Natural gas supply-demand balance of the European Union in 2023

How to prepare for winter 2023/24

International Energy Agency

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Summary

The European and the global gas market suffered a major supply shock in 2022: Russia's steep gas supply cuts to the European Union put an unprecedented pressure on the market, triggering a global natural gas crisis. **Despite the steep decline in Russian piped gas, the European Union was able to fill up its gas storage sites to well-above historic averages.** The strong storage build-up was supported by a combination of well-tailored policy measures, a record inflow of LNG and a steep drop in natural gas consumption, in particular in gas-intensive and energy-intensive industries. The current natural gas crisis makes it clear that clean energy transitions are urgent and will help to increase stability in the global gas market.

Global gas supply is set to remain tight in 2023 and the global balance is subject to an **unusually wide range of uncertainties** and **exogenous risk factors**. This includes the possibility of complete cessation of Russian piped gas deliveries to the European Union, as well as a recovery of China's LNG imports in line with the country's long-term LNG contracts and a potential lower availability of LNG supply. **Taking into consideration a combination of these risks**, and assuming at the time that EU gas storage facilities would be around one-third full at the beginning of the 2023 filling season,, the 2022 "How to Avoid Gas Shortages in the European Union" Report identified a potential supply-demand gap of 57 bcm in the European Union in 2023.

Since the publication of our Report in mid-December 2022, the prevailing tensions on the European Union's gas supply-balance have moderated. The combination of stronger supply and lower-than-expected demand resulted in inventory levels standing 15 bcm above the storage levels modelled in the analysis underpinning our "How to Avoid Gas Shortages in the European Union" Report.

This improved outlook should not be a distraction from the measures necessary to reduce natural gas demand in a structural manner to mitigate the European Union's **exposure to the exogenous risks**. We have developed a new stress scenario whereby Russian gas ceases from mid-February 2023, LNG supplies remain tight and weather-related demand increases later in the year. This update, taking into account data available up to 15 February 2023, would result in a potential supply-demand gap of 40 bcm in the European Union over the remainder of 2023 in contrast with our base case not foreseeing such a gap. The following Report identifies **four key policy measures** to enhance the European Union's and its Eastern neighbourhood's natural gas supply security:

1. **Reduce natural gas demand in a structural manner**: Analysis by the members of the IEA's Task Force on Gas Market Monitoring and Supply Security (TFG) suggests that the European Union could potentially reduce

its natural gas demand by close to 37 bcm in 2023 through improving energy efficiency, continued expansion of renewables power generation, deployment of heat pumps and behavioural changes. The magnitude of such demand reduction would require a collective and simultaneous deployment of these solutions at unprecedented speed and scale. Moreover, non-EU countries in Europe have also taken measures to reduce demand by over 3 bcm, which would close the above mentioned potential 40 bcm supply-demand gap.

2. **Continue optimising the use of existing infrastructure and implement the remaining gas infrastructure priority projects:** Considering the changing pattern of natural gas imports and cross-border gas flows, the European Union and its Member States should continue optimising the use of existing infrastructure and carefully assess future-proof gas infrastructure requirements in close coordination with relevant stakeholders, while avoiding carbon lock-in effects and stranded assets.
3. **Enhance solidarity with the Eastern Neighbourhood of the European Union:** Upholding energy security and sovereignty in Ukraine, Moldova and other resource-limited countries in the region requires that allies around the world are able to stand firm and enhance cooperation and coordination, including on gas and energy supply security. There is a continued need to assess the solidarity gas needs in particular of Ukraine and Moldova and enhance interconnectivity and infrastructure co-use with the European Union.
4. **Enhance market transparency and facilitate data exchange on energy supply security security among IEA members and likeminded countries:** The current global energy and gas crisis requires the establishment of a closer and more regular dialogue between responsible energy producers and consumers. This should be underpinned by enhanced market transparency, a regular exchange of data and close monitoring of natural gas supply security.

Without implementing these policy measures, the European and global gas market could face renewed period of supply-demand tensions, coupled with heightened price volatility through 2023, and an increased risk of gas supply shortages over the 2023/24 winter season. Considering the increasingly globalised nature of the gas market, increased gas demand in the European Union or other regions of the world could, undermine gas and electricity supply security in other, more price sensitive markets. **This is why joint efforts, including among IEA members and with other likeminded countries, are needed to reduce stress on the global gas markets.**

The gas supply shock of 2022

Russia's steep gas supply cuts to the European Union put an unprecedented pressure both on the European and global gas markets, triggering a global gas crisis. Russia's piped natural gas exports to OECD Europe fell by an estimated 49% (or 82 bcm) y-o-y in 2022, to their lowest level since the mid-1980s. Whilst deliveries to the Republic of Türkiye declined by 15% y-o-y, gas supplies to the European Union more than halved -translating into a drop of 78 bcm compared to 2021.

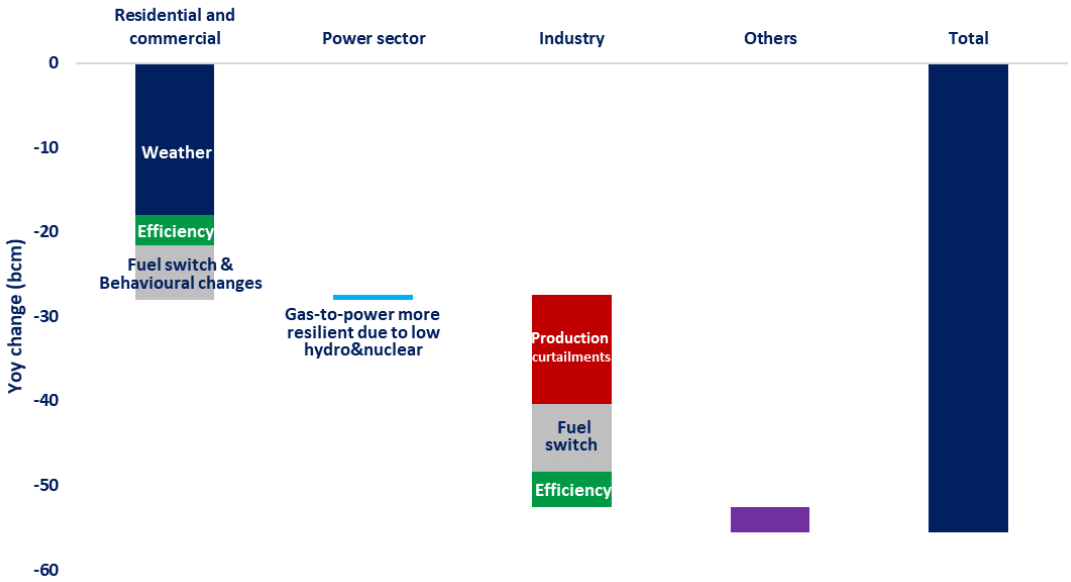
The steep drop in Russian gas supply drove up European hub prices, and indirectly Asian spot LNG, to all-time highs in 2022. In Europe, TTF spot prices averaged at a record high EUR 120/MWh (USD 38/MBtu) in 2022 –almost eight times their five-year average during 2016-2020. Gas prices rose to their highest level in Q3, as the steep decline in Russian piped gas coincided with higher gas burn in the power sector and strong storage injections. Month-ahead prices on TTF spiked to an all-time high of EUR 340/MWh (USD 99/MBtu) at the end of August. All-time high gas prices in Europe put upward pressure on Asian spot LNG prices, which averaged at USD 34/MBtu in 2022 –their highest level on record and more than five times their five-year average during 2016-2020. The strong increase in gas prices led to record high electricity prices across the European Union. In Germany, electricity month-ahead prices averaged at over EUR 280/MWh –more than seven times their five-year average during 2016-2020.

Flexible US LNG played a crucial role in mitigating the shortfall in Russian piped gas supply. LNG inflows into the European Union rose by 70% or 55 bcm in 2022 compared to the previous year –almost twice the increase in global LNG production. The strong price signals provided by the European hubs led to a **reconfiguration of global LNG flows towards the European Union**, primarily spot and destination-flexible LNG from more price sensitive markets. Lower LNG deliveries **deteriorated electricity supply security in South Asian markets** – including in Bangladesh and Pakistan where load shedding schedules were introduced through 2022. The strong LNG inflow into Europe was partly enabled by **an unprecedented drop in China's LNG imports**, which declined by 21% (or 22 bcm) in 2022 –which was primarily due to lower procurements on the high-priced spot market.

Record high prices depressed natural gas demand in 2022. Latest estimates indicate that global gas consumption fell by over 1% (or 55 bcm) in 2022, primarily due to lower demand in the key importing markets of the Asia Pacific region and Europe. China's natural gas demand fell by 0.7% (or 2.5 bcm) –for the first time since 1982. Slower economic growth, covid-induced lockdowns and price-driven

gas-to-coal switching weighed on China's natural gas demand. Japan's and Korea's gas demand remained broadly flat, while India's gas consumption declined by 4% amidst lower gas use in power generation, refining and the petrochemicals sector. **In the European Union, natural gas consumption fell by an estimated 13%** (or 55 bcm) in 2022 compared to 2021 –its steepest decline in absolute terms in history. Distribution-network related demand fell by an estimated 17% (or 28 bcm) in 2022, accounting for over half of the total reduction in gas consumption. Milder weather conditions weighed on space heating requirements, while record high prices incentivised fuel-switching and energy efficiency measures in the residential and commercial sectors. Heating degree days (HDDs) were 12% below their 2021 levels driving down gas demand in the residential and commercial sectors by around 18 bcm. Energy efficiency improvements, together with fuel-switching dynamics and behavioural changes reduced gas use in buildings by an estimated 10 bcm. Gas demand in industry fell by 25% (or 25 bcm) in 2022. **Production-curtailments across the most gas- and energy-intensive industries accounted for around half of the decline**, fuel-switching (primarily towards oil products) for an estimated 30%. A combination of efficiency gains, import substitutions and weather effect explain the remainder of the decline. Gas use in the power sector remained flat in 2022 despite lower electricity demand and gas-to-coal switching, as low hydro and nuclear power generation supported gas-fired generation.

Estimated year-on-year change in natural gas demand in the European Union in 2022



Source: IEA analysis based on various market data, including transmission system operators.

Despite the steep decline in Russian piped gas, storage injections reached a record of over 70 bcm during the April to mid-November period. Unseasonably

mild weather in October and the first half of November effectively delayed the start of the European heating season by one month, allowing for a 4 bcm of gas injections between mid-October and mid-November –a period when storage sites typically turn to withdrawals. Inventory levels reached 95% of their working storage capacity by mid-November and closed the calendar year standing at 20% (or 14 bcm) above their five-year average. This progress was tremendously encouraging, but we should note that the ability to repeat this accomplishment for next winter could be hindered by the reduced availability of Russian piped gas to inject into storage.

Major European initiatives already taken to ease strains on gas markets

Alongside the broader structural changes targeted by the Fit for 55 package and the REPowerEU plan, there have been a number of additional initiatives and infrastructure projects put in place over the past year that seek to increase the resilience of European gas markets that the IEA supported with its 10 point plan:

- **Introduction of minimum gas storage obligations:** The European Union adopted a new storage regulation in June 2022, according to which storage sites have to be filled to at least 80% of their capacity before the winter of 2022-23, and to 90% ahead of all following winter periods. Several EU Member States adopted more stringent regulations, aiming for filling targets above 90%.
- **A regulation on co-ordinated demand reduction measures for gas:** This targets a 15% voluntary reduction in EU gas demand between 1 August 2022 and 31 March 2023, compared with its five-year average. The reduction target could become mandatory in case the European Union would trigger the EU alert crisis level.
- **Energy diplomacy**: the European Union intensified its international outreach to strengthen energy partnerships with key natural gas and LNG suppliers, including Algeria, Azerbaijan, Norway and the United States.
- **Joint Gas Purchasing Mechanism** adopted in December 2022 will facilitate a better coordination of joint gas purchases through a two-step process, including demand aggregation and voluntary participation in joint purchasing. Besides the European Union, the joint purchasing mechanism is open to participation of companies from Energy Community Contracting Parties.
- **Enhanced solidarity:** the Council adopted in December 2022 new default rules for sharing natural gas amongst EU member states in case of a genuine emergency. The default rules will step in only if member states have not concluded bilateral agreements setting the modalities of solidarity.
- **New floating storage regasification units (FSRUs) and the expansion of existing regasification terminals** will allow the European Union to have 25%

more regasification capacity in 2023 than in 2021 (an increase of around 40 bcm on an annualised basis).

- **Several interconnectors were commissioned** ahead of the 2022-23 heating season that facilitated internal gas flows and diversification of gas supply, including between Central and South-Eastern European countries that have historically had a higher reliance on Russian pipeline gas.
- **Faster deployment of renewables**. As part of the REPowerEU Plan, the European Commission has proposed an increase of the EU's 2030 target for renewables to 45%. The EU has adopted emergency measures to accelerate permitting of renewables.
- **The electricity emergency measures**, including reduction of electricity in peak hours, which led among other positive impacts to the reduction of gas use for electricity production and reduce pressure on prices.

Global gas supply-demand balance in 2023: base forecast

Unseasonably mild weather since the start of the European heating season, together with continued strong LNG inflow and high inventory levels put downward pressure on European and Asian spot prices, averaging at EUR 60/MWh (USD 20/MBtu) since the beginning of 2023. Nevertheless, **global gas supply is set to remain tight** in 2023 and the global balance is subject to an **unusually wide range of uncertainties**.

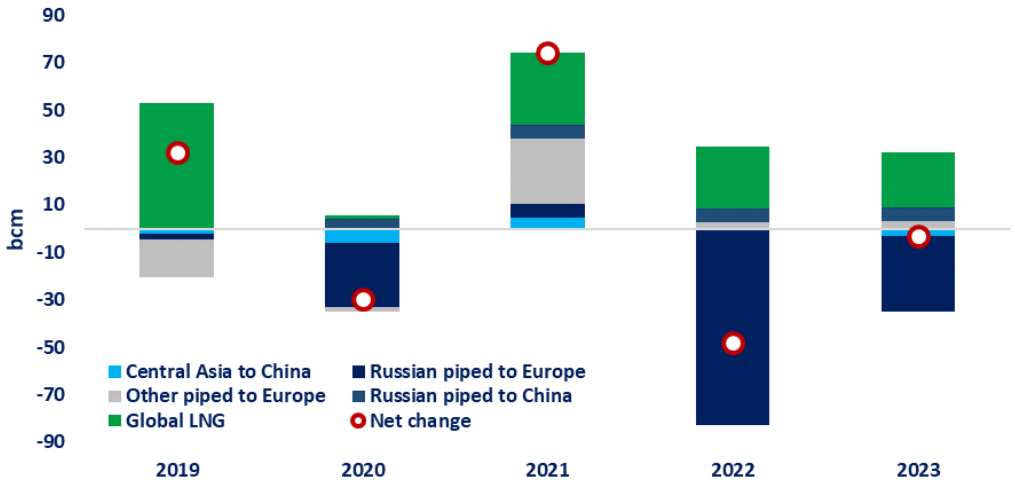
According to IEA's forecast, **global gas demand is expected to remain broadly flat in 2023**, with growth almost entirely concentrated in the gas-rich Middle Eastern markets and the Asia Pacific region. Gas demand in North America, Europe and Eurasia is expected to decline in 2023. **In Asia, gas demand is expected to increase by close to 3%**, primarily driven by China and India. Natural gas demand in **China** is forecasted to grow by 6.5% (or 24 bcm) in 2023, driven by the expected recovery in economic activity following the easing of Covid-19 lockdown restrictions. In **India**, total gas consumption is projected to increase by 3%, driven by higher gas burn in the power sector and continuing—albeit slow—growth in the industrial and city gas sectors. In **Japan**, gas demand is expected to decrease by nearly 4% amidst growing solar and higher nuclear output (thanks to additional restarts and improving operating rates of already restarted units). **Korea**'s natural gas demand in 2023 is projected to decrease by

another 2%, driven by lower gas burn in the power sector amidst the start-up of 2.1 GW of new coal-fired capacity, the restart of the 1 GW Hanbit 4 nuclear unit after and the commissioning of the 1.4 GW Shin Hanul 1 nuclear block scheduled for H2 2023.

Natural gas demand in the European Union is expected to decline by close to 3% (or 10 bcm) in 2023 compared to 2022 to 350 bcm. This will be entirely **driven by lower gas-to-power demand**, declining by almost 20% compared to 2022. Continued expansion of wind and solar power generation capacity is expected to reduce gas burn in the power sector by around 12 bcm. Hydro power generation is assumed to recover to its five-year average, further reducing gas-to-power demand by 8 bcm. In the case of nuclear, higher French generation in 2023 is set to be largely offset by reductions in Germany and plant closures in Belgium (Doel 3 in September 2022 and Tihange 2 in February 2023). We estimate that EU nuclear power generation will increase by around 2% (or 10 TWh) in 2023, leading to gas savings of 2 bcm. **We do not expect further gas-to-coal switch during 2023 in the European Union,** despite higher available coal capacity in some countries, mainly Germany, as higher nuclear and renewable generation will reduce the opportunities to dispatch coal plants. In this regard, our analysis shows that gas demand for power is very elastic to gas prices as long as there is available coal –and oil- capacity. High emission allowances prices benefit gas versus coal in the merit order even at relatively high gas prices, which could in fact reduce coal –and oil- power generation in 2023 compared with 2022. However, when there is no available capacity of coal and oil, gas demand is very inelastic to gas prices as it remains as the main source of flexibility. That was the case during a big part of last year amid restricted nuclear and hydro output, in which despite extremely high gas prices, demand for power increased. The steep drop in natural gas prices since the second half of December 2022 is expected to support gas demand in industry. Considering recent price trends along the forward curve, **industrial gas use is expected to increase** by 13% in 2023. In contrast, with the “How to Avoid Gas in the European Union” Report, this forecast does not assume continued gas-to-oil switching in the industrial sector, amidst the improving competitiveness of natural gas vis-à-vis oil products in industry. Assuming a return to average weather conditions through the rest of 2023, natural gas demand in the **residential and commercial** sectors is expected to increase by 3%.

Global natural gas supply is expected to remain tight in 2023: the incremental LNG supply is 2023 won’t be sufficient to offset the expected drop in Russia’s piped gas supplies to the European Union.

Year-on-year change in global LNG supply and key pipeline gas supplies (2019-2023)



Source: IEA analysis based on various market data, including customs data, transmission system operators.

Global LNG supply is expected to increase by 4.5% (or 23 bcm) in 2023. The United States alone will account for half of the incremental supply, supported by the ramp-up of the Calcasieu Pass LNG terminal and the return of of Freeport LNG. In addition to the United States, LNG supply from Africa is projected to increase by close 10 bcm, amidst improving feedgas availability in Algeria and Egypt, and the ramp-up of the Coral South and Congo FLNG plants.

In our base case, **LNG inflows into the European Union will increase by around 9%** (or 11 bcm) compared to 2022 to 140 bcm in 2023–although this is assuming a moderate recovery of 3% in Asian LNG imports. Higher LNG uptake will be facilitated by newly commissioned FSRU-based regasification plants in the Netherlands, Finland and Germany.

Russian piped gas deliveries to the European Union will decline by around 35 bcm in 2023 to just 25 bcm. This is assuming natural gas flows via TurkStream and Ukraine will continue at the average flow rates observed in December 2022.

Non-Russian pipeline suppliers to the European Union have limited upside potential, projected to remain flat year-on-year. Natural gas production is expected to increase by just 1 bcm from 121 bcm in 2022 to 122 bcm in 2023. Hence, **Norwegian piped gas flows** to the European Union are expected to remain broadly flat. Similarly to Norway, **Azeri gas deliveries** via the TAP pipeline were close to nameplate capacity in 2022 and are expected to increase by less than 1 bcm in 2023. In the case of **Algeria**, some limited upside is expected with the development of gas fields in the Berkine South basin. Pipeline imports from

the **United Kingdom** are assumed to marginally decline by from their historic highs reached in 2022, amidst tighter price spreads between NBP and TTF.

Domestic natural gas production in the European Union is expected to decline by around 5% in 2023. In **the Netherlands**, Groningen gas production has been capped at 2.8 bcm for the Gas Year 2022/23 (down from 4.5 bcm during the previous Gas Year) and extraction at the field is due to cease completely by 2024 at the latest. In **Romania**, natural gas production is set to increase from the Midia Gas Development project and from the Doina and Ana offshore fields– offsetting the declines from more mature fields. In **Denmark**, the return of the Tyra field was delayed into late 2023 or early 2024. The field was in redevelopment since 2018 and will supply 2.8 bcm each year to the European market once operational.

Russia's natural gas deliveries to China via the Power of Siberia pipeline system are set to ramp-up by over 40% from 15 bcm in 2022 to 22 bcm in 2023. **Pipeline imports from Central Asia** are expected to marginally decline amidst weak upstream deliverability in Uzbekistan and Kazakhstan.

Key exogenous risks in 2023

The global and European natural gas balance is subject to an unusually wide range of uncertainties in 2023. If not mitigated through a proper set of measures, these exogenous risks can break the fragile balance described in the previous section. This would lead to higher-than-expected price levels, further damage the economy and drive up demand for more polluting fuels.

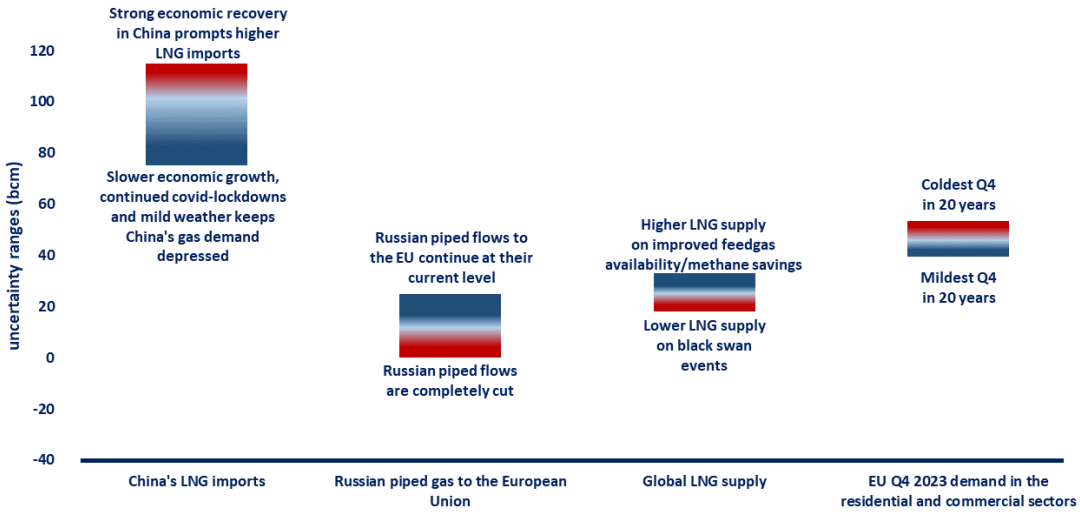
Four key exogenous risks should be considered:

- **China's LNG appetite**: Our base forecast anticipates China's LNG imports to increase by 10% (or 8 bcm) to reach 94 bcm in 2023, although this is subject to a wide range of uncertainty. Our analysis indicates that a set of only moderately bearish assumptions on total gas consumption, domestic production and pipeline gas imports could depress LNG demand by another 12% (10 bcm) in 2023, whereas a confluence of modestly bullish conditions could boost China's LNG intake by 35% (30 bcm) to well-above the previous peak in 2021. The total uncertainty range is about 40 bcm.
- **Russia's behaviour**: Russian piped gas supplies to the European Union further declined since the beginning of 2023 (recording a 35% drop in January 2023 compared to December 2022 levels) and could cease

entirely. This would be 25 bcm lower than the supply assumed in our base case and would result in a year-on-year drop of 58 bcm in gas supply to the European Union.

- **Global LNG supply** is expected to increase by 23 bcm in our base case. We estimate that the development of small-scale LNG projects and the improved availability of feedstock gas to existing facilities –including via enhance methane savings- could result in an additional 10 bcm of LNG supply in 2023. Conversely, unplanned outages could limit the growth in new LNG supply to well below 20 bcm in 2023. The possibility of unexpected outages is heightened by high utilisation levels of available capacity in recent years, alongside postponed maintenance at some facilities.
- **Weather conditions in Q4 2023:** considering the temperature-sensitivity of natural gas demand in the residential and commercial sectors, colder than average temperatures in Europe and/or northeast Asia could further tighten up the global gas market at the end of 2023. Our analysis indicates that if Q4 2023 would display similar temperature patterns as in 2010 (the coldest Q4 in the last two decades) distribution-network related demand would be 10 bcm higher than in our base case. In contrast, if heating degree days drop to a similar level as in 2006 (the mildest Q4 in two decades), distribution network-related demand would be 4 bcm below our base case.

Uncertainty ranges of key exogenous risks to the European and global gas balance in 2023



Notes: red indicates a tightening of the global/European gas balance. Blue indicates loosening of the gas balance.

The scenario underpinning the “How to Avoid Gas Shortages in the European Union” Report was constructed around a combination of the above highlighted risks and uncertainties:

- **A complete cut of Russian piped gas deliveries** to the European Union, starting from the beginning of 2023;
- **Recovery in China’s LNG imports close to their 2021 levels** (108 bcm), in line with the country’s growing exposure to long-term LNG contracts. China’s LNG contracts are set to increase by 13 bcm/yr in 2023 to close to 110 bcm/yr. This provides China with the opportunity to increase its LNG imports without incremental procurements from the spot market and
- A recovery in Chinese LNG import demand would limit LNG availability to European buyers. The **European Union LNG imports would increase by just 7 bcm**under this scenario.

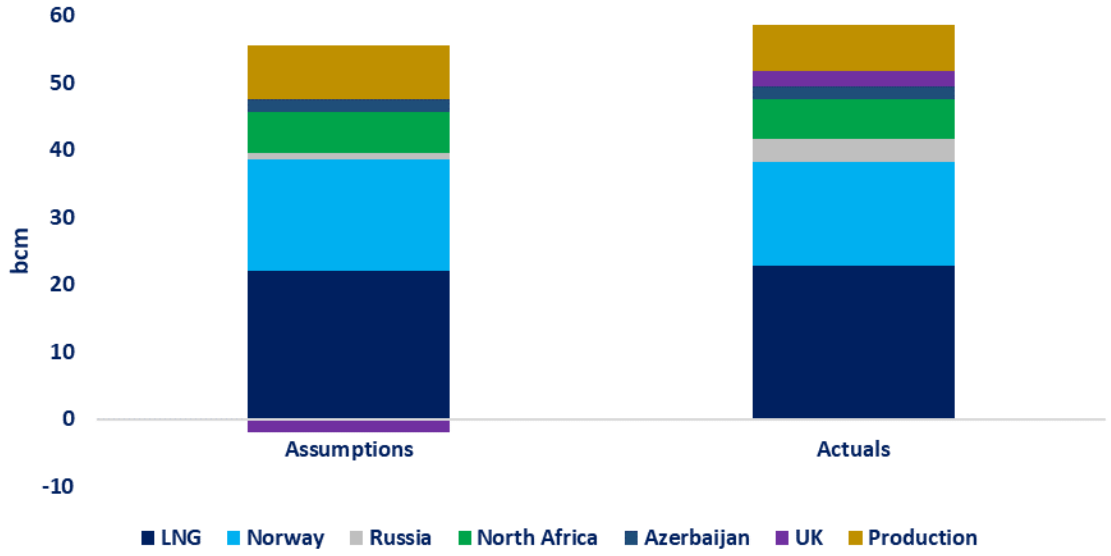
Taking into consideration these risks, and assuming at the time that EU gas storage facilities would be around one-third full at the beginning ofthe 2023 filling season, the 2022 “How to Avoid” Report identified **a potential supply-demand gap of 57 bcm in 2023**. This included 12 bcm of natural gas exports to Ukraine and Moldova, necessary to refill gas storages to adequate levels and ensure gas supply security in the case of full cessation of Russian piped gas flows.

Update of the gap analysis

The supply-demand gap identified in the “How to Avoid Gas Shortages in the European Union” Report is dynamic by nature. It evolves depending on recent supply and demand dynamics, change in price trajectories and inventory levels. The following section provides an update of the European Union’s gas supply-demand balance under a stress case, reflective of recent market dynamics.

Natural gas supply to the European Union was 5 bcm higher than modelled in our scenario for the mid-December 2022 – mid-February 2023 period. Russian piped gas flows did not cease entirely by the start of 2023, although flow rates dropped by 35% in January 2023 compared to their December 2022 levels.

Natural gas supply to the European Union over mid-December 2022 to mid-February 2023 (modelled vs actuals)



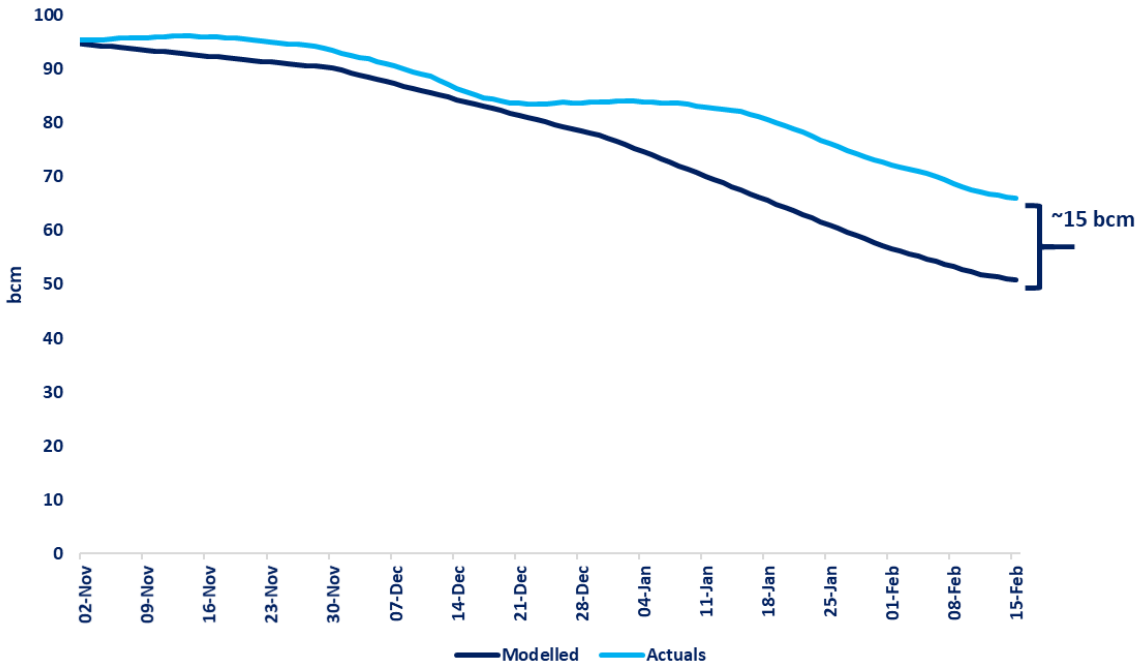
Source: IEA analysis based on various market data, including transmission system operators.

Indirect LNG imports from the United Kingdom to the European Union continued over mid-December to mid-February period –reversing the usual pattern when the United Kingdom imports natural gas from Continental storage sites during winter. Direct LNG inflows and pipeline imports from Azerbaijan and North Africa are broadly aligned with modelled flow levels. Norwegian piped deliveries to the European Union were 1 bcm lower than modelled –primarily due to lower nominations and a series of unplanned outages at key export infrastructure.

Natural gas consumption in the European Union fell 10 bcm more than expected over the mid-December to mid-February 2023 period. We estimate that milder weather conditions –lower heating degree days and stronger wind speeds- explain around two-thirds of this downward trajectory. The remainder one-third can be partially attributed to improving energy efficiency, higher wind power output and behavioural changes.

The combination of stronger supply and lower-than-expected demand reduced significantly the call on gas storage withdrawals, which stood 33% below their five-year average during the mid-December to mid-February 2023 period. As of mid-February inventory levels stood 40% (or 20 bcm) above their five-year average and **15 bcm above the storage levels modelled** in the analysis underpinning our “How to Avoid Gas Shortages in the European Union” Report.

EU natural gas storage levels as of mid-February 2023 (modelled vs actuals)



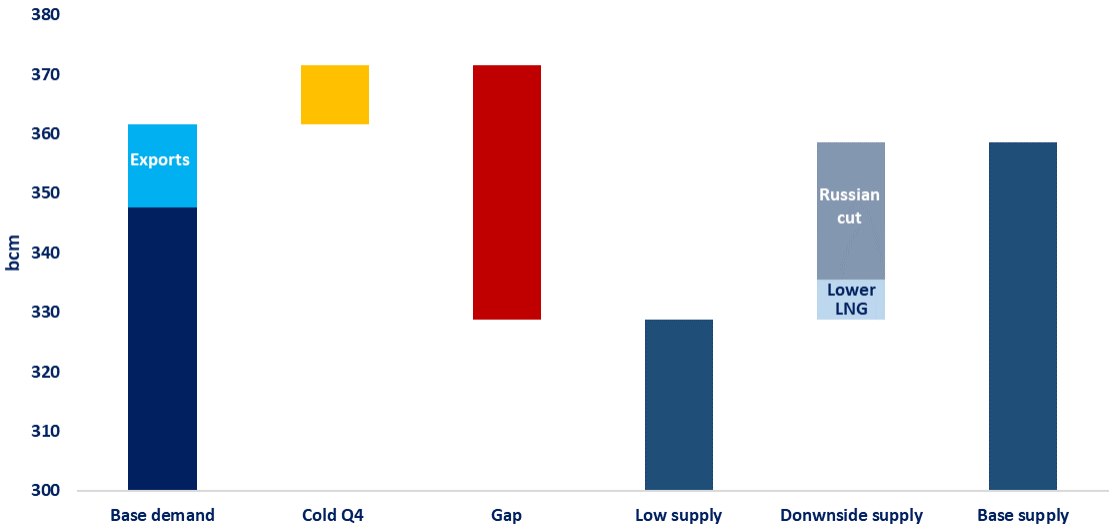
Source: IEA analysis based on Gas Infrastrucure Europe (2023), Aggregated Gas Storage Inventory.

Higher inventory levels are moderating down the initial supply-demand gap of 57 bcm to around 40 bcm, under a stress case. The stress case is based on the following assumptions:

- **a complete cessation of Russian piped gas** deliveries to the European Union after mid-February 2023;
- **limited LNG availability of incremental LNG** to the European Union (amidst a recovery of China's LNG imports to their 2021 levels), resulting in just 4% (or 5 bcm) of additional LNG imports;
- **a cold Q4 2023** displaying the lowest temperature patterns in two decades and increasing Q4 2023 demand in the residential and commercial sectors by 10 bcm above our base case;
- **non-Russian pipeline imports** are assumed to remain close to their 2022 levels, while domestic **EU gas production** is projected to decline by 5% compared to 2021;
- **EU gas demand is aligned with our base forecast** and includes a Q4 displaying the coldest temperatures in two decades;

- the stress test also assumes **10 bcm of exports** from the European Union **to Ukraine and Moldova**.

Potential natural gas balance of the European Union in 2023 in case of full cessation of Russian flows, limited LNG availability and cold Q4 2023



Policy actions to mitigate exogenous risk factors

Since the publication of our Report in mid-December 2022, the prevailing tensions on the European Union's gas supply-balance have moderated. Supply has been stronger than expected, while demand was significantly lower than projected, primarily due to milder weather conditions but supported by stronger policy actions already taken by EU member countries. Inventory levels standing well-above their five-year average provide cautious optimism for the remainder of the 2022/23 heating season, while the prospect of lower injection needs might reduce market tensions over the 2023 summer season.

This improved outlook should not be a distraction from the further measures necessary to mitigate the European Union's exposure to the exogenous risks identified in the previous sections and to reduce natural gas demand in a structural manner.

The following section identifies **four key policy measures** to enhance the European Union's and its Eastern neighbourhood's natural gas supply security. European Union member countries have already started to implement those measures and they have shown certain effects in reducing gas demand and strengthening gas supply infrastructures. Without further implementing these policy measures in a more robust manner, the European and global gas market could face a renewed period of supply-demand tensions, coupled with heightened price volatility through 2023, and an increased risk of gas supply shortages over the 2023/24 winter season. Considering the increasingly globalised nature of the gas market, increased gas demand in the European Union or other regions of the world could undermine gas and electricity supply security in other, more price sensitive markets. This is why joint efforts, including among IEA members and with other likeminded countries, are needed to reduce stress on the global gas markets. Policies should be carefully crafted, in a manner that short-term imperatives do not undermine longer term policy goals.

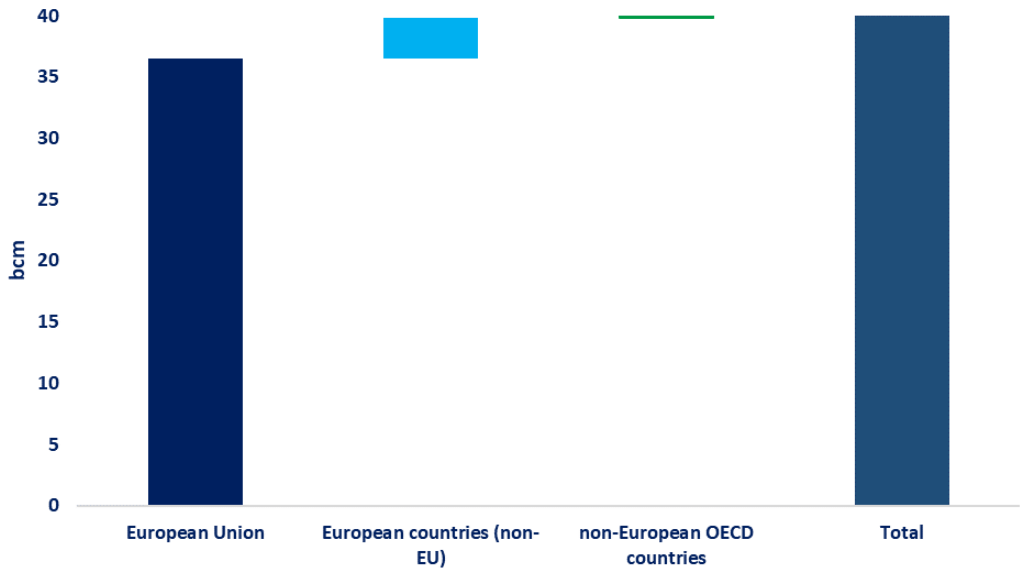
The TFG should play an ongoing role in supporting IEA analysis and revised scenarios with up-to-date data to ensure future shocks, wars and disasters do not trigger further energy crises across the globe. IEA countries and partners are more resilient and secure as a result of faster adoption of IEA Net Zero transition policies and measures, among other action.

1. Reduce natural gas demand in a structural manner

As noted above, the EU and its member states have been taking aggressive action to ease strains on gas markets. Analysis by the members of the IEA's Task Force on Gas Market Monitoring and Supply Security (TFG) suggests that **the European Union could potentially reduce its natural gas demand by close to 37 bcm in 2023** through improving energy efficiency, continued expansion of renewables power generation, deployment of heat pumps and behavioural changes, recognizing that this magnitude of gas savings assumes collective and simultaneous deployment of these solutions at unprecedented speed and scale. However, that gas gap would not affect all regions of the EU equally, so the greatest efforts of solidarity should be focused on those regions where gas scarcity is more likely or in by gas systems able to contribute to a greater extent to the collective effort, due to having greater interconnection capacity or greater gas savings potential.

Reduced demand outside the European Union would alleviate tensions on the global LNG market and could potentially improve the LNG availability to the European Union. Analysis by the members of the IEA's TFG indicates that European countries outside the European Union could contribute to a 3 bcm reduction in natural gas demand in 2023, while non-European OECD countries would reduce their demand by 0.5 bcm through a combination of enhanced energy efficiency measures, expansion of renewables power generation and behavioural changes.

Potential for natural gas demand reduction in 2023 in the IEA's TFG member countries



To prevent the most significant part of these energy savings coming from the production curtailment of gas-intensive industries as happened in 2022, it is necessary to deploy structural solutions that maintain economic activity and strategic autonomy in critical value chains.

Faster improvements in energy efficiency can be achieved via increased home renovations and efficient appliance sales, enhanced energy savings in public buildings and for public lighting, and by providing support for industrial energy efficiency programmes that can realise immediate savings.

- **Increase home renovations and efficient appliance sales** (lighting, insulation, controls, information, and audits), prioritising vulnerable households and the renovation of social housing to reduce energy poverty, support low-income households, and repurpose derelict and vacant buildings.

- **Expand existing programmes for quick wins** by, for example, boosting existing national renovation services; offering more financial support, through increasing public funding of grant and loan schemes for home renovation expanding Energy Efficiency Obligation schemes, increasing funding and promotion of energy management and audit schemes for SMEs and industry.
- **Accelerate the adoption of high efficiency appliances** and lighting, and increase the deployment of smart technology, actively encourage and promote the installation of smart thermostats for achieving cost-effective energy savings, through subsides, energy efficiency obligations, promotion etc.
- **Focus on public sector efficiency** to take the lead with a strong push on energy efficiency, including buildings, municipal water and wastewater services, and street lighting. Increasing the involvement of sub-national level governments, provinces and cities is an essential strategy to move energy efficiency projects and savings forward quickly.

Encourage behavioural changes is key to moderate down natural gas consumption patterns. Next to lack of awareness, access to suitable offers or lack of financing, there are often behavioural barriers. Some consumers may see the process of change (eg. improving energy efficiency of their home) as too complex and burdensome and others struggle to find the advice they can trust. Engagement strategies and behavioural campaigns should be designed to facilitate behavioural change and trigger an actual positive behavioural response to an evolving environment that combines technologies, incentives, social norms and rewards. To change consumer behaviour, consumers should have easy access to independent advice and more effective tools. For instance, promoting adjustment of heating controls in gas-heated buildings can be promoted (i.e. lowering thermostat temperatures), embedding efficiency into default settings on appliances, providing tailored energy efficiency advice (eg. one-stop-shops) or providing consumers with more accurate and frequent information on their gas consumption via faster deployment of smart meters (and especially on gas). These actions can enable consumers to reduce their gas consumption and keep their energy bills manageable. Moreover, the measures introduced by the European Union in 2022 and awareness campaigns that aim to reduce overall electricity demand and peak-demand, help to avoid gas power generation and contribute to moderation of gas demand and reduction of energy costs.

An action plan on heat pumps should be developed to increase efficiency and accelerate the electrification of heat, while phasing-out natural gas. Provide financial incentives for heat pump purchases, change tax measures that disadvantage electrification, and scale up support for industrial electrification will

be required. It will also be important to support the growth of the supply chain in terms of both equipment and qualified installers.

A more rapid deployment of renewables should be targeted reduced permitting timelines, increased investor confidence via stronger incentives and market regulation, and the continued promotion of the integration of renewables and distributed resources.

- **Accelerate permitting**: The IEA estimates that there is around 80 GW of onshore wind and 150 GW of solar PV projects (utility-scale) are under various permitting stages in the EU. Accelerating their approval would significantly benefit the gas supply-demand balance of the European Union both in the short- and medium-term. The European Commission included a Recommendation on permitting in the communication package of the REPowerEU Plan. A rapid agreement between European Parliament and the Council concerning Renewable Energy Directive (RED) amendments including permitting would accelerate the deployment.
- **Investor confidence should be promoted,** primarily via improved auction design and wider use of renewables power purchase agreements. This should include increasing the volume of already planned auctions and/or accelerate the calendar and announce additional auction rounds in the first half of 2023. Moreover, well-coordinated and transparent market design reforms can be usefully targeted to provide long term price signals and reduce consumer exposure to volatile fossil fuel prices. A stable short term ***and*** long term market framework can help avoid uncertainty among investors. A public consultation on market design is currently ongoing.
- **Promote the integration of renewables and distributed resources:** by ensuring sufficient grid capacity, both at transmission/interconnection and distribution level, to allow renewable electricity to displace gas consumption. Accelerated permitting of new grid infrastructure, alongside measures to boost transparency on grid status at the distribution level will help to ensure that renewables are deployed in areas where the network is able to integrate additional distributed resources in a timely, secure and effective manner. Improving market access and removing barriers to flexibility (storage, demand response, etc.) will also enhance the grids' abilities to absorb wind and solar power. Innovative digital solutions and eased permitting requirements, accompanied by measures to build capacity and provide financial incentives – in line with the EU Solar Strategy - will help empower consumers to both individually and collectively produce, store and share renewable energy.

The deployment of biomethane and low-emission hydrogen should be accelerated. Reducing the permitting of biomethane project approvals, ease their

access to the gas grid, and enhance support mechanisms should be short-term priorities. The **IEA's Low-emission Gases Work Programme** is ready to provide support to policy makers and facilitate dialogue with private actors.

2. Continue optimising the use of existing infrastructure and implement the remaining gas infrastructure priority projects

The European Union suffered a major gas supply shock in 2022. Russia's steep gas supply cuts lead to an unprecedented surge in LNG imports and a reconfiguration of intra-European natural gas flows. The **new pattern of gas flows** led to infrastructure bottlenecks, a decorrelation of hub prices and consequently a sub-optimal allocation of natural gas.

Thanks to the EU TEN-E policy and financial support through the Connecting Europe Facility, cohesion funds, and other instruments, several new gas pipelines, interconnectors and LNG terminals in Central-Eastern and South Eastern Europe have come online. The European Union has successfully supported enabling reverse flows on most of the existing interconnections in the region, including on those with Ukraine and Moldova. Hence, the interconnectivity of the region has improved, as the new infrastructure opened access to new regional supply sources (such as direct access to pipeline gas from the Caspian region and access to the global LNG market from the Świnoujście LNG terminal and the Krk FSRU), increased market integration, and enhanced risk preparedness and resilience even in extreme demand conditions.

Considering the changing pattern of natural gas imports and cross-border gas flows, the European Union and its Member States should **carefully assess indispensable gas infrastructure requirements** in close coordination with relevant stakeholders. This should include the following elements of gas infrastructure:

- New future-proof **gas and LNG import capacities** and/or the expansion of existing LNG terminals in markets which relied historically on Russian piped gas or are transiting regasified LNG into other markets;
- **Finalise remaining priority and future-proof cross-border interconnectors** in markets which are facing congestions and/or require further diversification to phase-out Russian piped gas imports;

- **Implement planned underground storage projects** to reflect the changing flexibility of primary natural gas supply (domestic production and imports);
- **Reverse compressor stations** to enable a closer integration between distribution and transmission networks, which is needed to ensure a better integration of biomethane into the transmission system and access to gas storage sites.

In all cases, a careful assessment will be required to avoid potential carbon lock-in effects. New infrastructure should be designed in a future-proof manner to enable the import and integration of low-emission gases (including ammonia, synthetic methane/LNG and low-emission hydrogen).

Given the clear expectation of strong electrification and electricity consumption in decarbonised economies, a stronger, well interconnected and smart electricity grid is also a priority.

3. Enhance solidarity with the Eastern Neighbourhood of the European Union

Upholding energy security and sovereignty in Ukraine and Moldova and other resource-limited countries requires that allies around the world are able to stand firm and enhance cooperation and coordination, including on gas and energy supply security. The IEA is ready to provide policy support, energy data and capacity building to assist Ukraine in its short-and longer-term challenges.

A cut-off of gas supplies from Russia would leave Ukraine and Moldova in a particularly vulnerable situation. Ukraine has been relying on a combination of physical and virtual reverse flows from the EU since it stopped importing gas directly from Russia in 2015. The cessation of transit via Ukraine would make the continuation of virtual reverse flows impossible, whilst physical reverse flows would need to be rerouted from more distant sources (e.g. LNG from the Świnoujście terminal, entailing significantly higher costs). As end of January 2023, Ukraine's natural gas inventory levels stood at 11 bcm (around one-third of the storage sites' working capacity).

Moldova is highly reliant on gas imports from Russia via Ukraine, although significant progress has been made to reduce its vulnerability. On 2 November 2022, Moldova imported, for the first time, natural gas through physical reverse flow from the Slovak-Ukraine border (5.6 million cubic meters) and on 1

December, from south to north along the Trans-Balkan corridor (4.3 million cubic meters). Moldova has no underground gas storage, although 250 mcm of gas has been reserved in Ukraine. The Ungheni-Chisinau pipeline was completed in late 2020 and enables Moldova to import some 1.5 bcm/year from Romania, well below its annual consumption of over 3 bcm (including Transnistria). Moreover, supplies from Romania would not be able to reach the breakaway region of Transnistria, where more than three-quarters of Moldova's electricity is supplied from the gas-fired MGRES power plant. This plant has 12 power units (coal, fuel oil and gas) with a total installed capacity of 2.5 GW. Of these units, only three or four are reportedly in operation, potentially limiting its fuel-switching capabilities. The configuration of Moldova's gas and power system puts the country in a very vulnerable position vis-à-vis Russia and a solidarity-related solution may be needed.

Our assessment indicates that in the case **of a full cessation of Russian piped gas deliveries,** Ukraine and Moldova would require over 10 bcm of piped imports from the European Union. This would be required to rebuild gas inventories to adequate levels and to ensure gas supply security over the 2023/24 heating season.

There is a continued need to assess the solidarity gas needs of Ukraine and Moldova and other resource-limited countries in the region, and enhance interconnectivity and infrastructure co-use with the European Union by removing regulatory obstacles, and ensuring the establishment of firm capacities at the existing interconnections between EU Member States and Ukraine. Ukraine starting a new certification process to allow gas storage operator UkrTransGaz to store EU gas stocks in its vast underground storage sites is a welcomed step.

4. Enhance market transparency and facilitate data exchange on energy supply security

The current global energy and gas crisis requires the establishment of a closer and more regular dialogue between responsible energy producers and consumers. This should be underpinned by enhanced market transparency, a regular exchange of data and close monitoring of natural gas supply security. To this end, with the adoption of the Regulation 2022/2576 the EU introduced improved rules regarding transparency of LNG terminals and storage facilities, which will be available on-line by the end of February. The EU is also improving existing congestion management measures to enable accelerated marketing of

unused long-term capacities. These measures will further improve usage of European Union's gas infrastructure and enhance accessibility to the market.

In light of the current market developments, the following steps should be taken:

- **Establishment of a Weekly Gas and LNG Storage monitor**: with data submissions from OECD Americas, OECD Asia, OECD Europe and Ukraine. Monitoring the evolution of natural gas and LNG storage levels is crucial to assess short-term gas supply security and risks ahead the next heating season.
- **Collaborate on the acquisition of essential inputs to develop data-driven tools, such as a contingency model,** to effectively defend and manage serious risks to the resiliency of European natural gas and power systems, respond to disruptions, and use for emergency response measures.
- **Share information on public policies and regulatory measures**, particularly on energy security, to facilitate coordination between members in aspects such as gas storage filling or joint purchasing of gas.
- **Regular market updates** provided by the Agency to the members of the Task Force.

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