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HIGHLIGHTS OF THE REPORT

- In the second quarter of 2018, EU gas consumption decreased by 8% year-on-year, driven by mild weather and lower gas use in the power sector. The last time a year-on-year decrease of such a magnitude occurred was four years ago.

- Indigenous gas production decreased by 12% in the second quarter of 2018 year-on-year. A new bill passed by the Dutch parliament commits the state to reduce and ultimately stop production at the Groningen field "as quickly as possible".

- Imports increased by 3% year-on-year in the second quarter of 2018, as falling production and high injection demand offset the decrease in consumption. Russian pipeline supplies covered 46% of extra-EU imports, the highest quarterly share in the last five years. The EU's estimated gas import bill was around 21 billion euros, 29% more than a year earlier.

- EU LNG imports decreased by 2% year-on-year in the second quarter of 2018. Asian prices remained relatively high, especially in June, drawing cargoes away from Europe.

- In May 2018 the Commission delivered its decision on Gazprom, regarding a set of obligations to enable the free flow of gas at competitive prices in Central and Eastern European gas markets. In June, it opened a formal investigation to assess whether Qatar Petroleum's long-term LNG contracts contain territorial restrictions.

- Injections ramped up more quickly than in 2017 but, starting from a lower stock level, filling rates remained lower than year-ago levels throughout the second quarter of 2018.

- Despite the mild weather and the falling gas consumption, spot prices at European gas hubs remained high in the second quarter of 2018, driven by rising oil and coal prices and the strong injection demand.
EXECUTIVE SUMMARY

- After two years of almost continuous growth, EU gas consumption was 8% less in the second quarter of 2018 than in the same period of 2017. The last time a year-on-year decrease of such a magnitude occurred was four years ago. Mild weather and lower gas-fuelled power generation contributed to the decrease. In absolute level, the quarterly consumption amounted to 86 bcm.

- EU gas production fell by 12% year-on-year in the second quarter of 2018; Dutch output alone fell by 23%. A new bill passed by the Dutch parliament commits the state to reduce and ultimately stop production at the Groningen field “as quickly as possible” but sets no specific timeline.

- Despite the falling consumption, EU gas imports were 3% higher in the second quarter of 2018 than a year earlier as lower indigenous production and strong injection demand supported imports. Although imports from both Russia and Algeria increased by 10% in year-on-year comparison, but this was offset by decreases in Norwegian, Libyan and LNG supplies. Russian pipeline supplies remained the main source of EU imports, covering 46% of extra-EU imports, the highest quarterly share in the last five years. It was followed by Norwegian pipeline imports (31%), LNG imports (14%) and pipeline supplies from North Africa (9%). With both volumes and import prices increasing year-on-year, the EU’s estimated gas import bill rose to around 21 billion euros in the second quarter of 2018, 29% more than a year earlier.

- In the second quarter of 2018, Ukraine re-emerged as the main supply route of Russian gas to the EU (after being temporarily replaced by Nord Stream in the previous quarter), covering 44% of the total Russian supplies. The share of Nord Stream was 33% while gas supplies transiting Belarus covered 23% of total EU imports from Russia.

- EU LNG imports decreased by 2% year-on-year in the second quarter of 2018 but were 30% higher than in the first quarter of 2018. The spread between European and Asian prices widened towards the end of the second quarter of 2018, drawing cargoes away from Europe and even providing incentives from some reloads/re-exports.

- In the second quarter of 2018, Qatar confirmed its position as the EU’s main LNG supplier while the share of the US dropped to 1.3%. In July 2018, European Commission President Juncker and US President Trump agreed to increase LNG trade from the US to Europe.

- The European Commission continued to work on dismantling trade barriers and completing the energy market. In May 2018, it delivered a decision on Gazprom, regarding a set of legally binding obligations to enable the free flow of gas at competitive prices in Central and Eastern European gas markets. In June, it opened a formal investigation to assess whether Qatar Petroleum’s long-term LNG contracts contain territorial restrictions.

- Because of the late winter cold spell, storages reached unusually low levels at the end of the gas season. Injections ramped up more quickly than in 2017 but, starting from a lower stock level, filling rates remained lower than year-ago levels throughout the second quarter of 2018. On 30 June the average filling rate was 49%, compared to 51.2% a year earlier.

- Despite the mild weather and the falling gas consumption, spot prices at European gas hubs remained high in the second quarter of 2018, with the average prices only slightly below the level observed in the first quarter. Rising oil, coal and carbon prices and the strong injection demand provided support to hub prices in this period. Oil-indexed prices were rising throughout the period.

- International gas prices moved closer in April but diverged afterwards, with Asian prices getting close to the levels reached during the winter, developing a large premium over EU prices. The difference between EU and US prices also increased.

- Liquidity on European gas hubs increased in the second quarter of 2018 by 12% 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 two-three 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 two years of almost continuous growth, EU gas consumption dropped by 8% in the second quarter of 2018 compared to the same period of 2017. The last time a year-on-year decrease of such a magnitude occurred was 4 years ago. Mild weather and a lower level of gas-fuelled power generation contributed to the decrease. In absolute level, the quarterly consumption amounted to 86 bcm.

Figure 1. EU gas consumption

Source: Eurostat, data as of 15 September 2018 from data series nrg_103m. In case of missing data points (June 2018 for Croatia, May and June 2018 for the Netherlands and the UK), the Eurostat data series nrg_ind_343m was used instead.

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

Source: Eurostat, data as of 15 September 2018 from data series nrg_103m. In case of missing data points (June 2018 for Croatia, May and June 2018 for the Netherlands and the UK), the Eurostat data series nrg_ind_343m was used instead. Calculations of DG Energy, based on consumption measured in bcm.
In the second quarter of 2018, gas consumption decreased in the majority of Member States, with only five countries registering a growth, including Spain (6%) and the UK (5%). The biggest year-on-year decrease was observed in Romania (-25%) but 13 other countries also had a double-digit decline, including France (-11%) and Germany (-17%).

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

GDP growth is slowing down in the EU: compared to the same quarter of the previous year, seasonally adjusted gross domestic product (GDP) rose by 2.1% in the second quarter of 2018, the lowest growth rate for more than a year. The growth of industrial activity was also lower than during the last year: the gross value added in the manufacturing sector was 2.7% higher in the second quarter of 2018 than a year earlier. However, due to the weather conditions being different from the last year, consumption of gas in the EU, as it was mentioned before, went down in Q2 2018 in year-on-year comparison.

1 Source: Eurostat, data as of 19 September 2018 from data series namq_10_a10; seasonally and calendar adjusted data
Figure 4. EU GDP Q/Q-4 change (%)

Source: Eurostat, data as of 19 September 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 second quarter of 2018. In most of the EU, temperatures in April and May were well above the long-term average (and also well above the temperatures seen in the same period of 2017), thereby decreasing gas demand for heating.

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

Source: Joint Research Centre (JRC), European Commission

- Based on ENTSO-E data, gas-fuelled power generation decreased by 6% in the second quarter of 2018 compared to the same period of 2017. Volumes were particularly low in April 2018 (-15%). Relatively high gas prices in the second quarter of 2018 certainly had an impact on the profitability of gas-fuelled generation although coal prices were also rather high in this period.
• The decrease was particularly strong in France (-63%) where an improvement in the availability of nuclear capacity and more hydropower contributed to the moderate gas use in the power sector. From the largest markets, gas-fuelled generation also decreased in Italy (-8%) and Spain (-1%) while the UK (3%) and the Netherlands (10%) experienced a year-on-year growth.

• According to a draft law presented in May 2018, the Dutch government plans to ban the use of coal in power generation by 2030 and shut down two of its five coal-fired plants already at the end of 2024 unless they switch fuels.2 This will potentially increase of others sources, such as gas use in the power sector.

• UK clean spark spreads – measuring the profitability of gas-fired generation – averaged 5.5 €/MWh in the second 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 39.9% in the UK in the first quarter of 2018, slightly less than one year earlier (40.5%); gas share decreased at the benefit of renewables while the share of coal also decreased.3

• Clean spark spreads in Germany averaged -9.0 €/MWh in the second 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 second quarter of 2018: it was only 8.0%, compared to 10.6% in the same period of 2017.5

Figure 6. Gas-fuelled power generation in the EU

Source: Based on data from the ENTSO-E Transparency Platform, data as of 15 September 2018

1.2 Production

• In the second quarter of 2018, EU gas production was 28 bcm, 12% less than in the same period of 2017. Gas output was outside the 2014–2017 range in all three months of the quarter. Looking at the eight largest producers, gas output decreased in Denmark

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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
(−23%), Germany (−22%), Ireland (−12%), the Netherlands (−23%), Romania (−4%) and the UK (−6%), was flat in Poland and increased only in Italy (15%). In case of the two largest producers, the Netherlands and the UK, only “short-term” statistics were available for May and June 2018, therefore the figures for these countries might be revised later.

- On 6 July 2018, the Dutch parliament passed a bill, amending the Gas Act and the Mining Act, committing the state to reduce and ultimately stop production at the Groningen field “as quickly as possible”. According to the new framework, the current production cap would be replaced with the principle that output cannot be more than necessary to meet the demand for low-calorific gas, to be estimated every year by grid operator GTS. The bill itself does not specify a timeline of terminating output at the field.\(^6\) The Dutch government hopes that falling output at Groningen will be partly offset by smaller onshore and offshore fields which face no output constraints. The government has already given provisional approval to a fracking project.\(^7\)

![Figure 7. EU gas production](source)

Source: Eurostat, data as of 15 September 2018 from data series nrg_103m. In case of missing data (June 2018 for Croatia, May and June 2018 for the Netherlands and the UK), the Eurostat data series nrg_ind_343m was used instead.

### 1.3 Imports

- While EU consumption decreased by 8% in the second quarter of 2018, Eurostat data show that net imports\(^8\) in this period were 3% higher than a year earlier, driven by falling indigenous production and strong storage injections in this period. There has been a strong increase in the net imports of Ireland (77%), the Netherlands (32%) and the UK (27%) in the wake of the falling output in these countries. Among the other big EU gas markets, the net imports of Germany (−4%), France (−4%) and Italy (−1%) slightly decreased.

- According to ENTSO-G data, imports amounted to 1040 TWh in the second quarter of 2018, 3% more than a year earlier. Imports from Russia and Algeria showed a robust year-on-year growth but this was offset by decreases of various sizes in Norwegian, Libyan and LNG supplies.

- In the second quarter of 2018, pipeline imports from Russia were 10% higher than in the same period of 2017. In addition to high injection demand, price developments provided support to Russian imports: as oil-indexed prices are set to rise following the time

\(^6\) ICIS Gas in Focus, 16 July 2018
\(^7\) ICIS European Gas Markets, 16 April 2018
\(^8\) Net imports equal imports minus exports and do not account for stock changes.
lag with current oil prices in the contracts. Therefore, buyers with such contracts had an incentive to increase nominations in the second quarter, to be offset by reduced volumes in the third quarter.

- Russia confirmed its position as the top supplier of the EU, covering 46% of total extra-EU imports in the second quarter of 2018, 3 percentage points more than in the same period of 2017 and the highest quarterly share in the last five years.

- In April 2018, Gazprom signed a new 5-year contract for gas deliveries to Slovenia. The contract provides for annual supplies of 0.6 bcm from 1 January 2018 to 1 January 2023. The volume corresponds to around two-thirds of Slovenia’s yearly consumption. In June 2018, Gazprom and the Austrian OMV extended their existing long-term gas supply agreement (which was valid until 2028) to 2040.

- On 24 May 2018, in the context of the antitrust investigation started in 2012, the European Commission has adopted a decision imposing on Gazprom a set of legally binding obligations that address the Commission’s competition concerns and enable the free flow of gas at competitive prices in Central and Eastern European gas markets, to the benefit of European consumers and businesses. In particular, Gazprom has to remove any restrictions placed on customers to re-sell gas cross-border and prices have to reflect the price level in competitive Western European gas markets, especially at liquid gas hubs.

- In a ruling published on 10 August, the World Trade Organisation (WTO) rejected most of Russia’s claims concerning the alleged incompatibility of the EU’s energy policy measures with the multilateral trade rules. The WTO panel did not find basis to the claim concerning the alleged EU discrimination in its Third Energy Package against Russian pipeline transport services, service suppliers, or against Russian natural gas. The panel also ruled in favour of the EU concerning the rules on unbundling, i.e. the requirement to separate energy supply and generation from the operation of transmission networks, as well as on LNG and on upstream pipeline networks.

- Imports from Norway, the EU’s second gas supplier, decreased by 1% year-on-year in the second quarter of 2018 and the country’s market share was 31%, 1 percentage point less than a year earlier. A number of planned and unplanned outages affected Norwegian supplies in this period, especially those destined to the UK. In the second quarter of 2018, Norwegian gas production amounted to 28.9 bcm, 2% more than in the same period of the previous year.

- On 24 May 2018, a grant agreement was signed for EUR 33.1 million of EU funding from the Connecting Europe Facility (CEF) to carry out preparatory studies and surveys as well as pre-construction activities for the Baltic Pipe Project. On 16 July 2018, the project received another EUR 18.3 million from CEF for the reinforcement of the national gas transmission systems in Poland and Denmark. The Baltic Pipe would carry up to 10 bcm/year of Norwegian gas from Denmark to Poland. The pipeline is planned to be operational in October 2022.

- Imports from Algeria grew by 10% in the second quarter of 2018 while imports from Libya decreased by 45% year-on-year. Algerian supplies to Spain and Portugal increased by 41%, more than offsetting the decrease of deliveries to Italy (-16%). Maintenance on the Libya-Italy pipeline (with no flows were reported from 2 April to 10 May) contributed to lower volumes on that route. The combined share of Algeria and Libya from total extra-EU imports was 9% in the second quarter of 2018, unchanged from the same period of 2017.

- In June 2018, the Spanish utility company Gas Natural Fenosa (since than renamed to Naturgy) extended its contracts with Sonatrach for purchasing Algerian gas until 2030. The renewed contracts represent more than 40% of the company’s overall gas procurement.

- According to ENTSO-G data, imports of LNG slightly decreased in the second quarter of 2018 and covered 14% of total extra-EU gas imports, down from 16% one year earlier (see further details below).

- Both the import volumes (from 1010 to 1040 TWh) and the estimated average import price (from 16.2 €/MWh to 20.2 €/MWh) increased compared to the same period of 2017. As a result, the EU’s estimated gas import bill increased by 29% year-on-year, reaching around 21 billion euros in the second quarter of 2018.
The Trans-Anatolian Pipeline (TANAP), a crucial element of the Southern Gas Corridor, was inaugurated in June 2018. TANAP will link up with the Trans-Adriatic Pipeline (TAP), allowing Europe to receive gas from Azerbaijan from 2020.18

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

Source: Based on data from the ENTSO-G Transparency Platform, data as of 31 August 2018

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

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

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

Figure 9 depicts EU gas imports from Russia on the three main supply routes: Ukraine (which includes the Brotherhood Pipeline and the Balkan route), Belarus (mainly the Yamal pipeline) and Nord Stream.

In the second quarter of 2018, the volume of Russian imports transiting Ukraine was 5% higher than in the same period of 2017. Ukraine re-emerged as the main supply route of Russian gas to the EU (after temporarily being replaced by Nord Stream in the previous quarter), covering 44% of the total.

Gas flows on the Nord Stream pipeline represented 33% of total EU imports from Russia in the second quarter of 2018. In absolute terms, volumes were 32% higher than in the same period of 2017 and the utilisation was practically 100%.

Gas supplies transiting Belarus in the second quarter of 2018 were unchanged from the same period of 2017 and covered 23% of total EU imports from Russia. Deliveries on this route decreased by around 18% between 18 and 30 June, presumably because of maintenance.

In the second quarter of 2018, Ukraine continued to rely on imports from the EU. Gas flows coming from Hungary, Poland and Slovakia reached about 2.6 bcm in this period, 7% less than in the same period of 2017. In June, there was a strong increase in deliveries coming from Hungary, offsetting declining volumes from Slovakia but the latter remained the most important supply route of Ukrainian imports.19 Looking ahead, Ukraine expects declining consumption and – helped by lower loyalties – rising domestic production in the years to come which, if realized, would significantly reduce the country’s import dependence.20

19 Based on data from the ENTSO-G Transparency Platform, data as of 24 September 2018
20 ICIS European Gas Markets, 15 June 2018
According to Thomson Reuters data, after a 14% year-on-year decrease in the first quarter, EU LNG imports decreased by 2% year-on-year in the second quarter of 2018. Decreases in the UK (-23%), France (-1%), Italy (-19%), the Netherlands (-31%), Greece (-26%) and Lithuania (-2%) were largely offset by increases in Spain (2%), Belgium (82%), Portugal (19%) and Poland (68%).

EU LNG imports continue to show a counter-seasonal behaviour, with volumes peaking during summer and ebbing in winter. In the second quarter of 2018, LNG imports were 30% higher than in the first quarter, in spite of record gas demand in February and March. 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. Unlike in 2017, the spread between European and Asian prices widened towards the end of the second quarter of 2018, drawing cargoes away from Europe and even providing incentives from some reloads/reexports (see also Section 2.2 and 2.3).

After the issuance of the building permit in June 2018, the expansion of the Świnoujście LNG terminal (Poland) entered the construction stage. The project aims at increasing the capacity of the terminal from the current 5 bcm/year to 7.5 bcm/year. Once the expansion is finalised, the terminal will be able to satisfy nearly half of the Polish gas demand.21

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In the second quarter of 2018, Qatar remained the main LNG supplier of the EU, with its market share bouncing back above 40% (43%). Qatar was followed by Nigeria (17%), Algeria (16%), Trinidad and Tobago (9%) and Norway (9%). The share of the US was only 1.3%, half of the share observed in the same period of 2017.

In the second quarter of 2018, Qatar had a dominant role in the Belgian (99%), Italian (78%), Polish (78%) and UK (54%) LNG markets. Algeria was the largest LNG supplier of France (36%) and Greece (100%) while Portugal’s main supplier was Nigeria (72%). Norway was the sole LNG supplier of Lithuania. Spain had the most diversified portfolio: it received LNG from seven extra-EU suppliers, with Qatar having the biggest market share (29%).

On 21 June 2018, the European Commission opened a formal investigation to assess whether Qatar Petroleum’s long-term agreements for the supply of LNG into the European Economic Area (EEA) contain direct and/or indirect territorial restrictions, in violation of EU competition rules. An opening by the Commission of a formal investigation does not prejudge its outcome.22

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• In the second quarter of 2018 only two LNG cargoes arrived from the US, unloading in April in the Netherlands and the UK, respectively. The volume (0.2 bcm of gas equivalent) was 51% lower than in the same period of 2017 and represented 3% of total US LNG exports in this period. Total US LNG exports were up by 18% compared to the second quarter of 2017 and the majority of supplies went to the Latin American (45%) and Asian (38%) market. After a 3-months hiatus, with no deliveries from May to July, two additional US cargoes arrived to Europe in August, to Malta and Spain.23

• US liquefaction projects under development are expected to add up to over 80 bcm/year, with the bulk of this additional capacity to be commissioned by 2020.24 In May 2018, Cheniere made a final investment decision on the 3rd train of its Corpus Christi LNG project, representing the first final investment decision on new liquefaction capacity in the US since 2015.25

• On 25 July 2018, European Commission President Juncker and US President Trump agreed to strengthen the strategic cooperation with respect to energy. President Juncker confirmed that the EU wants to import more LNG from the US to diversify its energy supply.26 Growing imports of US LNG, if priced competitively, is expected to play an increasing and strategic role in EU gas supply. The EU and the US are working within the framework of an Executive Working Group set up by Presidents Juncker and Trump to facilitate US exports of LNG to Europe, inter alia by removing any regulatory and infrastructural constraints.27

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23 Commission calculations based on tanker movements reported by Thomson Reuters
24 IEA Market Report Series: Gas 2018
1.4 Storage

- Figure 13 shows EU stock levels as the percentage of storage capacity in gas years 2017 and 2018, compared to the 5-year range of gas years 2013-2017. According to figures published by Gas Infrastructure Europe, EU storage capacity amounted to 1,067 TWh (roughly 100 bcm) on 30 June 2018, 1% less than one year earlier.

- An unusually cold February and March boosted gas demand, prompt prices and storage withdrawals in Europe. Relatively low imports also contributed to a greater reliance on stocks. EU stock levels bottomed out on 30 March, at 17.8% of storage capacity, well below the 5-year range. In fact, this is the lowest level on record.\(^28\) On 31 March 2018, the average filling rate was 18.3%, compared to 25.8% a year earlier and 35.4% in 2016.

- Because of the late winter cold spell, the injection season started relatively late. Injections ramped up more quickly than in 2017 but, starting from a lower stock level, filling rates remained lower than year-ago levels throughout the second quarter of 2018. On 30 June, the average filling rate was 49.8% (compared to 51.2% a year earlier), close to the lower border of the 5-year range.

- While shippers generally wait for low prompt prices in the summer to inject gas, this was not the case this year: because of the unusually depleted stocks they had less flexibility and had to start injections despite the lack of financial incentive to do so.\(^29\)

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\(^{28}\) Gas Storage Europe reports storage data from 1 January 2011

\(^{29}\) ICIS European Gas Market, 16 April 2018
• On average, net injections made during the second quarter of 2018 were equivalent to 31.4% of storage capacity (compared to 25.4% in the same period of 2017): the average filling rate increased from 18.4% on 31 March 2018 to 49.8% on 30 June 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 March 2018) and the pace of injections.

• The Netherlands and France saw the highest rate of injections in this period, with the filling rate increasing by 40 and 38 percentage points, respectively. Poland and Germany also experienced above-average injections in the second quarter of 2018, with the filling rate decreasing by around 33 percentage points.

• Italy and Poland had the highest filling rate at the end of the second quarter, close to 70% of storage capacity. On the other hand, storage levels were rather low in Belgium, Slovakia and the UK, with filling rates 10-11 percentage points lower than a year earlier.

• In May 2018, the Latvian government introduced strategic gas reserves rules, requiring the TSO to store an additional 0.3 bcm of gas at the Incukalns storage facility from the end of the injection season until 1 March of the following year.30

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30 ICISS Gas in Focus, 16 July 2018
On the NBP, seasonal spreads averaged 3.1 €/MWh in the second quarter of 2018, around 0.6 €/MWh more than in the same period of 2017. On the TTF, the average seasonal spread was 1.4 €/MWh in the second quarter of 2018, 0.1 €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 14. Gas storage levels as percentage of maximum gas storage capacity by Member State

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

- The price of Brent oil has continued to increase in the second quarter of 2018, supported by robust global demand growth, the US withdrawal from the Iran nuclear deal (announced on 8 May) and plunging Venezuelan output. In the middle of May 2018, Brent reached 80 USD/bbl, the highest level in three and a half years. On 22 June, OPEC and non-OPEC producers agreed to do away with the over-compliance with the cuts agreed back in 2016, implying a theoretical output increase of around 1 million barrels per day in the second half of the year. This step, along with the expected increase of US shale oil output, pending on transport infrastructure availability, 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 averaged 21.1 €/MWh in the second quarter of 2018, 35% more than in the same period of 2017 and only slightly less than in the first quarter of 2018 (21.4 €/MWh). While EU gas consumption decreased year-on-year, rising oil and coal prices and strong injection demand (due to depleted stocks) provided support to European hub prices in this period.

- Oil prices started to recover in mid-2017 but, in line with the typical 6-9 month time lag used in the pricing formula, oil-indexed prices started to rise only in the first quarter of 2018. The price rise continued in the second quarter: 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 22.4 €/MWh, 1.3 €/MWh more than the TTF. Over the period, oil-indexed prices remained slightly higher than most hub prices.

- According to the International Gas Union, oil-indexation accounted for 28% of European gas consumption in 2017, slightly down from the previous year (30%). There are considerable regional differences: the share was 8% in Northwest Europe, 25% in Central Europe, 61% in the Mediterranean, 32% in Southeast Europe and 28% in Scandinavia and the Baltics.31

- After receding at the beginning of 2018, coal prices have been on the rise in the second quarter of 2018, supported by increasing Chinese and Indian imports and higher oil prices (which increase transport costs). The CIF ARA spot price averaged 75 €/ton in this period, 8% more than in the same period of 2017. Rising coal prices, coupled with the recent increase in the price of European emission allowances, improved the relative competitive advantage of gas vis-a-vis coal.

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

![Figure 16. Spot prices of oil, coal and gas in the EU](source: Platts)

31 [https://www.igu.org/content/download-email-capture?foo=93583](https://www.igu.org/content/download-email-capture?foo=93583)
2.2 International gas markets

- Figure 17 displays an international comparison of wholesale gas prices. In the last few years, there has been a convergence of international prices but this trend was interrupted during the last two winters (2016-2017 and 2017-2018) when Asian prices showed a steep rise due to strong seasonal demand. European and US prices also increased but to a lesser extent, resulting in a widening gap between regional benchmarks.

- In the second quarter, TTF averaged 7.4 USD/mmbtu (21.1 €/MWh). The average German border price was somewhat lower (6.5 USD/mmbtu or 18.7 €/MWh).

- Asian prices significantly fell in April as the winter season has come to an end. However, prices increased again in May and June because of continued strong gas demand supported by coal-to-gas switching. The average Japanese LNG price was 10.3 USD/mmbtu in June 2018, close to the peaks seen in January. In the second quarter as a whole, the average price was 8.6 USD/mmbtu, 59% more than in the same period of 2017. The premium above the Dutch TTF hub was on average 1.3 USD/mmbtu in the second quarter but in June it reached 2.8 USD/mmbtu.

- The average import price of Chinese pipeline imports was 6.4 USD/mmbtu, well below LNG prices.

- The Henry Hub price had been rather stable since February 2017, fluctuating around 3.0 USD/mmbtu, with a small peak in January 2018. In the second quarter of 2018, the average price was 2.8 USD/mmbtu, 8% lower than in the same period of 2017.

- While in the second quarter of 2017 there has been a strong convergence among key international gas prices, this was not the case in the second quarter of 2018: price differences, especially in June, were comparable to those observed in winter. The ratio of the Japanese LNG price and US Henry Hub was 3.1 in the second quarter of 2018, unchanged from the first quarter but significantly more than in the second quarter of 2017 (1.8). The average TTF/Henry Hub ratio increased to 2.6 in the second quarter of 2018 from 1.7 in the same period of 2017. In absolute terms, the price spread between Henry Hub and TTF was 4.5 USD/mmbtu in the second quarter of 2018, up from an average 2.0 USD/mmbtu in the same period of 2017.

- The euro has considerably strengthened compared to the US dollar between the beginning of 2017 and early 2018: 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. However, the euro weakened in the second quarter, with the exchange rate dropping to 1.17 by the end of June, thereby decreasing 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

- The sizeable gap seen between Asian and European LNG prices has practically disappeared in April when Asian prices dropped in line with the falling seasonal demand. However, Asian prices started to rise again from May, driven by rising oil prices and the continued strong demand in the region. While the heating season in the northern hemisphere ended, coal-to-gas switching provided support to LNG demand, especially in China and Korea.³²

- In the second quarter of 2018, spot prices averaged 7.2 USD/mmbtu in the UK, 7.6 USD/mmbtu in Spain, 8.6 USD/mmbtu in Japan and 8.5 USD/mmbtu in China. In June, the difference between the Japanese and UK price reached 2.9 USD/mmbtu, approximating the premium observed in January (3.5 USD/mmbtu).

- JCC, the Japanese benchmark of oil-indexed LNG prices averaged around 9.5 USD/mmbtu in the second quarter of 2018, around 1.0 USD/mmbtu more than the average spot price.

- Similarly to the previous quarter, LNG imports increased in the second quarter of 2018 in China (+12% year-on-year), India (+16%) and Korea (+9%) but decreased in Japan (-10%) and Latin America (-7%).³³

- Global LNG supply continued to expand in the second quarter of 2018: Cameroon became the 20th LNG exporting country in May 2018 when its floating LNG production vessel, operated by Golar LNG, dispatched its first cargo³⁴ while the second train of the Chevron-operated Wheatstone project in Australia started in June³⁵.

**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 €/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 €/MWh cheaper. Since May 2015, the estimated price of Norwegian imports is also aligned with the NBP price,

³² Oxford Quarterly Gas Review no. 3
³³ Source: Commission calculations based on tanker movements reported by Thomson Reuters
indicating that Norwegian export prices are now clearly linked to European hub prices. In the second quarter of 2018, the average spot LNG price (20.5 €/MWh) was slightly lower than the average NBP price (21.0 €/MWh) and the estimated Norwegian import price (21.2 €/MWh).

- While Spanish LNG prices exhibit a clear seasonality, with robust Asian demand driving up prices during the past two winters, the price of pipeline imports coming from Algeria 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-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 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 of 2017. In the second quarter of 2018, however, LNG remained more expensive than Algerian pipeline gas (on average by 2.9 €/MWh), probably contributing to the rising pipeline imports from Algeria in this period.

**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 increased in the second quarter of 2018: total traded volumes amounted to around 11,700 TWh (equivalent to around 1100 bcm), 12% more than in the same period of 2017. This is around 17.5 times more than the gas consumption of the seven Member States covered by the analysis in this period. Liquidity increased year-on-year in all three months of the quarter, with the biggest growth rate in May (23%). Liquidity was supported by storage-backed trading as depleted storages had to be filled and by higher trade on the curve, helped by a high-price environment.36

- Traded volumes increased year-on-year in the Dutch (32%), German (10%) Italian (13%), Austrian (68%) and Belgian (4%) hubs which was partly offset by decreases in the UK (-8%) and French (-22%) hubs.

- On the UK NBP hub, 48% total traded volumes were executed directly on an exchange in the second quarter of 2018. This share was 20% on the Dutch TTF hub, 28% at the French hubs, 12% at the German hubs, 20% at the Austrian hub but only 2% at the Italian hub and 1% at the Belgian hub. In the Netherlands, the share of exchange trade was markedly lower than a year earlier (-5 percentage points), while it increased in France (+4 percentage points).

36 ICIS European Gas Markets, 15 June 2018 and ICIS Gas in Focus, 16 July 2018
At EU level, OTC markets remained the main trading venue and their share actually increased from 66% in the second quarter of 2017 to 71% in the same period of 2018. 12% of OTC volumes were cleared at a clearinghouse in the second quarter of 2018, up from 11% in the same period of the previous year. Rising liquidity at the Dutch TTF hub were driven by higher OTC volumes (+41% year-on-year) while exchange-traded volumes grew only modestly (5%).

Figure 20. Traded volumes on the main European gas hubs in the second 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 second quarter of 2018: compared to the same period of 2017, its share increased from 46% to 54%, while that of NBP fell from 43% to 35%. NBP and TTF continue to overshadow the other European hubs. In the second quarter of 2018, the combined market share of the Belgian, French, German and Italian hubs was 12%, up from 11% a year earlier.
In the last three years, there has been a clear trend of exchange trade gaining ground but in the last quarter of 2017 and the first quarter of 2018 this trend seems to have turned. In the second quarter of 2018, the share of total traded volumes executed directly on an exchange increased again, reaching 29%, but remained below the year-ago level (34%). The share of cleared OTC volumes was 8% of total traded volumes in the second quarter of 2018, up from 7% a year earlier.

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 rather high, averaging around 21-22 €/MWh, in the first quarter of 2018 when exceptionally cold temperatures raised gas demand amid depleting stocks. In the second quarter, the weather was relatively mild and consumption decreased year-on-year, yet prices remained at an elevated level: the average price was practically the same as in the first quarter and about a third higher than in the second quarter of the previous year.

- The main factors providing support to wholesale prices in the second quarter of 2018 were rising oil, coal and carbon prices and the strong injection demand observed in the period in the wake of the late-winter cold spell and the resulting unusually low storage levels. Relatively low LNG imports (as higher prices in Asia drew away cargoes from Europe, especially towards the end of the second quarter) also pushed European hub prices upwards. Unusually, prices continued to increase throughout the second quarter and the average TTF price in June (22.0 €/MWh) was 45% higher than a year earlier.

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

![Wholesale day-ahead gas prices on gas hubs in the EU](source: Platts)

- Like in the previous two years, gas at the UK hub traded below the Dutch TTF hub in June (-0.6 €/MWh) as the UK market was oversupplied. This was particularly true during the two-week maintenance of the UK-Belgium Interconnector, preventing excess gas from leaving the UK.

- In the second quarter of 2018, prices at the Italian PSV hub remained on average 2.1 €/MWh higher than at hubs in Northwest Europe. In addition to storage injections, planned maintenance on a number of pipelines (those coming from Libya, Switzerland and Austria) provided temporary support to Italian prices.

- In France, PEG Nord and TRS traded at parity during the first quarter of 2018 but in the second quarter the TRS price was on average 1.3 €/MWh higher, supported by capacity restrictions on the north-south link and lower-than-usual LNG imports (as higher prices in Asia encouraged shippers to divert cargoes there).

- The two French hubs are due to merge into one market area called Trading Region France (TRF) on 1 November 2018. Based on trader’s concerns expectations of higher prices and high price volatility in the new market, deals for winter-delivery gas at PEG Nord were concluded at a premium to TTF. Day-ahead prices were not affected; in fact, PEG Nord has traded slightly below TTF throughout the second quarter of 2018.

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37 ICIS Gas in Focus, 29 June 2018
Figure 24. The premium of wholesale day-ahead gas prices at selected hubs compared to TTF

Source: Platts

- Figure 25 looks at the development of forward prices one, two and three years ahead in comparison to the development of the day-ahead price on the Dutch TTF.

- 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 forward prices. In the first quarter of 2018, day-ahead prices at the TTF were on average 2.1 €MWh higher than year-ahead prices but in the second quarter this difference dropped to 0.8 €MWh.

Figure 25. 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 26 compares a selection of estimated border prices of gas deliveries from the main exporters to the EU: Russia, Norway, and Algeria. For comparison, the evolution of the day-ahead prices on the Dutch TTF hub is also presented.

- Over the last 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.

- In April 2018, the difference between the highest and lowest price depicted in Figure 26 decreased to 1.7 €/MWh, the lowest level on record. In the following months, however, the difference increased. Unusually, the Dutch TTF hub price was the highest among the observed prices throughout the second quarter, in spite of the fact that oil-indexed prices were also on the rise.

**Figure 26. 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 second quarter of 2018

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

- Figures 27 and 29 show the degree of convergence of retail gas prices for household and industrial consumers, using as a metric the relative standard deviation of the prices in individual Member States. Monthly retail prices are estimated by using half-yearly prices from Eurostat (with the latest available figures relating to the 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 second quarter of 2018 was 6.44 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 27. In 2017-2018, 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 second quarter of 2018, the estimated household price in consumption band D2 varied between 3.35 Eurocent/kWh in Romania and 11.31 Eurocent/kWh in Sweden, resulting in a price differential ratio of 3.4 between the cheapest and the most expensive Member State. This ratio gradually decreased since March 2012 when it reached 4.8.

![Figure 27. Relative standard deviation of gas prices paid by household consumers in EU Member States](image)

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

- Figure 28 shows the level and the breakdown of residential end-user gas prices paid by typical households in 25 European capitals in June 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%).

- There are significant differences across Member States, with the share of energy cost ranging from 27 to 68%, the share of distribution/storage costs ranging from 8 to 49% and the share of taxes ranging from 8 to 52%. In Amsterdam and Copenhagen, taxes make up around half of the price while in London and Luxembourg their share is less than 10%. For 7 of the 25 capitals covered, the price does not include an energy tax component. While there are significant differences across Member States in network costs and taxes, Figure 28 also shows that even the energy component is very variable: it is 5.5 times higher in Stockholm than in Budapest.

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38 Note that these are arithmetic averages.
• In 14 of the 25 capitals, prices were higher in June 2018 than a year earlier, with the biggest increase in Bucharest (14%), driven by a 36% growth of the energy component. As a result, Bucharest has overtaken Budapest which is now the cheapest capital in the EU in terms of gas prices for household consumers. At the other end of the spectrum, prices decreased by 8% in Lisbon and Athens.

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

![Energy and Other Components of Gas Price](image)

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 2.35 Eurocent/kWh in the second quarter of 2018, 2% less than a year earlier. Prices decreased in this period in around half of the Member States with the biggest decline in Spain (-13%). Lithuanian (35%), Swedish (17%) and Bulgarian (13%) industrial consumers had to cope with a double-digit increase. (See the estimated industrial prices on Map 3.)

• Figure 29 indicates that, for industrial customers, the relative standard deviation has been significantly lower than in the case of households, indicating smaller price differences across Member States. 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 second quarter of 2018, the UK had the lowest estimated industrial price in consumption band I4 (1.84 Eurocent/kWh), while the highest price was observed in Sweden (3.91 Eurocent/kWh), resulting in a ratio of 2.1. The price differential ratio between the cheapest and the most expensive Member State has been fluctuating between 1.7 and 2.4 in 2015-2018.
Figure 29. Relative standard deviation of gas prices paid by industrial consumers in EU Member States

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

- Maps 2 and 3 show the estimated retail gas prices paid by households and industrial consumers in the second quarter of 2018.
Map 2. Retail gas price estimates for households in the EU – Second quarter of 2018
Map 3. Retail gas price estimates for industrial consumers in the EU – Second 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 €/MWh. After the day ahead market closes, market participants still have the opportunity to level off their positions on the balancing market. That is why a high level of FAPD does not necessarily equate to irrational behaviour. In addition, it should be noted that close-to real time transactions represent only a fractional amount of the total trade on gas contracts. The FAPD chart provides detailed information on adverse flows. It has two panels: The first panel estimates the ratio of the number of days with adverse flows to the total number of trading days in a given period. It also estimates the monetary value of energy exchanged under adverse flow conditions (mark-up) compared to the total value of energy exchanged across the border. The mark-up is also referred to as “welfare loss”. A colour code informs about the relative size of FAPD events in the observed sample, going from green if less than 10% of traded days in a given period are FAPDs to red if more than 50% of the days are FAPDs. The second panel gives the split of FAPDs by sub-category of pre-established intervals of price differentials. It represents the average exchanged energy and relative importance of each sub-category on two vertical axes.

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

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

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

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

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