second quarter of 2019 **EU gas consumption increased by 20%** compared to the same quarter of 2018, primarily owing to increasing gas use in electricity generation. Gas consumption in Q2 2019 was 103 bcm in the EU, up from 85 bcm a year earlier. In the first half of the year gas consumption amounted to 265 bcm.

- Indigenous **gas production, amounting to 27 bcm in the second quarter of 2019 in the EU, fell by 7%** compared to Q2 2018. Gas production decreased in the two biggest producers in the EU, the UK and the Netherlands. Production from the Groningen field might be discontinued in 2022, eight years before the earlier planned date, as the Dutch government signalled.

- **Net gas imports increased by 21% year-on-year** in the second quarter of 2019 in the EU. Russian pipeline supplies covered 45% of extra-EU gas imports, followed by Norway (25%), LNG imports (25%) and pipeline imports from North Africa (5%). In April and May the share of LNG imports was higher than pipeline imports from Norway, implying that LNG became the second import source after Russia. Net gas imports amounted to 109 bcm in Q2 2019 and to 210 bcm in the first half of 2019. Increasing gas consumption was satisfied by increasing imports amid decreasing production.

- The EU’s **estimated gas import bill was around 19 billion euros in the Q2 2019, 17% less than a year earlier, as falling import prices, down by 31%, more than compensated the impact of increasing import volumes**.

- **EU LNG imports showed a huge increase, up by 102% year-on-year** in the second quarter of 2019. Global LNG supply glut and converging prices in different regions (e.g.: between Europe and Asia) enabled plentiful LNG influx to Europe. The three most important LNG suppliers to Europe were Qatar (30% of all LNG imports), Russia (19%) and the US (12%).

- The **Polish PGNiG company signed a new agreement with a US firm on additional LNG imports (2 bcm from 2023)**. At the same time the European Commission found Croatian plans to support the construction and operation of the LNG terminal at Krk-island to be in line with EU State aid rules.

- An agreement was signed by the Commission on granting financing from the Connecting Europe Facility to the works related to the **Baltic Pipe**, linking Poland and the Baltics with Norway and Denmark, and creating a new supply corridor.

- **Gas storage levels in the EU stood at 73% at the end of June 2019, which was the highest in the last eight years in this period of the year**. Low spot prices on wholesale gas markets, abundant LNG imports and expectations on higher prices in the future helped in reaching high filling rates by the end of Q2 2019.

- **Traded volume on the European gas hubs increased by 26% in the second quarter of 2019** in year-on-year comparison, and the share of trade on the Dutch TTF, which emerged to be the most liquid hub in the EU, rose to 66% among the observed European hubs, also reinforcing the role of euro in gas trade.

- **Spot prices at some European gas hubs (including the TTF) fell to the lowest since the end of 2009 in the second quarter of 2019**. A significant premium could be observed for forward prices to the spot market. European wholesale prices were well aligned with the Asian markets and shrank their premium to the US Henry Hub. The price ratio of between Henry Hub and the TTF decreased to 1.7 in Q2 2019.

- **Retail gas prices showed only a minor decrease in second quarter of 2019 compared to Q1 2019**, whereas on year-on-year comparison they were still up significantly, implying that the recent price fall on the wholesale gas markets did not yet filter in the retail prices.
EXECUTIVE SUMMARY

- In the second quarter of 2019 EU gas consumption was 20% higher than in same period of 2018. This was the biggest year-on-year increase since the fourth quarter of 2016 and followed the decreases of the previous four quarters. Gas-fired electricity generation was significantly up in the EU (by 39%), reducing the role of coal in power generation in several countries. EU gas consumption in Q2 2019 was higher than the range of the last five years. In absolute numbers, gas consumption in Q2 2019 amounted to 103 bcm, up from 85 bcm a year earlier. In the first half of 2019 gas consumption in the EU was 265 bcm, 4% higher than in the same period of 2018, when it was only 255 bcm.

- EU gas production fell by 7% year-on-year in the second quarter of 2019; amounting to 27 bcm. Gas production decreased in all major EU gas producing countries, including the Netherlands (-12%) and the UK (-6%). In the first half of 2019 gas production in the EU amounted to 58 bcm, down by 8% compared to the same period of 2018. Following an earthquake on 22 May, the Dutch mining authority proposed to further decrease the production cap at the Groningen field, and later the government signalled that regular gas production from this field will be finished in 2022, eight years ahead of the originally planned timing, 2030.

- In parallel with increasing consumption and decreasing domestic production, EU gas net imports rose by 21% in the second quarter of 2019 compared to Q2 2018. Pipeline gas imports from Russia increased by 18% year-on-year in Q2 2019, while those from Norway decreased by 2%. Algerian pipeline gas imports fell steeply, by 39% compared to Q2 2018. In contrast, pipeline gas import from Libya rose by 143%, though its share remained marginal in the total EU gas import. LNG imports in Q2 2019 more than doubled compared to Q2 2018 and ensured almost 25% of the total extra-EU gas imports. In Q1 2019 the total net EU gas import was 109 bcm, and in the first half of the year it amounted to 210 bcm, up by almost 19% compared to the first half of 2018.

- Russian pipeline supplies remained the main source of EU gas imports, covering 45% of extra-EU imports in Q2 2019, followed by Norwegian pipeline imports (25%), LNG imports from various sources (almost 25%) and pipeline supplies from North Africa (5%). The share of LNG within the total gas imports was up by 10 percentage points compared to Q2 2018, mainly to the expense of Norwegian and Algerian pipeline imports. In April and May 2019 LNG temporarily overtook the pipeline gas imports from Norway, and became the second import source for the EU. The EU’s estimated gas import bill was around 19 billion euros in the Q2 2019, 17% less than a year earlier, as a result of falling import prices (by 31%), more than offsetting increasing import volumes. LNG imports amounted to €4.3 billion in Q2 2019 in the EU.

- In the second quarter of 2019, Ukraine was the main supply route of Russian pipeline gas to the EU, covering 42% of the total Russian supplies (around 20 bcm), down by 1 percentage points compared to in Q2 2018. The share of Nord Stream was 40% (19 bcm) up by 7% compared to Q2 2018 and reaching the highest share since 2014, while gas supplies transiting Belarus covered 18% (9 bcm) in the total EU imports from Russia. In May 2019 both Nord Stream and the Ukrainian transit registered the highest monthly volume (above 7 bcm) in the last five years.

- EU LNG imports showed a strong increase in the second quarter of 2019, up by 102% in year-on-year comparison. Global LNG supply glut and converging prices in different regions (e.g. between Europe and Asia) enabled plentiful LNG influx to Europe. Qatar remained the biggest LNG supplier to the EU, raising back its share above 50% in the total imports in Q2 2019, followed by Russia (19%) and the US (12%). France was the largest LNG importer in Q2 2019 within the EU (with 7 bcm), followed by Spain (5.6 bcm) and the United Kingdom (4.9 bcm).

- On 12 June 2019 the Polish Oil and Gas Company (PGNiG) has signed an agreement to purchase an additional 1.5 million tonnes per annum (2 bcm) of liquefied natural gas (LNG) from the United States. Deliveries will commence on the commercial operation date, currently expected in 2023. With this new contract, PGNiG’s total volume of commitment with US LNG exporters amounts to more than 9 bcm per year. Meanwhile, the European Commission has found Croatian plans to support the construction and operation of the LNG terminal at Krk-island to be in line with EU State aid rules. The LNG terminal is designed to transport up to 2.6 billion cubic meters per year of natural gas into the Croatia national transmission network and in the region beyond, as from 2021.

- Gas storage levels in the EU stood at 73% at the end of June 2019, which was highest in the last eight years in this period of the year. Amid abundant LNG imports and steadily decreasing spot prices, gas filling in Q2 2019 amounted to 33% of the total storage capacity, as opposed to 27% in the second quarter of 2018. Besides very low wholesale gas market prices, storage fillings were helped by concerns on security of gas supply issues ahead of the winter period, mainly relating to the expiry of contract on the Russian gas supply though the Ukrainian transit route at the end of 2019. The gas market follows closely the trilateral talks between the EU, Ukraine and Russia.

- Spot prices at European gas hubs continued to decrease and by June 2019 the TTF spot hub price fell to the lowest since the end of 2009. Gas prices in Europe were mainly impacted by abundant LNG influx to Europe. In Q2 2019 European hub prices were down by 27-42% in year-on-year comparison. Oil-indexed gas prices showed only a slight decrease, reflecting the oil price decrease at the end of 2018. At international level, European and Asian remained well-aligned and falling EU prices had a shrinking premium to US Henry Hub as well. The price ratio of between Henry Hub and the TTF decreased to 1.7 in Q2 2019. By the end of Q2 2019 the premium of forward contracts increased measurably to the spot prices, implying that the market might expect higher spot prices in the future.
In the second quarter of 2019 trade volume on the European gas hubs increased by 26% in year-on-year comparison, and the total traded volume on the most liquid European hubs was more than 14 700 TWh, being 24 times as much as the gas consumption of the EU Member States these hubs are located in. High traded volumes were the result of well supplied gas market and trading strategies building on the price differentials between spot and forward contracts. The share of the Dutch TTF hub in the total EU trade rose to 66%, having three times the traded volume of the NBP hub in the UK.

On 15 April 2019 an agreement was signed for the €214.9 million Connecting Europe Facility (CEF) grant, for works for the Baltic Pipe project, connecting Poland and Denmark with Norway. The Baltic Pipe Project is a gas infrastructure project aiming at creating a new gas supply corridor in the European market. The new pipeline will allow, as of 2022, the shipment of gas from the North Sea to the Polish market and further to the Baltic States and to other neighbouring EU countries.

Retail gas prices for both household and industrial customers showed only a minor decrease in the second quarter of 2019 compared to Q1 2019, whereas in year-on-year comparison they were still up significantly (respectively 17% and 14% in the EU on average), implying that recent price fall on the wholesale gas markets did not yet filter in the retail prices. Increase in the final retail prices might also have been driven by non-market elements, such as network costs and taxes.
1. Gas market fundamentals

1.1 Consumption

- EU gas consumption in the second quarter of 2019 showed a sharp upturn, increasing by more than 20% year-on-year, which was the biggest increase since the fourth quarter of 2016. In absolute numbers, the quarterly gas consumption in Q2 2019 amounted to an estimated 102.7 bcm, in comparison to 85.3 bcm in Q2 2018. Gas-fired electricity generation showed a measurable increase in Q2 2019 in year-on-year comparison in many European countries; being the main contributor to the increase in gas use in the EU. The weather across Europe was generally in line with the seasonal average in the second quarter of 2019, however, some periods (e.g.: May 2019) was colder than usual, resulting in higher heating needs and gas consumption. In the second quarter of 2019 gas consumption in all three months of the quarter was above the range of 2014-2018, as Figure 1 below shows.

Figure 1. EU gas consumption

![Image of gas consumption graph]

Source: Eurostat, data as of 30 August 2019 from data series nrg_103m. Data missing for the Netherlands in June 2019 are calculated by using short term monthly gas data (nrg_ind_343m) as proxy.

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

![Image of year-on-year change graph]

Source: Eurostat, data as of 30 August 2019 from data series nrg_103m. Data missing for the Netherlands in June 2019 are calculated by using short term monthly gas data (nrg_ind_343m) as proxy.
In the second quarter of 2019, the biggest year-on-year increase in gas consumption could be observed in Slovakia (70%, representing a volume of 0.8 bcm in Q2 2019). Gas consumption increased in all EU Member States, with the exception of Malta, where it fell by 40%, though the total consumption was only 0.04 bcm in Q2 2019. In Denmark, Sweden and Hungary the quarterly gas consumption increased by more than 40% in year-on-year comparison, probably owing to the fact that these countries have significant gas-fired electricity generation capacities to put in operation. Among the biggest consumers, in France the consumption went up by 37%, in Germany by 22%, in Italy by 21%, and in Spain and the Netherlands by 18%.

In absolute numbers, gas consumption in Q2 2019 increased by in the Germany (3.4 bcm), Italy (2.7 bcm), France (2.4 bcm) the UK (1.5 bcm), the Netherlands (1.4 bcm), Spain (1.3 bcm). These countries altogether represented an increase of 12.6 bcm, representing almost three quarters of the total growth in gas consumption in the EU compared to Q2 2018.

In the first half of 2019 gas consumption in the EU went up by 4.2% (11.4 bcm) compared to the same quarter of 2018. The biggest increase in absolute numbers could be observed in Germany (4.6 bcm), while in the UK consumption decreased by more than 1 bcm (3.4%)

Figure 3 Year-on-year change in gas consumption in the second quarter of 2019

Economic activity in the EU in the second quarter of 2019 was comparable with that in the previous two quarters (Q4 2018 and Q1 2019), and GDP grew by 1.4% in year-on-year comparison. However, the rate of growth of value added in industrial sectors that consume significant amount of energy (e.g.: manufacturing, construction) showed deceleration in Q1 2019 (in manufacturing value added even decreased by 0.9%, while in construction it went up by 3.4% in year-on-year comparison). However, this had a relatively small impact on the consumption of natural gas in Q2 2019 in the EU, as the key driver was the electricity sector.

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1 Source: Eurostat, data as of 6 September 2019 from data series namq_10a10; seasonally and calendar adjusted data
Figure 4 EU GDP Q/Q-4 change (%)

Source: Eurostat, data as of 6 September 2019 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\(^2\) in individual EU Member States in the second quarter of 2019. Although in April 2019 the weather was generally milder than usual in most of Europe, in May temperatures were lower than usual, which in spite of the end of the general heating season might have contributed to higher domestic gas consumption. As of June with the onset of the summer heating degree days are less relevant, cooling needs are reflected by cooling degree days (CDDs). In some European countries (Malta, Italy, Greece, Spain, Hungary, Croatia, Cyprus, etc.) June was warmer than usual, which might have resulted in an increase in domestic electricity consumption for cooling needs, also impacting gas-fired electricity generation and the consumption of natural gas.

Figure 5 Deviation of actual heating degree days and cooling degree days from the long-term average in the second quarter of 2019

Source: Joint Research Centre (JRC), European Commission

\(^2\) Long term average temperatures, heating and cooling degree days refer to the period between 1975 and 2016
Based on data from ENTSO-E, gas-fired power generation was up by 39% in the second quarter of 2019 compared to the same period of 2018. In absolute terms, electricity generated from gas increased by 34.2 TWh in year-on-year comparison. As Figure 6 shows, gas-fired generation did not decrease in the second quarter after the end of the winter period, in contrast to the previous years. The main reason behind this difference is that decreasing coal and lignite fired generation, down by 16% in the EU in Q2 2019 in year-on-year comparison, was mainly replaced by natural gas in the EU electricity mix. Primarily owing to low natural gas prices at the EU markets and high carbon prices, remaining in the range of 21-27 €/tCO2 throughout the second quarter of 2019, gas-fired electricity generation became highly competitive vis-à-vis coal that resulted in an immense coal squeeze-out from the power mix. Although wind power generation showed a double-digit increase in Q2 2019 compared to the same quarter in 2018, hydro generation decreased in year-on-year comparison, offsetting the increase in wind and thus reinforcing the role of natural gas, amid receding solid fuels and practically unchanged nuclear in Q2 2019 in year-on-year.

Decreasing coal-fired generation, assuming competitive gas prices, can create a room for natural gas, as shown in Q2 2019. In April 2019 there was a 90 hour long period in the UK over the Easter holidays, when coal-fired generation was zero in the country’s energy mix, which length was unprecedented since the beginning of the industrial revolution more than two centuries ago. It happened in the first time in April 2017 that coal-fired generation fell to zero during a whole day, whereas this current period was nearly four times longer. This reflects the impact of high carbon prices and the carbon tax, coupled with competitive renewable and gas sources that all lead to a more and more visible squeeze out of coal from the country’s electricity generation mix.

In France, Italy, Spain and Portugal the amount of electricity generated from gas respectively increased by 158%, 90%, 62% and 37% in Q2 2019 in year-on-year comparison, owing to changes in the local power generation mixes. Both in France and Italy decreasing hydro and coal-fired generation was replaced by increasing gas use, in Spain besides increasing wind and nuclear gas-fired generation filled the gap left by diminishing coal and hydro. In Portugal increasing imports managed to keep electricity supply sufficient to satisfy demand, amid general fall of coal and hydro generation in Q2 2019. In the UK gas fired generation also decreased slightly, so increasing imports managed to satisfy demand for electricity amid lower coal, nuclear and hydro generation. In the other countries on Figure 6 quarterly gas consumption in Q2 2019 was up by 16-48% in year-on-year comparison.

**Figure 6 Gas-fuelled power generation in the EU**

![Graph showing gas-fuelled power generation in the EU](image)

Source: Based on data from the ENTSO-E Transparency Platform, data as of 3 September 2019.

UK clean spark spreads – measuring the profitability of gas-fired generation by taking into account variable costs – averaged 13.2 €/MWh, in Q2 2019, up from 5.8 €/MWh in the second quarter of 2018, implying that profitability of gas-fired generation in

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3 See more information in Quarterly Report on the European Electricity Markets, Vol. 12, Issue 2
4 As electricity generation from gas is less carbon intensive than from coal, for the production of 1 MWh electricity
the UK improved in the second quarter of 2019 (see Figure 7). However, the amount of electricity generated from gas decreased slightly in Q2 2019 in year-on-year comparison, as renewable sources and electricity imports were more competitive alternatives to gas, even amid low gas prices. The share of gas in power generation was 47.2% in the UK in the second quarter of 2019, slightly higher than compared to Q2 2018 (45.1%). This can mainly be explained by increasing imports replacing domestic electricity generation, which mainly impacted generation sources other than gas (e.g.: coal, nuclear, renewables).

- Clean spark spreads in Germany averaged 4.6 €/MWh in the second quarter of 2019, which was the highest since Q1 2017. In June 2019 the monthly average clean spark spread rose to 8.6 €/MWh, last seen in January 2017 and signalling the returning profitability\(^6\) of gas-fired generation in Germany, after negative or close-to-zero ranges in the previous quarters. This was mainly due to competitive natural gas prices, decreasing more than the wholesale electricity price in the country\(^7\) compared to the previous quarters.

Figure 7 Clean spark spreads in the United Kingdom and Germany

![Clean spark spreads in the United Kingdom and Germany](image)

Source: S&P Platts Global

**1.2 Production**

- In the second quarter of 2019 EU gas production was approximately 26.8 bcm\(^8\), 7% (2.1 bcm) less than in the same period of 2018 (See Figure 8). During the whole Q2 2019 gas output was below the 2014-2018 range, reinforcing the decreasing trend of domestic production in the EU. In the Netherlands natural gas production decreased by 12% (1.1 bcm) and in the UK it decreased by 6% (0.6 bcm) in Q2 2019 in year-on-year comparison. Looking at the following six largest producers, gas output increased in Germany (8%, 0.1 bcm), in Denmark (7%, 0.1 bcm) and in Poland (4%, 0.05 bcm) but decreased in Ireland (-24%, 0.2 bcm), Italy (-11%, 0.2 bcm), and Romania (-2%, 0.1 bcm). The non-EU member Norway produced 29.2 bcm gas in Q2 2019, slightly increasing (by 0.4 bcm) compared to Q2 2018.

- In the first half of 2019 natural gas production in the EU amounted to 57.5 bcm, which was by 7.6% less than in the first half of 2018, implying a decline in production of 4.7 bcm. The two biggest EU gas producers were the UK (19.8 bcm) and the Netherlands (18.7 bcm).

- Following an earthquake of magnitude 3.4 in the vicinity of the Groningen gas field in the Netherlands taking place on 22 May 2019, the State Supervision of Mines authority proposed to cut the field’s gas production cap to 12 bcm for the 2019 gas year (the period from 1 October 2019 to 30 September 2020). This is 4 bcm less than the Dutch government’s original proposal. Later an announcement from the government evolved\(^9\), according to which the regular production from the Groningen field can drop to zero by mid-2022, eight years before than the earlier target of 2030. Operation would completely stop only in 2026, as during exceptionally cold winters some withdrawals might be needed from this field.

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\(^6\) Assuming an average gas power plant efficiency, see more in the Glossary
\(^7\) Charts of clean spark spreads in Germany and the UK can also 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
\(^8\) Given that in some countries data for some periods are based on estimation, this number might retrospectively change
**1.3 Imports**

- In parallel with increasing EU gas consumption, Eurostat data show that net imports\(^\text{10}\) in the second quarter of 2019 increased by 21% compared to the same period of 2018. This measurable increase is the highest quarterly growth since Q1 2016. In most of the EU countries net imports increased in Q2 2019 compared to the same period of the previous year (in the biggest EU gas consumer Germany it rose by 14%), showing only decrease in Denmark, however, by a marginal extent in volume (0.1 bcm).

- In the second quarter of 2019 the total net EU gas imports reached 108 bcm, up from only 90 bcm in the same period of 2018. The five biggest importers in the EU in Q2 2019 were Germany, Italy, France, Spain and the United Kingdom, respectively with net imports of 24 bcm, 20 bcm, 13 bcm, 9 bcm and 8 bcm, representing together around two thirds of the total EU net gas imports in this quarter. In the first half of 2019 the total net EU gas imports in the EU amounted to 210 bcm, which was 19% more than in the first half of 2018, amid increasing consumption (+4.5%) and decreasing domestic production (-7.6%), pointing to further increase of gas import dependency in the EU.

- According to ENTSO-G data, imports amounted to 1 259 TWh in the second quarter of 2019, which was 21% more than in Q2 2018. While imports from Russia and Libya increased in Q2 2019 in year-on-year comparison, imports from Norway decreased slightly and that from Algeria fell measurably. At the same time, LNG imports showed a huge increase, more than doubling since Q2 2018 and reaching 310 TWh in Q2 2019.

- Russia remained the top pipeline gas supplier of the EU, covering almost 45% of total extra-EU gas imports in the second quarter of 2019, which was 1 percentage point less than in the same period of 2018. However, in Q2 2019 gas imports from Russia increased by 18% in year-on-year comparison\(^\text{11}\).

- Imports from Norway, the EU’s second largest gas supplier, decreased by 2% year-on-year in the second quarter of 2019, and the country’s share in extra-EU gas imports also fell to as low as 25% (from 31% in Q2 2018\(^\text{12}\)), which was the lowest in the last five and half years. In April and May 2019, for the first time since the beginning of available time series (2014), LNG imports in the EU

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\(^{10}\) Net imports equal imports minus exports and do not account for stock changes.

\(^{11}\) It is worth to note that Russia increased its importance in the EU LNG imports as well over the last year, numbers presented in this section, with the exception of LNG, refer to pipeline imports.

\(^{12}\) Note that Norway to UK flows reported by ENTSO-G includes some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.
were higher than pipeline gas imports from Norway, implying that LNG temporarily replaced Norway as the second biggest extra-EU gas supplier. Although in the second quarter of 2019 Norwegian gas production amounted to 29.2 bcm, slightly up (1.4%) year-on-year, competitively priced LNG managed to reduce the share of Norway in Q2 2019. On the top of price competition, gas imports from Norway were also influenced by the onset of infrastructure maintenance season (for example, outage on the Troll field started on 9 June and lasted until the end of the month).

- Pipeline gas imports from Algeria continued to fall in Q2 2019 (down by 39% in year-on-year comparison), reaching the lowest amount since Q4 2014, and the share of Algeria was barely 4% in the total extra-EU gas imports, being the lowest share in the last five years. In contrast, imports from Libya reached the highest since Q3 2015, up by 143% in Q2 2019 compared to the same quarter of 2018, due to the low base in Q2 2018, owing to supply disruptions in the country’s gas production in that period. However, the share of Libya was only 1.3% in the total EU gas imports. Imports from both Algeria and Libya showed a great volatility over the last few years, reflecting the issue of import price competitiveness and supply availabilities in these two countries.

- According to several data sources, including ENTSO-G and Thomson-Reuters data, imports of LNG increased significantly in the second quarter of 2019 in year-on-year comparison, and covered almost 25% of total extra-EU gas imports, which was similarly to previous quarter, the highest quarterly share in the last five years. Comparing to Q2 2018, when the share of LNG was 14% in the total extra-EU gas imports, LNG grew mainly to the expense of the share of Norwegian and, to lesser extent, to the Algerian pipeline gas imports.

- Import volumes of natural gas increased from 1 041 TWh to 1 259 TWh in the second quarter of 2019 compared to the same period of 2018, while at the same time the estimated average import price decreased significantly, by 31%, from 21.4 €/MWh to 14.7 €/MWh. As a result, the EU’s estimated gas import bill decreased measurably, by 17% year-on-year, reaching around 18.5 billion euros in the second quarter of 2019.

**Figure 9 EU imports of natural gas by source, 2016-2019**

Source: Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2019.
Russian deliveries to Estonia and Latvia were reported only for a limited period (Narva from 15 June 2015 to 10 December 2015, Värska and Misso Izborsk from 26 May 2015). Therefore currently exports to the Baltic states and Finland are not included in the chart.
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 includes some gas from UK offshore fields, resulting in an overestimation of Norwegian imports.

- Figure 10 shows the breakdown of EU gas imports from Russia to the three main pipeline supply routes: Ukraine (which includes the Brotherhood Pipeline and the Balkan route), Belarus (mainly the Yamal pipeline) and Nord Stream.

- In the second quarter of 2019, the volume of Russian imports went up by 18%, if compared with the same period of 2018. Gas flows transiting Ukraine were almost 14% higher than in Q2 2018, while flows through Belarus decreased by 6% over the same period of 2018.

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period. Gas flows through the Nord Stream showed a huge increase (40%) in Q2 2019 in year-on-year comparison. In May 2019 both flows through Ukraine and the Nord Stream reached the highest monthly over the last five years.

- As a result, the share of the transit through Ukraine, being the main supply route of Russian gas to the EU, reached 42% within the total Russian pipeline gas imports to Europe, similarly to Q2 2018, when it was 43%. The share of pipeline gas transit through the Nord Stream was 40% in Q1 2019 (after 33% in Q2 2018 and the highest since the beginning of 2014), and the Belarus transit route represented 18%, falling from 23% measured in Q2 2018. This implies that increasing pipeline gas imports from Russia was mainly satisfied by transit through Ukraine and the Nord Stream, whereas the utilisation of the Yamal pipeline remained the same or slightly decreased.

- Recalling that in Q2 2019 that Russian pipeline gas imports represented around 45% in the total net extra-EU gas imports and at the same time the total net gas imports in the EU amounted to 109 bcm, it can be estimated that the Ukraine transit route represented 19% (20 bcm), the Nord Stream had a share of 18% (19 bcm), and the Belarus transit route ensured 8% (9 bcm) of the total net extra-EU gas imports in Q2 2019.

- In the second quarter of 2019 imports of natural gas from the EU to Ukraine ramped up measurably, and the country imported more than 4 bcm natural gas from Poland, Slovakia and Hungary, which was the highest since the beginning of 2014 and practically doubled compared to Q2 2018\textsuperscript{14}. The decreasing trend characterising the Ukrainian gas imports from Europe since mid-2016 showed a strong reversal in Q2 2019. The main reason behind this was the increasing activity of gas storage operators in the western part of Ukraine to build up stocks, regarding the security of supply risks ahead of the expiry of the gas transit agreement with Russia at the end of 2019. During Q2 2019, the share of Slovakia in Ukrainian imports from the EU decreased to 59%, the share of Hungary rose to 31%, and that of Poland to 10%; the shares of the three countries in Q2 2018 respectively were 67%, 28% and 5%. Increase in Hungarian exports to Ukraine was helped by favourable export tariffs, compared to the costs of exports from Slovakia and Poland. This also helped in increasing liquidity on the MGP gas virtual trading point in Hungary.

- Meanwhile, Gazprom increased its gas sales on its Electronic Sales Platform (ESP), and in June 2019 it sold 1.3 bcm (the majority of this to the German Gaspool area). In this month Gazprom sold 8% of its total export sales in Europe through the ESP, implying that even for Gazprom, traditionally strong in the pipeline business with long term contracts, market based selling is becoming more and more important, especially during the periods of abundant gas supply, as buyers have greater bargaining power, demanding more seller flexibility on prices and deliveries.

**Figure 10 EU imports of natural gas from Russia by supply route, 2016-2019**

![Graph of EU imports of natural gas from Russia by supply route, 2016-2019](image)

Source: Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2019.

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

\textsuperscript{14} Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2019.
On 15 April 2019 an agreement was signed for the €214.9 million Connecting Europe Facility (CEF) grant, for works for the Baltic Pipe project, connecting Poland and Denmark with Norway, in the presence of high level officials from the European Commission and Poland. The Baltic Pipe Project is a gas infrastructure project aiming at creating a new gas supply corridor in the European market. The new pipeline will allow, as of 2022, the shipment of gas from the North Sea to the Polish market and further to the Baltic States, as well as to end-users in neighbouring countries. At the same time, it will enable the supply of gas from Poland, including LNG imports, to the Danish and Swedish markets. This new pipeline is a European Project of Common Interest (PCI).

On 15 April 2019 the Council of the European Union adopted the proposal for amendment of the Gas Directive (2009/73/EC) on the extension of EU rules to pipelines to from third countries. The overall objective of the amendment to the gas directive is to ensure that the rules governing the EU’s internal gas market apply to gas transmission lines between a member state and a third country, up to the border of the member state’s territory and territorial sea. The new directive was published in the Official Journal of the European Union on 3 May. Member states will have 9 months from entry into force to transpose the new rules into national law (implying a transposition deadline of February 2020). This might have implications on some ongoing gas pipeline projects.

On 28 June 2019 the developer of the Nord Stream 2 pipeline, linking Russia with Germany, has withdrawn a permit application for the route following the existing pipeline. The two other pending applications, unlike the original route, cross only the Danish Exclusive Economic Zone, and thus do not require the consent of the foreign ministry of the country. This means that the two route applications can be assessed purely on environmental basis, therefore the developer believes that this will speed up the permitting process. Until September 2019 Denmark did not give all permissions to finalise the project, whereas in three quarters of the total length pipelines are already laid.

On 31 July 2019 the European Commission has found Croatian plans to support the construction and operation of a (LNG) terminal at Krk-island to be in line with EU State aid rules. The project will contribute to the security and diversification of energy supplies without unduly distorting competition. The measures approved will support the construction and operation of a floating LNG terminal, consisting of a floating storage and regasification unit (FSRU) and the connections to the national gas transmission network. The LNG terminal is designed to transport up to 2.6 billion cubic meters per year of natural gas into the Croatia national transmission network as from 2021. The total investment costs to build the terminal amount to €233.6 million, of which a contribution of €101.4 million is ensured by the Connecting Europe Facility (CEF).

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**Figure 11 – Ukrainian pipeline gas imports from Poland, Slovakia and Hungary**

![Graph showing Ukrainian pipeline gas imports from Poland, Slovakia and Hungary](image)

Source: Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2019

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- EU LNG imports registered a huge increase in Q2 2019, reaching 29 bcm, up by 102% compared to the second quarter of 2018. The total EU LNG imports amounted to an estimated €4.3 billion in Q2 2019. With the exception of Sweden, importing LNG in small quantities, where decrease could be observed, all LNG importing countries in the EU showed measurable (double or triple digit) increases in per cent compared to Q2 2018. In the Netherlands and Greece there was a more than threefold increase in the volume of imported LNG in Q2 2019 in year-on-year comparison, while in the UK imports rose by a factor of 3 as well. In Belgium and France LNG imports respectively rose by 135% and 107%. In Q2 2019 France remained the largest LNG importer, with a quarterly volume of 7 bcm, followed by Spain (5.6 bcm) and the United Kingdom (4.9 bcm).

- In the second quarter of 2019, LNG market prices in Europe remained closely aligned with their East Asian peers (see Figure 20 and Figure 21), implying that Europe offered a competitive destination for LNG cargos, especially if shipment costs are also taken into account (in the case of cargos from the Atlantic Basin and the Middle East).

**Figure 12 LNG imports to the EU by Member State**

- In the second quarter of 2019, Qatar remained the largest LNG supplier of the EU, raising its market share above 30%, which was the highest since Q3 2018. Russia came to the second place within the total EU LNG imports, reaching 19% in Q2 2019, which is a slight decrease compared to the last quarter (23%), but up from 8% in Q2 2018. The third most important LNG source was the United States, ensuring 13% of the total EU LNG imports. The share of Nigeria shrunk further to 12% (from 14% in the previous quarter), closely followed by Algeria and Nigeria, both slightly above 10%. Trinidad and Tobago and Norway both had a share in the EU LNG imports around 6% in Q2 2019.

- In the second quarter of 2019, Qatar was the biggest import source for Spain and Poland (above 70% of the total imports), its share was more than 50% in Belgium, and it ensured 40% of the LNG imports in Italy. Russia was an important supplier to Sweden (65%, albeit with marginal quantities), the Netherlands (50%), Belgium (43%), France (36%). The US ensured 26% of the LNG imports in the Netherlands, while in Greece and the UK its share was close to 20%. Nigeria was the biggest LNG supplier in Portugal (68%). Norway remained a dominant LNG supplier of Lithuania (89%). Albeit exporting only a small quantity (150 million cubic metre), Trinidad and Tobago was the sole LNG supplier of Malta in Q2 2019. France, the UK and Italy had a diversified LNG import source structure in Q2 2019, having eight different sources in each country, on the other hand, Finland and Malta had to rely on a single LNG supply source.
In the second quarter of 2019, 39 LNG cargoes arrived from the US, unloading more than 3.6 bcm of LNG (in re-gasified form), amounting to an estimated €0.5 billion. Both the number of cargos and LNG import volumes were up by several magnitudes compared to Q2 2018 (in that quarter only 2 cargos arrived, carrying only 0.2 bcm LNG). LNG exports to the EU represented 33% of total US LNG exports in Q2 2019. In the second quarter of 2019 the five most important EU destinations of the US LNG exports were Spain and France (both slightly above 1 bcm), the Netherlands (0.8 bcm), Italy (0.4 bcm) and Poland (0.2 bcm). Other countries, such as the UK, Greece and Portugal also imported LNG from the US, showing the diversification of US LNG exports to Europe.
On 2 May 2019, following European Commission President Juncker and US President Trump agreement on strengthening the strategic cooperation with respect to energy in July 2018, top energy business executives from both sides of the Atlantic met in Brussels at the 1st EU-U.S. Energy Council B2B Energy Forum. Following this, on 14 May European Commission Vice-President Maroš Šefčovič and US President Donald Trump took a first look at the Cameron LNG export terminal in Hackberry in the U.S. State of Louisiana, which is expected to launch first shipment in the second half of 2019. Both parties emphasized that “Transatlantic cooperation on LNG is a perfect match. Europe has an attractive, well-integrated gas market that is ready to welcome more competitively priced LNG from the US. By doing so, it will significantly boost Europe’s energy security as well as open new business opportunities on both sides.”

On 12 June 2019 the Polish Oil and Gas Company (PGNiG) has signed an agreement with Venture Global LNG to purchase an additional 1.5 million tonnes per annum (MTPA) of liquefied natural gas (LNG) from the United States. Under this agreement, the volume of LNG from the Plaquemines terminal will increase from 1.0 to 2.5 million tonnes per year (from 1.4 to 3.4 bcm of natural gas after regasification). Deliveries will commence on the commercial operation date, currently expected in 2023. This new amendment raises PGNiG’s total commitment with Venture Global LNG projects to 3.5 MTPA (4.7 bcm), and the total volume of PGNiG’s commitment with US LNG exporters amounts to more than 9 bcm per year.

Figure 15 EU LNG imports from the US

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

1.4 Storage

Figure 16 shows EU stock levels as the percentage of storage capacity in gas years 2018 and 2019, compared to the 5-year range of gas years 2014-2018. According to figures published by Gas Infrastructure Europe, operational EU storage capacity amounted to 1,131 TWh (roughly 100 bcm) by the end of 2018, plus 177 TWh capacity planned or already under construction (adding potentially another 16 bcm).

On average, net storage re-fillings made during the second quarter of 2019 were equivalent to 32.6% of storage capacity, which was slightly more than that of 31.9% in the same period of 2018: the average filling rate increased from 40.4% on 31 March 2019 to 73% on 30 June 2019. As result, at the end of June 2019 the average filling rate in the EU was 23% higher than a year before, implying less intensive storage refilling needs in the course of summer 2019. At the end of the winter the average filling rate in 2019 was already higher than a year before, and the intensity of storage filling during Q2 2019 was also greater than in the second quarter of 2018.

19 See more in Quarterly Report on European Gas Markets, Vol 12, Issue 1
- The weather was milder during April 2019 but in May 2019 it was colder than usual across the European countries, however, this did not play a significant role in the evolution of storage fillings, as the main driver was the well-supplied gas markets across Europe.

- Significantly increasing LNG imports in Europe, amounting to twice as much in Q2 2019 as a year before, and high send-outs to the gas grid in many countries resulted in competitive gas prices across the EU and provided for opportunities for gas storage operators to inject as much gas in the storages as possible, at favourable costs.

- On the other hand, it has been well known that the Russia gas transit agreement with Ukraine, representing a principal supply route to the EU, will expire at the end of 2019, resulting in a risk averse behaviour for storage operators giving strong incentives to fill the storages. As it was mentioned, on 30 June 2019 the average EU gas storage filling rate stood at 73%, which was the highest in the last eight years in this period of the year.

**Figure 16 Gas storage levels as percentage of maximum gas storage capacity in the EU in the middle of the month**

![Gas storage levels graph](https://agsi.gie.eu/#!faq)

*Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 31 August 2019. See explanations on data coverage at [https://agsi.gie.eu/#!faq](https://agsi.gie.eu/#!faq). The 5-year range reflects stock levels in gas years 2014-2018. The graph shows stock levels on the 15th day of the given month.*

- However, as Figure 17 shows, there was a significant variation among Member States in terms of both the starting position (the filling rate at the end of March 2019) and the pace of fillings. Although the change in the filling rate over Q2 2019 was 32.6% on EU average, in Slovakia gas amounting to more than half of the total storage capacity was injected within the quarter, in France, Croatia and Belgium the filling rate in Q2 2019 was around 40%. At the end of Q2 2019 Denmark and Slovakia had the highest storage filling rates (88% and 84%, respectively), while in Latvia and the UK the filling rate was in the range of 30-40%.

- The only exception in Europe, where the filling rate decreased over Q2 2019, was the UK, probably owing to better profitability to sell gas on the continent than to fill up the remaining storages during the summer period. However, uncertainties around Brexit may prompt storage operators to increase fillings in the forthcoming months.

- Portugal the filling rate increased only a little over Q2 2019, probably owing to already very high filling rate at the end of Q1 2019. In this quarter Sweden has reported changes in the storage level for the first time since several quarters, though the total storage capacity is marginal in the country, implying that filling rates do not tell too much on gas security of supply.
18

Figure 17 Gas storage levels as percentage of maximum gas storage capacity by Member State

Source: Gas Storage Europe AGSI+ Aggregated Gas Storage Inventory, extracted on 31 August 2019; calculations of DG Energy. See explanations on data coverage at https://agsi.gie.eu/#/faq. Injection level data in Sweden changed significantly for the first time since the first data reporting period in March 2017. Nevertheless, the Swedish storage facility has a limited capacity (10 mcm), mainly used for LNG storage.

- On the NBP, seasonal spreads (the difference between summer and winter 2020 contracts) stabilised in relatively high ranges over the second quarter of 2019 (3-4 €/MWh, similar to Q1 2019, giving 3.6 €/MWh on average for both quarters). At the same time the average 2020 seasonal spread on the TTF continued its increase and by June 2019 it rose to 2.1 €/MWh, whereas in March 2019 it was still below 2 €/MWh.

- Increasing 2020 summer-winter spreads over Q2 2019 could be observed in many other European gas markets, as spot prices showed a huge decrease, owing to abundant LNG send-outs to the grid. However, contracts on the curve were less influenced by current market conditions, widening the spread with spot prices. Well supplied markets in Q2 2019 pushed down spot contracts, however, uncertainties prevail over the future evolution of the LNG price premium in Asia to Europe, resulting in potential shipment redirecting incentives, away from Europe, and supply concerns during wintertime on Russian pipeline sources though Ukraine. These factors all contributed to the widening spread of winter contracts compared to the spot prices.

- As in the UK there is a structural gas oversupply during the summer and tighter market during the winter, owing to less storage capacities in comparison to continental Europe, the UK seasonal (winter-summer) spreads developed a perceivable premium to the continent over the last few years, which was reinforced by the decommissioning of some storage facilities (e.g.: Rough) in the country.
Figure 18 Winter-summer spreads in the Dutch and British gas hubs
Euro/MWh

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, W-S 2020 refers to the difference between the winter 2020-21 price and the summer 2020 price.
2. Wholesale gas markets

2.1 EU energy commodity markets

- The price of Brent crude oil, after the recovery in the first quarter of 2019, showed a great degree of volatility over Q2 2019. At the end of March 2019 the crude oil price reached 68 USD/bbl (61 €/bbl), and at the end of June it stood at 66 USD/bbl (58 €/bbl), ending the quarter at similar price as it began, however, in the second half of May the crude price rose to 75 USD/bbl (67 €/bbl). The main factors resulting in price swings across Q2 2019 were mainly related to geopolitics, namely at the Middle East (In May and June 2019 several incidents - attacking oil tanker vessels, shooting down a US military drone, etc. - occurred close to the Hormuz strait at the Arab peninsula), which resulted in increasing market tensions and concerns on security of supply. On the other hand, tense trade relations, principally between the US and China, have casted a shadow over global economic perspectives, implying lower economic growth and less demand for crude oil.

- By June 2019 the Dutch TTF spot gas price, continuing the downward trend started in the fourth quarter of 2018, fell to 10.6 €/MWh, which was the lowest since November 2009, (and in the final days of June 2019 the daily average spot fell even into the single-digit ranges). This was primarily owing to the abundant gas supply on the market, as LNG imports in the EU doubled in Q2 2019 in year-on-year comparison. Higher than usual storage filling rates did not result in extra demand for gas, unlike in Q2 2018. On the demand side however, owing to low gas prices and high carbon emission prices, gas use increased in electricity generation, squeezing out coal from the power generation mix in many European countries. Nevertheless, the price fall was driven by huge increase in LNG with competitive prices, which growth in gas supply could not be counter-balanced by any demand side factor.

- Although crude oil prices in Q2 2019 did not show big difference at the beginning and the end of the period, the price decrease at the end of 2018, with the usual time lag of 6-9 month, started to filter in the oil-indexed gas contracts. However, bearing in mind the recovery of crude oil prices in the first half of 2019, it is likely that oil-indexed contracts will go up again in the forthcoming period. In Q2 2019 Platt’s North West Europe Gas Contract Indicator (GCI), a theoretical index showing what a gas price, linked 100% to oil would be, averaged 26.7 €/MWh, being twice as high as the TTF (13 €/MWh), reflecting that amid such low spot gas prices oil-indexed contracts completely lost their competitiveness vis-à-vis market based pricing.

- Spot coal prices fell below 43 €/Mt in June 2019 from 61 €/Mt in March 2019, and since October 2018 they practically halved (that time the monthly average price was 86 €/Mt). Demand for coal in electricity generation in Europe fell substantially, as low gas prices made gas fired generation more competitive. This low demand in electricity generation, coupled with high reserves in Europe and weaker Asian coal markets, owing to amongst others lower demand for power generation in China, as the country switched to other generation forms (mainly more hydro and renewables), resulted in an oversupply on global coal market and decreasing prices. Carbon prices remained stable in Q2 2019, averaging 25.5 €/MtCO2e.

Figure 19 Spot prices of oil, coal and gas in the EU

Source: S&P Global Platts
2.2 LNG and international gas markets

- Figure 20 displays the international comparison of wholesale gas prices. Over the last couple of years seasonality in the premium of Asian market prices to Europe could be observed, widening during the winter period when demand substantially rises both for heating and power needs increases in Asia. However, in the first half of 2019 the premium of Japanese and Chinese landed LNG prices to the European peers remained marginal, and LNG landed prices in Asia fell. Bearing also in mind lower transportation costs to Europe than to Asia, this meant a great opportunity to LNG exporters in the Atlantic Basin and the Middle East to direct their cargos towards the European markets in Q2 2019, continuing the trend of the preceding two quarters.

- The average Japanese LNG price was 4.9 USD/mmbtu in Q2 2019, down from 6.9 USD/mmbtu in Q1 2019 and by 44% compared to same quarter of 2018, when it stood at 8.7 USD/mmbtu. The Japanese premium above the Dutch TTF hub was on average 0.6 USD/mmbtu in the second quarter of 2019, down from 0.8 USD/mmbtu in Q1 2019, and from 1.3 USD/mmbtu in Q2 2018. On quarterly average, LNG import prices in China were comparable with their Japanese peers (4.9 USD/mmbtu) in Q2 2019. These numbers show a measurable price convergence between European and Asian LNG prices over the last year.

- The average price of Chinese pipeline gas imports in Q2 2019 was 7.5 USD/mmbtu, which was above the Asian LNG reference prices by 2.5-3 USD/mmbtu, and showed a slightly increase compared to Q1 2019, contrasting the falling LNG prices and reflecting the time-lag impact of oil price escalation, which is still dominant in pipeline gas contracts in Asia, representing around two thirds of the gas traded volume in 2018.\(^{(23)}\)

- The Henry Hub price continued its downward trend in Q2 2019 and by June 2019 it fell to three-year low\(^{(24)}\), 2.3 USD/mmbtu. In March 2019 the monthly average price was 2.9 USD/mmbtu and in June 2018 it was close to 3 USD/mmbtu. However, the euro-dollar exchange rate changed over time, (1.13 in June 2019 vs. 1.17 in June 2018), implying that changes in the gas price in euro over the last twelve months preceding June 2019 was partly cushioned by the depreciating euro.

- In the second quarter of 2019, TTF averaged at 4.3 USD/mmbtu (13 €/MWh). The average German border price was somewhat higher (5.1 USD/mmbtu or 15.3 €/MWh), reflecting the impact of still existing oil-indexed contracts in the German gas import mix.

- Over the course of the second quarter of 2019 differentials in international price contracts decreased, as traditionally lower US prices only slightly decreased and European and Asian contracts fell significantly. The ratio of the Japanese LNG price and US Henry Hub was 1.9 in the second quarter of 2019, down from 2.4 in the Q1 2019 and from 3.1 in Q2 2018.

- The average TTF/Henry Hub ratio decreased to 1.7 in the second quarter of 2019 from 2.6 in the same period of 2018. In absolute terms, the price spread between Henry Hub and TTF was 1.8 USD/mmbtu in the second quarter of 2019, which compares to an average of 4.6 USD/mmbtu in the same period of 2018. By June 2019 the price differential between Henry Hub in the US and the TTF in the Netherlands (1.2 USD/mmbtu) was the lowest since September 2016.


\(^{(24)}\) Due to infrastructure bottlenecks in some shale gas producing regions of the US, resulting in inability to transport gas to other regions to be consumed, in some periods even negative spot prices occur in regional gas markets.
In the second quarter of 2019, spot prices averaged 4.3 USD/mmbtu in the Netherlands, 4.5 USD/mmbtu in Spain and 4.9 USD/mmbtu in Japan and China, implying that the Asian price premium to the TTF shrank to 0.6 USD/mmbtu, whereas in Q2 2018 it was 1.2 USD/mmbtu.

JCC (Japanese Crude Cocktail), the Japanese benchmark of oil-indexed LNG prices, averaged around 10.2 USD/mmbtu in the second quarter of 2019, which was more than twice as high as the average spot price (4.9 USD/mmbtu), reflecting the slow responsiveness (time-lag in the oil indexation) to the spot market price decrease of this oil-indexed contract.

LNG imports in the second quarter of 2019 increased measurably in China (+17% year-on-year) and in India (5.6%). However, LNG imports decreased Japan (-7%)\(^5\). In the case of China, and probably for India as well, increasing gas demand might have been driven by the electricity sector, while in Japan the role of gas might have slightly decreased in the power sector, as nuclear generation is gradually ramping up. All in all, looking at these three countries, demand for LNG in East Asia only slightly changed in Q2 2019 in year-on-year comparison.

Global LNG supply continued to expand in the second quarter of 2019: and LNG trade amounted to 118 bcm, 18% more than in the same quarter of 2018 (100 bcm). In Europe alone the demand for LNG increased by almost 15 bcm in Q2 2019 year-on-year.
Figure 21 Spot LNG landed prices in the EU and Asia

Note: Landed prices for LNG
Source: Thomson-Reuters

- Figure 22 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 second quarter of 2019, the estimated Algerian pipeline import price in Spain remained stable (around 22.5 €/MWh) and only in June could a slight decrease be observed, implying that presumably the time lag impact of the decrease in crude oil prices at the end of 2018 only started to filter in the Algerian oil indexed contracts. However, in June 2019 the average estimated Algerian import price in Spain was twice as high as other import price peers on the chart, giving a highly probable explanation why pipeline gas imports from Algeria fell by 39% in Q2 2019 in year-on-year comparison (See Chapter 1.3 Imports).

- In contrast, the estimated Norwegian import price contract in the UK, similarly to the other hub based contracts and LNG prices, continued to decrease and by June 2019 it fell below 11 €/MWh, the lowest since September 2016. As result, in the second quarter of 2019 the different contracts on Figure 20, with the exception of the Algerian contract, remained well-aligned, and the June 2019 average monthly prices fell in the range of 10-11.7 €/MWh. With the exception of the Algerian import contract, the quarterly average prices in Q2 2019 showed a huge decrease in the range of 35-40% compared to the second quarter of 2018.

- Spot LNG prices in Spain and the UK were mainly influenced by the strong LNG inflow in Europe, as in the consequence of the marginal Asian price premium more LNG cargos were sent to Europe, increasing the natural gas supply in the market. UK LNG prices were in a small discount to the TTF (~0.6 €/MWh) in Q2 2019 on average, while the Spanish LNG contracts retained their price premium over the TTF (0.7 €/MWh).
2.3 European gas markets

2.3.1. Gas trade on the EU hubs

- As Figure 23 and Figure 24 show, liquidity on the main European gas hubs increased in the second quarter of 2019: total traded volumes amounted to around 14 717 TWh (equivalent to around 1 516 bcm, and in monetary terms representing €191 billion26), 26% more than in the same period of 2018. This was around 24 times more than the gas consumption in the seven Member States27 covered by the analysis in Q2 2019. In April 2019 the year-on-year increase in gas traded volume on the observed European trading platforms was 48%, whereas in May and June the increase was lower (respectively 10% and 22%).

- Traded volumes in the second quarter of 2019 increased year-on-year at the greatest on the Dutch TTF hub (56%), which in itself had the highest traded volume in Europe. In France on the TRF hub volumes were up by 47% compared to Q2 2018, followed by Italy (45%), Austria (41%) and Germany (22%, the combined volume of NGC and Gaspool). At the same time the NBP hub in the UK registered a decline of 20% and Zeebrugge in Belgium fell by 51% compared to Q2 2018.

- The significant increase on the TTF hub further reinforced the leading role of TTF in Europe, in Q2 2019 pooling more than 66% of the total European gas trade alone. TTF has emerged to a liquid continental benchmark, having the advantage of euro-denomination, and benefiting from its good connection to various supply sources. On the other hand, further decrease on the NBP hub signalled a shift from once Europe’s most liquid market. The quarterly traded volume in Q2 2019 was down by 20% compared to the second quarter of 2018, and the share of NBP in Q2 2019 was only 22% in the total European observed trade, down from 35% in Q2 2018.

- As 88% of the observed European gas trade concentrated on the TTF and NBP together, other markets only had lower shares: Germany (NGC and Gaspool together) had a share of 6%, while the Italian PSV only had 2.4%, and the other markets remained below 2%.

- Rapidly increasing LNG imports in Europe, resulting in high LNG send-outs and contributing to low spot prices, played an important role in increasing traded volumes on the European gas hubs. Low prices were beneficial to storage operators at the beginning of the filling season. As curve contracts had a measurable premium to spot contracts, market actors were given incentives to conclude contracts on the spot market, either for hedging (e.g.: storage-backed hedging) or for speculative trade strategies.

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26 Assuming that all trade was carried out on the quarterly average spot price

27 Netherlands, UK, Germany, France, Italy, Belgium, Austria The ratio of the quarterly traded volume and gas consumption can show a big volatility across different quarters, as gas consumption has a high seasonality, whereas gas trade depends on market factors, which are albeit linked to consumption but have less seasonality.
- High LNG send-outs and refilling needs resulted in the increase in the traded volume on less liquid European hubs as well. However, the fall in traded volume on the Belgian Zeebrugge hub continued in Q2 2019, following the expiry of the long term transit contract on the UK-Belgium interconnector last autumn. Gas trade between the UK and the continent is increasingly carried out on the BBL link between the UK and the Netherlands, and start-up of reverse flows might accelerate this trend, implying even lower liquidity for the Zeebrugge hub in the future.

- On the UK NBP hub, 57% of the total traded volumes were executed directly on the exchange in the second quarter of 2019, which was the highest share in Europe. This share was lower, 32% on the Dutch TTF hub, 19% on French hub and 16% for the two German hubs, and 14% for the Austrian hub. In Belgium and Italy however, the share of exchange trade contracts remained marginal (respectively only 3% and 1.1%). On the TTF, NBP and the two German hubs the share of exchange trade went up, in comparison to Q2 2018, respectively by 12, 9 and 4 percentage points in the second quarter of 2019, while it decreased by 9 percentage points the TRF hub in France and by 6 percentage points on the VTP hub in Austria.

**Figure 23 Traded volumes on the main European gas hubs in the second quarter of 2018 and 2019**

![Traded volumes on the main European gas hubs in the second quarter of 2018 and 2019](chart)

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

Source: Trayport Euro Commodities Market Dynamics Report

**Figure 24 Monthly traded volumes on the main European gas hubs**

![Monthly traded volumes on the main European gas hubs](chart)

‘Other’ includes the following trading hubs: Germany: NCG (NetConnect Germany) and Gaspool; France: TRF (Trading Region France); Italy: PSV (Punto di Scambio Virtuale); Belgium: Zeebrugge beach. 1 bcm is equivalent to 9.71 TWh.

Source: Trayport Euro Commodities Market Dynamics Report
On the European hubs as whole, 59% of the total trade was OTC bilateral, 6% was OTC cleared and 35% was exchange executed, which latter was the highest share since Q3 2017. The share of exchange executed contracts went up by 6% year-on-year in Q2 2019, whereas the share of OTC bilateral and OTC cleared went down by respectively 4 and 2 percentage points.

Exchange executed volumes in Q2 2019 increased by 53% in year-on-year comparison on the observed European markets, which was the highest increase in the last three years. The total OTC traded volume (bilateral and cleared together) rose by 15 in the same period. In this quarter liquidity was driven by exchange executed contracts, whereas OTC volumes showed a slower increase.

Figure 25 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 12-17 €/MWh in the second quarter of 2019, which was lower than the range in Q1 2019 (18-21 €/MWh), as well as the range in Q2 2018 (20-24 €/MWh). In fact, in the second quarter of 2019 hub prices in Europe were down by 27-42% in year-on-year comparison, falling to several year lows, some hub prices reached the lowest in since the end of 2009. The average TTF hub price fell by 39% in Q2 2019, compared to the second quarter of 2018.

Wholesale gas prices in the second quarter of 2019 were generally driven by the abundant LNG inflows to the European markets, which have, worth to recall, doubled in Q2 2019 in year-on-year comparison. As LNG price peers across the globe remained well aligned and major LNG producers increased their export volumes, Europe could benefit from cheap import gas sources that drove down wholesale hub prices. Oil prices could not really influence hub prices in the period, and even increasing gas demand in power generation was unable to give support to falling gas prices.
After the price discount in April and May 2019, UK spot prices in June showed only a minor premium to the Dutch TTF hub (0.2 €/MWh), similarly to the German benchmarks, having an average premium (0.1–0.4 €/MWh) in Q2 2019 on average. The UK discount in April 2019 was primarily due to the closure of the British-Belgian interconnector between 21 April and 1 May, increasing the local supply in the UK, as exports to the continent were restricted.

The price premium of the Italian hub rose to as high as 3.9 €/MWh in June 2019, the highest since December 2017, and in Q2 2019 it reached 3.8 €/MWh on average, after 2.5 €/MWh in Q1 2019. This widening premium might have been the result of several factors. First, Italian storage operators have an obligation to inject a certain amount of gas in each month during the summer. Second, there were some interconnector outages at the northern border of Italy, (e.g.: at Tarvisio on 18-19 June), reducing the access of the country to cheap imports from North-West Europe. Similarly to many EU countries, Italy had abundant LNG send-outs during Q2 2019, however, more expensive sources, such as imports from Russia and Algeria also had their impact on the wholesale price formation in the country.

The Austrian gas hub also showed an increasing premium to TTF: while in March 2019 it was only (1.3 €/MWh), in May–June it rose to 2.7 €/MWh. This was also related to the abundant LNG supply in North-West Europe as Austria does not have a direct access to LNG and it imports significant amount of gas from Russia, where oil-indexation still plays a role. Higher price premium in Central Europe to Western Europe might give incentives to west-east gas flows, if there are no congestion bottlenecks. Throughout Q2 2019 the Belgian hub showed a minor price discount (0.4 €/MWh on average) to the TTF. The French TRS hub prices remained well-aligned to the TTF over the whole Q2 2019.
Figure 27 Premium of wholesale day-ahead gas prices at selected hubs compared to TTF

![Graph showing premium of wholesale day-ahead gas prices at selected hubs compared to TTF.](image)

Source: S&P Global Platts

- Figure 28 looks at the development of forward prices of one, two and three years ahead contracts in comparison to the development of the day-ahead price on the Dutch TTF.

- In the second quarter of 2019 daily spot prices on the TTF hub showed a significant decrease: whereas in the first half of April 2019 they were in the range of 14-16 €/MWh, by the end of June they fell below 10 €/MWh. However, forward contracts did not show such a big decrease, from the beginning of April until the end of June they slid from the range of 18-20 €/MWh to just below 17 €/MWh. In consequence, forward price premium to the spot rose from 2-4 €/MWh to more than 7 €/MWh throughout Q2 2019.

- This significant difference signals that the market anticipates a recovery in spot gas prices. The current abundant LNG influx to Europe might take a reverse in the forthcoming months, as current low LNG prices reduce the profit of LNG exporters. On the other hand during wintertime price premium of the Asian LNG markets might return, and in Europe security of supply issues related to gas transit of Russian origin might also add to the upward pressure on gas prices.

- It is worth to note that price differentials between forward contracts (one, two and three years ahead) practically disappeared by the end of the quarter, it seems that the market focusses on the difference between spot and forward contracts.
Figure 28 Forward gas prices on the Dutch gas hub

![Forward gas prices on the Dutch gas hub](image)

Source: S&P Global Platts

2.3.3. Prices of different contracts for gas in the EU

- Figure 29 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.

- Prices of European gas contracts showed a huge divergence in the first half of 2019, as the difference between the cheapest and most expensive contract has long not been so big as in June 2019 (more than 14 €/MWh). However, this difference stems from a single outlier, namely the estimated Algerian gas import price to Italy, without this the price differential would only be around 4 €/MWh, implying that price convergence across Europe still prevails.

- Hub based contracts, such as the Norwegian import, or hub prices themselves, showed measurable falls in the second quarter of 2019. Reported German border prices also fell, similarly to most of the hub-based and oil-indexed contracts, however they decreased a bit less, probably owing the existence of oil indexation in some import sources to Germany.

- In the second quarter of 2019 the estimated oil-indexed prices of Algerian import contract in Italy showed only a minor decrease partially reflecting the impact of the oil price decrease at the end of 2018 (with the usual 6-9 month time lag). In contrast, Russian gas imports prices in Latvia and the Czechia followed practically the same path as the other falling gas hub prices in Europe, implying an increasing role of hub-based price formation in these contracts to the detriment of the formally exclusive pure oil-indexation.
Figure 29 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.

- Figure 30 and Figure 31 provide a look at the evolution of gas price formation mechanisms over time and/or across regions. In Europe the share of gas-on-gas competition (hub-based pricing) increased from 15% to 76% between 2005 and 2018. However, there are big regional differences behind the European average.

- In North-Western Europe28 (Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, UK) gas-on-gas competition is now almost exclusive, its share was 96% in the total gas contracts (measured by consumption) in 2018, up from 28% in 2005. In other parts of Europe gas-on-gas competition practically did not exist in 2005, whereas in 2018 its share was 76% in Central Europe (Austria, Czechia, Hungary, Poland, Slovakia, Switzerland), 60% in Southeast Europe (Bosnia, Bulgaria, Croatia, North Macedonia, Romania, Serbia, Slovenia) and in Scandinavia and the Baltics as well (Estonia, Finland, Latvia, Lithuania, Norway, Sweden). In the Mediterranean region (Greece, Italy, Portugal, Spain, Turkey) gas-on-gas competition had the lowest share, around 44% in 2018.

- In parallel with the increasing share of gas-on-gas competition, the share of oil-price escalation (oil-indexed contracts) decreased, as well as other forms of price formation, such as bilateral monopolies or regulated contracts (such as regulation of cost of service, political and social regulation, etc.) between 2005 and 2018.

- Gas-on-gas competition had a share of 47% in the world on average in 2018, and oil price escalation represented 19%, whereas bilateral monopolies and diverse forms of price regulation had the remaining share (34%). With its share of gas-to-gas competition of 76%, Europe is the second region in the world behind North America regarding the penetration of hub-based pricing. In other regions, such as Asia, oil price escalation is still predominant, with its share of 64-67% in 2018. High share of oil-price indexation impacts the gas price differential between Europe and Asia, which can be a crucial factor in LNG supply in Europe.

- In Russia and other countries of the former Soviet-Union, Africa, Latin-America and the Middle East price regulation was still the most important contract form in 2018.

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Figure 30 The share of gas-on-gas competition and oil price indexation (escalation) in gas contracts in different regions of Europe

![Bar chart showing the share of gas-on-gas competition and oil price indexation (escalation) in gas contracts in different regions of Europe.](image)


Figure 31 – The share of gas-on-gas competition and oil-price escalation in different regions in 2018

![Bar chart showing the share of gas-on-gas competition and oil-price escalation in different regions in 2018.](image)

Map 1. Comparison of EU wholesale gas prices in the second quarter of 2019

The colour code for each Member State is defined according to a simple average of all available types of prices (HUB, LTC, LNG) in the respective Member State.

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 gas markets in the EU and outside Europe

- Figure 32 and Figure 34 show the degree of convergence (or divergence) of retail gas prices for household and industrial consumers, using as 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 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 overall increasing trend from 2016 to early 2019. However, in the second quarter of 2019 retail gas prices for household customers in the EU slightly decreased compared to the previous quarter. In the most typical consumption band, D2, the estimated average price (including all taxes) in the second quarter of 2019 was 6.86 Eurocents/kWh, as opposed to 6.95 Eurocents/kWh in Q1 2019 (See the estimated household prices on Map 2).

- Retail prices for households showed an overall increasingly diverging trend from 2016 to 2019, which seems to be come to a halt in the first half of 2019, as shown by the increase of the relative standard deviation in Figure 32. Moreover, for lower consumption bands alternating periods of price convergence and price divergence are also visible. Observed price differences are normally higher for the consumers with lower annual consumption, primarily owing to the higher share of fixed elements (not related to the actual consumption) in the final consumer bills.

- There were still significant differences in retail gas prices across the EU: in the second quarter of 2019, the lowest estimated household prices in consumption band D2 could be observed in Hungary (3.50 Eurocent/kWh) and Croatia (3.78 Eurocent/kWh), whereas the highest prices could be measured in Sweden (12.35 Eurocent/kWh) and in the Netherlands (9.56 Eurocent/kWh). The price differential ratio between the cheapest and the most expensive Member State was 3.5. The ratio showed a gradual decrease over time: while in the second quarter of 2012 it was still 4.8, since the third quarter of 2014 it stabilised around 3.6.

Figure 32 Relative standard deviation of gas prices paid by household customers in EU Member States

Note: all taxes included.
Source: European Commission estimates based on Eurostat data on consumer prices adjusted by the HICP

- Figure 33 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in June 2019. On average, 46% of the price covered the energy component, while the rest covered distribution/storage costs (28%), energy taxes (10%) and VAT (16%).

29 Note that these are arithmetic averages. No data are available for Helsinki (Finland), Nicosia (Cyprus), and Valetta (Malta).
There were significant differences across Member States, with the share of energy cost ranging from 24% (Copenhagen) to 67% (London), the share of distribution/storage costs ranging from 8% (Tallinn) to 45% (Sofia) and the share of taxes ranging from 2% (Riga) to 37% (Amsterdam). For 7 of the 25 capitals covered, the price does not include an energy tax component. There were considerable differences across Member States in the relative share of network costs and taxes. Figure 33 also shows that even the energy component is very variable in absolute terms: it was more than five times higher in Stockholm than in Budapest in June 2019. However the ratio of highest and lowest network components across the EU was 13 and highest-lowest tax component ratio (taking energy taxes and VAT together) was 18 in June 2019.

In 20 out of the 25 capitals prices were higher in June 2019 compared to the same month of the previous year, with the biggest relative increase in Amsterdam (29%), driven by a 29% growth of the energy component and a 35% growth of the energy tax component. At the same time prices decreased compared to June 2018 by 9% in Copenhagen, by 3% in Brussels, and London, by 2% in Vienna and by 1% in Budapest. In June 2019 Budapest remained the cheapest capital in the EU in terms of gas prices for household consumers, followed by Bucharest and Zagreb.

Figure 33 Breakdown of gas price paid by typical household customers in European capitals, June 2019

After the slight increase in the second half of 2018, retail gas prices for industrial customers remained stable in the first half of 2019 on EU average. The average estimated price (VAT and other recoverable taxes excluded) in consumption band I4 was 2.68 Eurocent/kWh in the second quarter of 2019, slightly down from 2.72 in Q1 2019 but still 14% more than in the same period of 2018. (See the estimated industrial prices on Map 3.) Prices increased in Q2 2019 year-on-year in all EU Member States with the exception of Belgium, implying that recent price decreases on the wholesale gas markets could barely filter in retail prices, neither for industrial nor for household customers.

Figure 34 shows that in the case of industrial customers the relative standard deviation was lower than for private households, indicating smaller price differences across Member States. In the price bands with smaller annual consumption (I1 and I2) the relative standard deviation decreased in the first and second quarters of 2019, implying better price convergence across the EU. In the remaining two bands (I3, I4) price convergence did not change significantly over the last two quarters.

In the second quarter of 2019, Belgium and the UK had the lowest estimated industrial prices in consumption band I4 (respectively 2.1 Eurocent/kWh and 2.3 Eurocent/kWh), while the highest prices could be observed in Sweden (4.4 Eurocent/kWh) and Lithuania (3.8 Eurocent/kWh). In Q2 2019 the price ratio of the cheapest and the most expensive in the EU country was 2.1. This price differential ratio has been fluctuating between 1.6 and 2.4 since the beginning of 2008.
The next Figure shows the evolution of industrial retail gas prices in the EU, compared with some important trade partners of the European economy. In the second quarter of 2019 retail gas prices for industrial customers were higher in Brazil, China and Korea compared to the EU average, however, in the United States, Russia and Indonesia retail gas prices were lower.

Maps 2 and 3 on the next two pages show the estimated retail gas prices paid by households and industrial customers in the second quarter of 2019.
Map 2. Retail gas price estimates for households in the EU – Second quarter of 2019

Sources: © European Commission, estimates based on Eurostat data on consumer prices for the second half of 2018, adjusted by the HICP.
© Eurostat/Enery - September 2019

Source: Eurostat
Map 3. Retail gas price estimates for industrial consumers in the EU – Second quarter of 2019

GAS PRICES FOR INDUSTRIAL CONSUMERS
Estimates for the second quarter of 2019

Excluding VAT (value added tax) and other recoverable taxes

Band 14: 2778 MWh < Consumption < 277800 MWh

EU Average: 2.68 c€/kWh
(28 countries)

Source: Eurostat
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.

**Cooling degree days (CDDs)** are defined in a similar manner as Heating Degree Days (HDDs); the higher the outdoor temperature is, the higher is the number of CDDs. On those days, when the daily average outdoor temperature is higher than 21°C, CDD values are in the range of positive numbers, otherwise CDD equals zero.

**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.

**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 and CDD comparisons**: In the case of both cooling and 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.

**Retail prices** paid by households include all taxes, levies, fees and charges. Prices paid by industrial customers exclude VAT and recoverable taxes. Monthly retail electricity prices are estimated by using Harmonised Consumer Price Indices (HICP) based on bi-annual retail energy price data from Eurostat.