Renewables helped the EU boost underground gas storage by 14% since start of 2022

Key findings

- The additional renewable electricity generation helped EU countries to save 14 billion cubic metres (bcm) of fossil gas[1] in 2022, corresponding to 12% of total underground gas storage (UGS) capacity, and another 2% or 2.25 bcm in January-March 2023.
- Solar and wind generated 625 TWh (terawatt-hours) of Europe's electricity in 2022, which is 22% of total electricity generation, while fossil gas generated 20%.
- Quarter-on-quarter, Europe's electricity generated from solar and wind increased by 6% from 164 TWh in 2022 to 175 TWh in 2023.
- Solar and wind generated 32% more electricity than gas during the first quarter of 2023. Wind alone generated 141 TWh of electricity, while only 119 TWh was generated from gas. In addition, solar energy generated 34 TWh.
- In 2022, the EU paid Russia EUR 57 bln for Russian pipeline gas and EUR 18 bln for LNG. During the first three months of 2023, the EU paid Russia EUR 5.1 bln for pipeline gas and LNG imports.
- Russia's energy blackmail with gas and the surge in gas prices in Europe allowed Russia to increase its gas revenues by 42% from EUR 53 bln in 2021 to EUR 75 bln in 2022. At the same time, Russia reduced its gas exports to the EU by 46%, from 156 bcm in 2021 to 84 bcm in 2022. The EU imported 10.3 bcm of fossil gas from Russia during the first quarter of 2023: 4.4 bcm via pipeline and 5.9 bcm of LNG.
- Although the winter of 2022/2023 was warmer than the preceding two winters, helping reduce gas demand, the savings from solar and wind make it possible to start the gas storage refilling for the heating season of 2023/2024 with 57% of the required stocks already in storage. Without the contribution of additional wind and solar, this share would be 43%.

[1] We use "fossil gas" throughout this briefing to refer to fossil methane, i.e. natural gas of fossil origin.

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Introduction

In 2022, the EU faced a significant challenge. As the COVID-19 pandemic ended, the Russian Federation launched a full scale invasion against Ukraine on 24 February. Russia's invasion of Ukraine also revealed threats to the EU's energy security, unveiling its high dependence on fossil gas from Russia. This dependence has not only allowed Russia to use energy as a tool to blackmail EU Member States by regulating or halting gas supply to countries that have refused to comply with the rules imposed by Russia - it has also allowed the manipulation of gas prices, which have reached unprecedented heights and also pushed up EU electricity prices.

Russia's policy has exposed the EU's energy security issues, including high dependence on a single unreliable supplier and reliance on fossil gas as an energy source. It has highlighted the need to diversify energy sources to increase reliability in supply as well as lower long-run energy production prices and reduce greenhouse gas emissions.

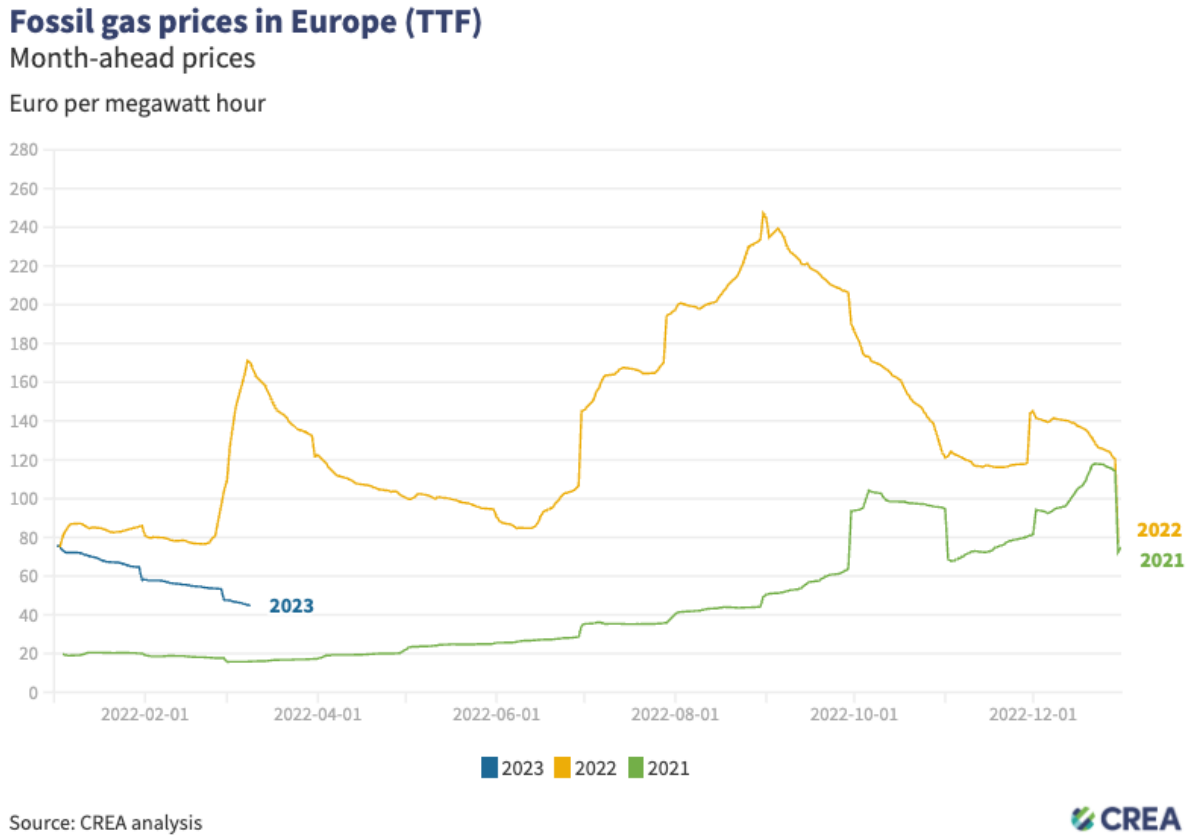
It was in 2022 and the first quarter of 2023 that solar and wind demonstrated their importance for the EU's energy security and highlighted the need to further invest in these types of energy production.

This briefing illustrates the importance of Renewable Energy Sources (RES) for the EU's energy security and how solar and wind generation has contributed to gas savings in the EU.

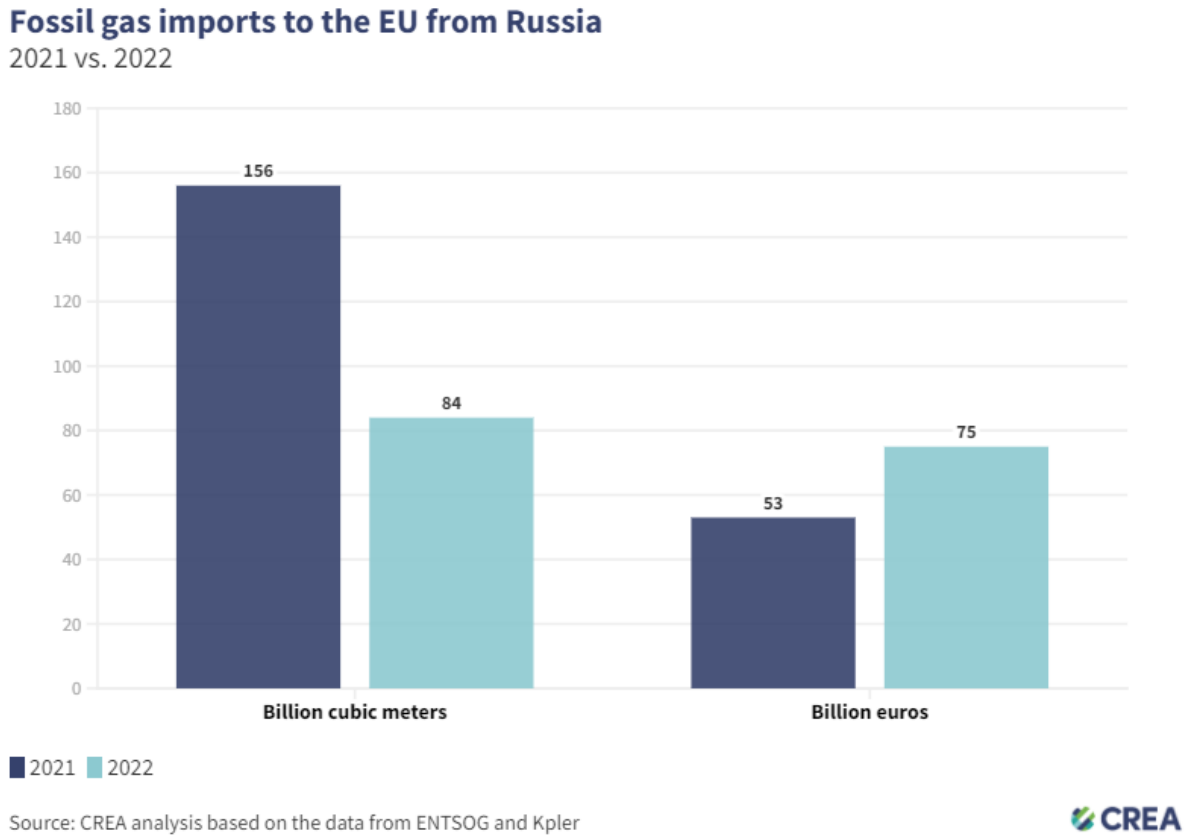
Russia's manipulation of gas supplies increased its revenues and helped finance its invasion of Ukraine

Russia's invasion of Ukraine was followed by energy blackmailing, such as the requirement to pay for gas in rubles rather than euros and gas disruptions being linked to the Kremlin, which increased prices. In August 2022, after the energy giant Gazprom stated it would halt fossil gas deliveries via Nord Stream-1, the Title Transfer Facility (TTF) day-ahead prices hit an all time record of over 300 Eur/MWh (Megawatt hour) with concerns of gas supply issues created by the Kremlin's actions.

These actions drove prices to record heights. In 2022 the average month-ahead gas price on the TTF was 221% higher than in 2021. The price shot up from EUR 42 per MWh in 2021 to EUR 135 per MWh in 2022.



In addition to the crisis, by blackmailing EU countries and threatening to cut off gas supplies, Russia has been cashing in on the price of fossil gas to finance the war it started in Ukraine. The massive spike in gas prices has allowed Russia to supplement its budget with fewer gas exports, thus financing military action in Ukraine while providing less gas for Europe. Our analysis reveals that while fossil gas imports both via pipeline and sea (LNG) from Russia to the EU fell by 46% from 156 bcm in 2021 to 84 bcm in 2022, revenues from gas increased by 42% from EUR 53 bln in 2021 to EUR 75 bln in 2022.



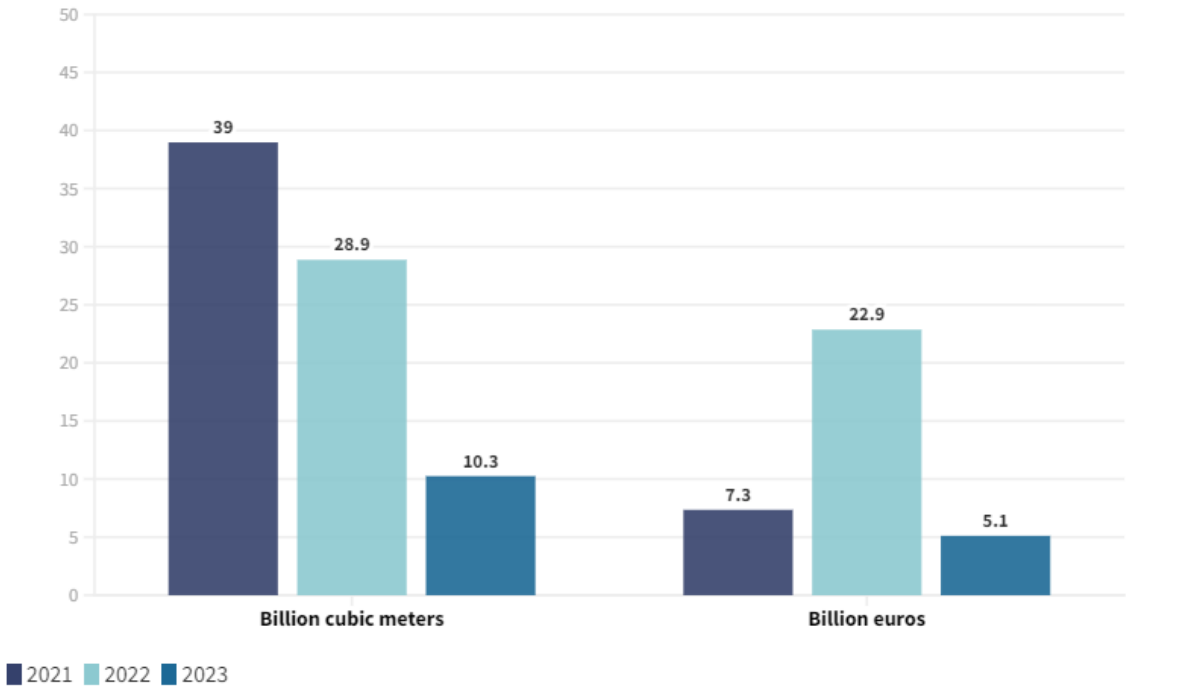
Although EU countries have imposed an embargo on crude oil and petroleum products from Russia, this embargo does not apply to pipeline gas or LNG. Therefore, in the first quarter of this year, the EU imported 10.3 bcm of fossil gas from Russia. Between January and March 2023, the EU countries paid Russia EUR 5.1 bln for gas.

A comparison of the first quarters of 2021 and 2022 shows natural gas imports to the EU from Russia fell by almost 26% from 39 bcm in 2021 to 28.9 bcm in 2022, but Russia's revenues from fossil gas rose by nearly 213% from EUR 7.3 bln in 2021 to EUR 22.9 bln in 2022. This situation is due to the rise in gas prices, which started before Russia invaded Ukraine, due to Russia's policy of stopping the gas supply from Russia via Belarus to Europe.

Compared the first quarter off 2022 and 2023, fossil gas imports into the EU from Russia fell by 64% from 28.9 bcm in 2022 to 10.3 bcm in 2023, while revenues from gas fell by almost 78% from EUR 22.9 bln in 2022 to EUR 5.1 bln in 2023.

Fossil gas imports to the EU from Russia

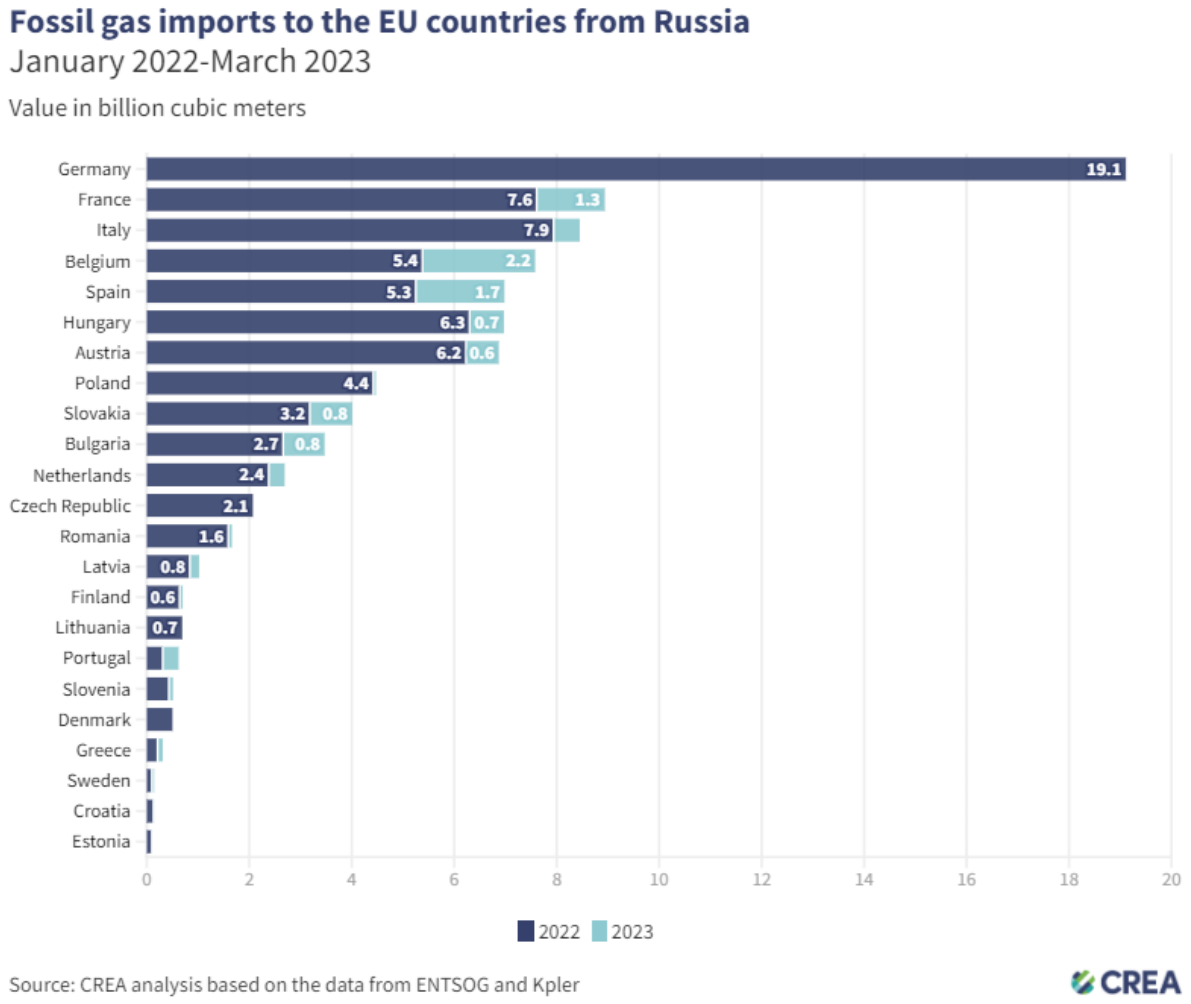
Comparison of import volumes and values during the first quarter of the year



Source: CREA analysis based on the data from ENTSOG and Kpler

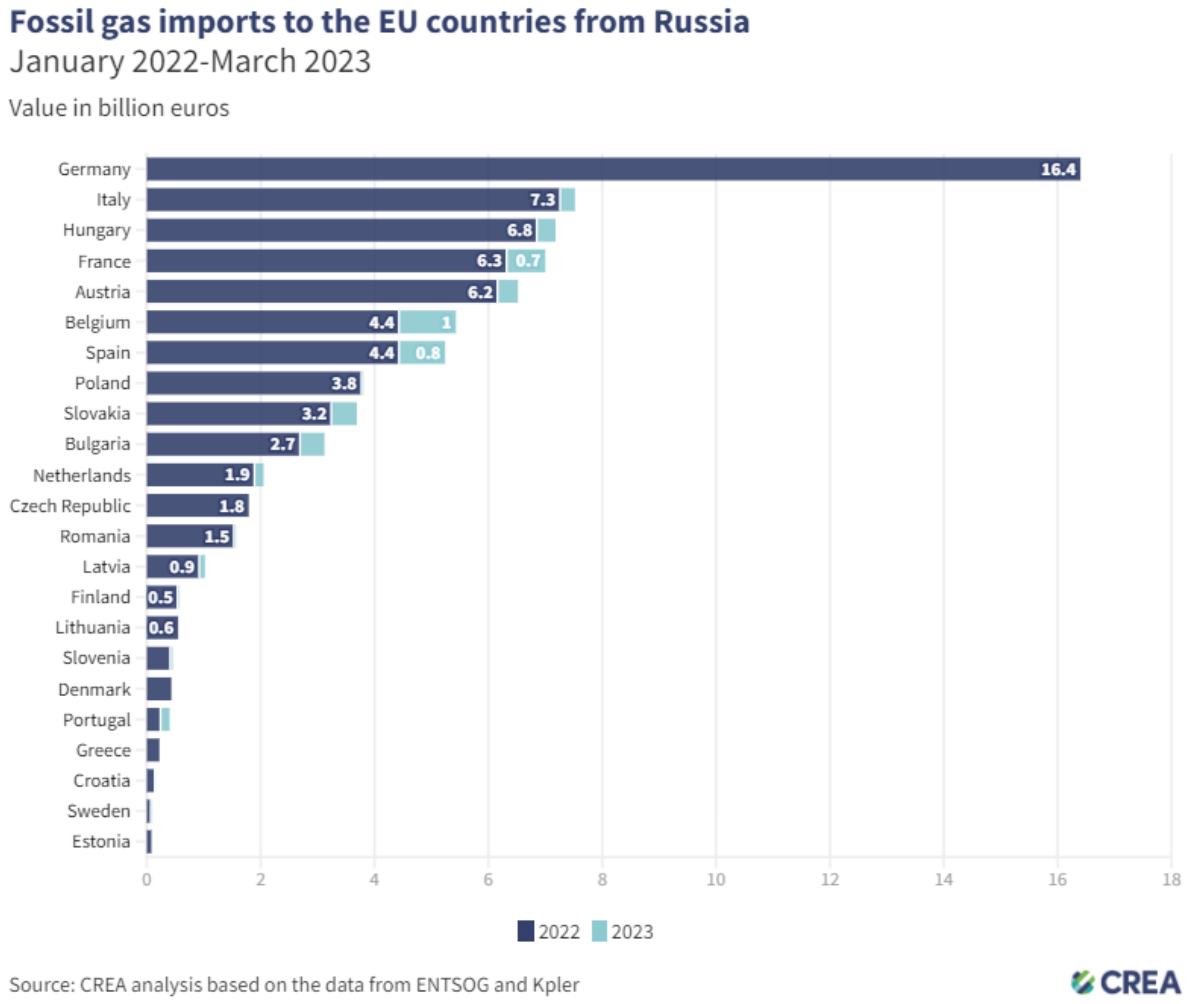
Despite Russia's blackmail of shutting off gas supplies to Europe, EU countries have been importing fossil gas from Russia, both via pipelines and LNG cargoes. In 2022 among EU countries, Germany was the largest importer of gas from Russia, importing 19.1 bcm. Italy and France followed with 7.9 and 7.6 bcm of imports respectively. Hungary and Austria rounded out the top five with 6.3 and 6.2 bcm.

Many EU countries stopped importing gas from Russia in 2022, and the situation with gas imports changed during the first quarter of 2023. In 2023, the biggest importer of fossil gas from Russia was Belgium, with 2.2 bcm, followed by Spain and France, which imported 1.7 bcm and 1.3 bcm. Bulgaria and Slovakia imported 0.8 bcm each and were thus included in the EU's top 5 Russian gas importers.



Germany paid Russia EUR 16.4 bln for imported fossil gas. Italy and Hungary paid Russia EUR 7.3 bln and EUR 6.8 bln respectively. France followed with EUR 6.3 bln and Austria with EUR 6.2 bln.

In the first quarter of 2023, Belgium paid EUR 1 bln for gas from Russia. Spain and France followed with EUR 0.8 bln and EUR 0.7 bln respectively. Slovakia was the fourth largest purchaser of Russian gas, spending EUR 0.5 bln followed by Bulgaria with EUR 0.4 bln.



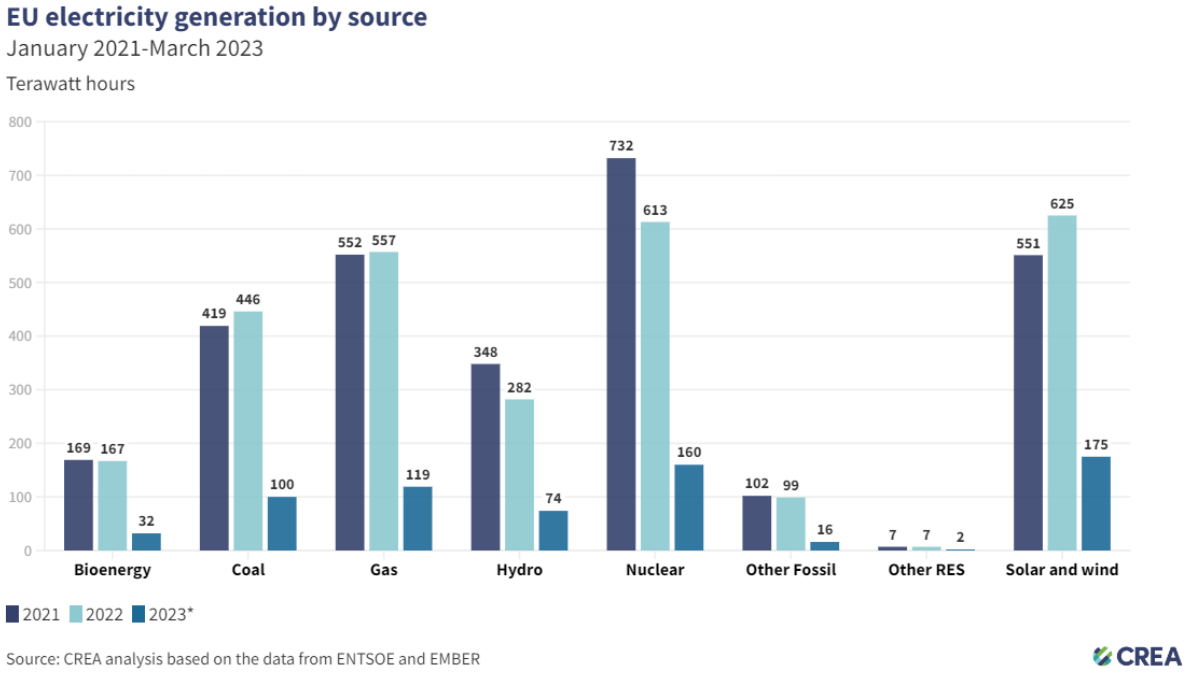
Additional solar and wind generation helped tackle the energy crisis

Price volatility has unveiled a dangerous dependence of the European gas market on a single unstable supplier. As a result, industrial companies have had to stop operating due to increased prices of gas, and electricity prices have risen to unprecedented heights, reaching EUR 650 per MWh in July 2022.

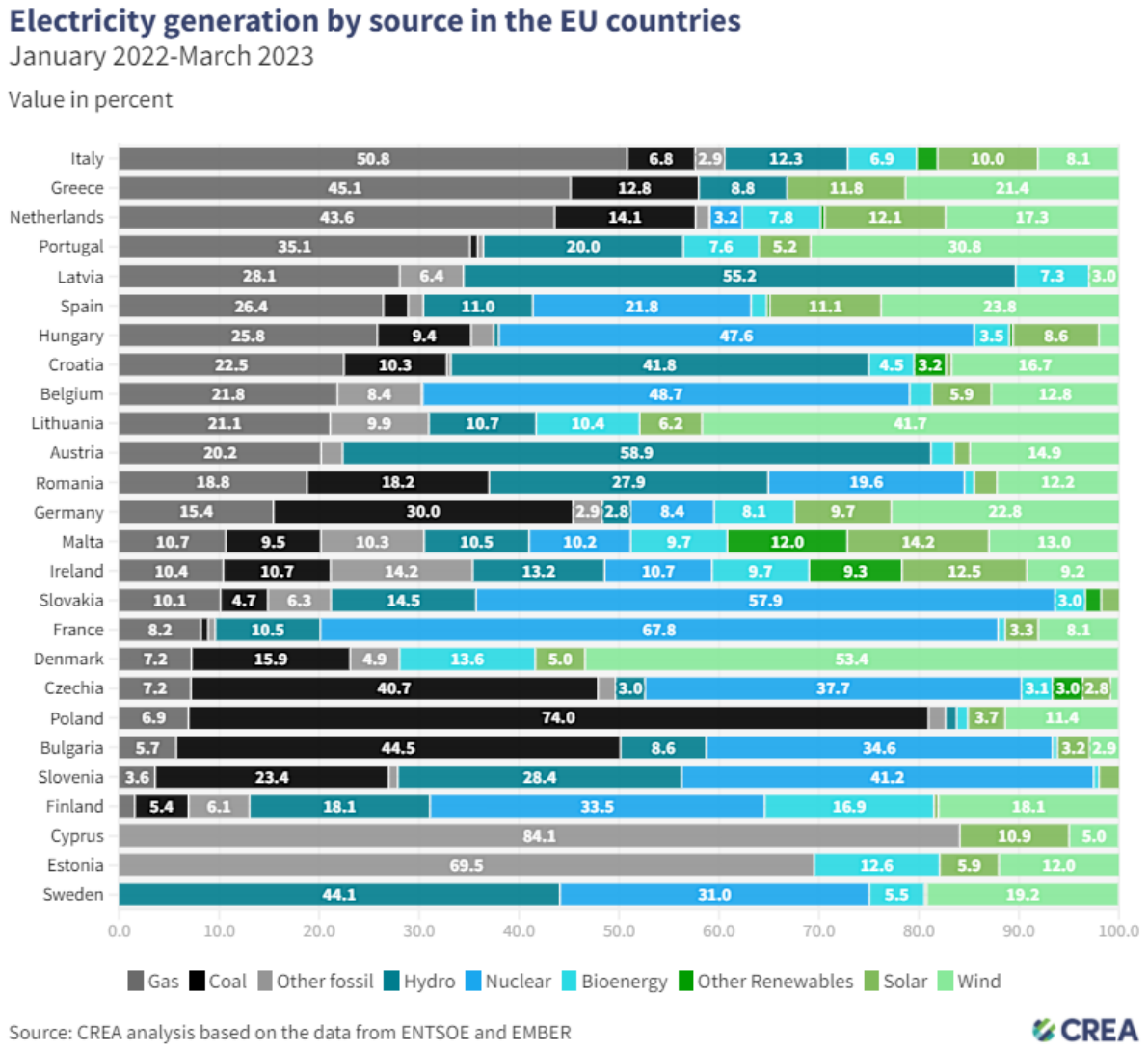
In addition, due to the challenging weather in 2022, electricity generation from hydro power decreased by 19%, and production from nuclear power fell by 17% due to technical reasons in France, and political reasons in Germany.

Some countries in the EU increased the utilisation of fossil fuels for electricity generation. With the electricity price volatility, unstable fossil gas supply from Russia, weather or technical obstacles, the landscape of electricity generation changed in 2022.

In 2022, combined solar and wind generation increased by 13% in comparison with 2021 and produced a record level of 625 TWh of electricity, or 22% of all electricity generation in the EU. For the first time, solar and wind outperformed electricity generation from fossil gas which produced 20% of Europe's total electricity production.



Year-on-year electricity generation from solar and wind increased 71TWh. This not only helped the EU countries to increase the use of renewable energy sources but also contributed to ensuring energy security. The additional 71TWh of electricity generation contributed to 14 bcm of fossil gas savings in 2022 or 12% of the total gas reserves in underground gas storages (UGS). In the first three months of this year, solar and wind generated 175 TWh, or 32% more electricity than gas, which generated 119 TWh.

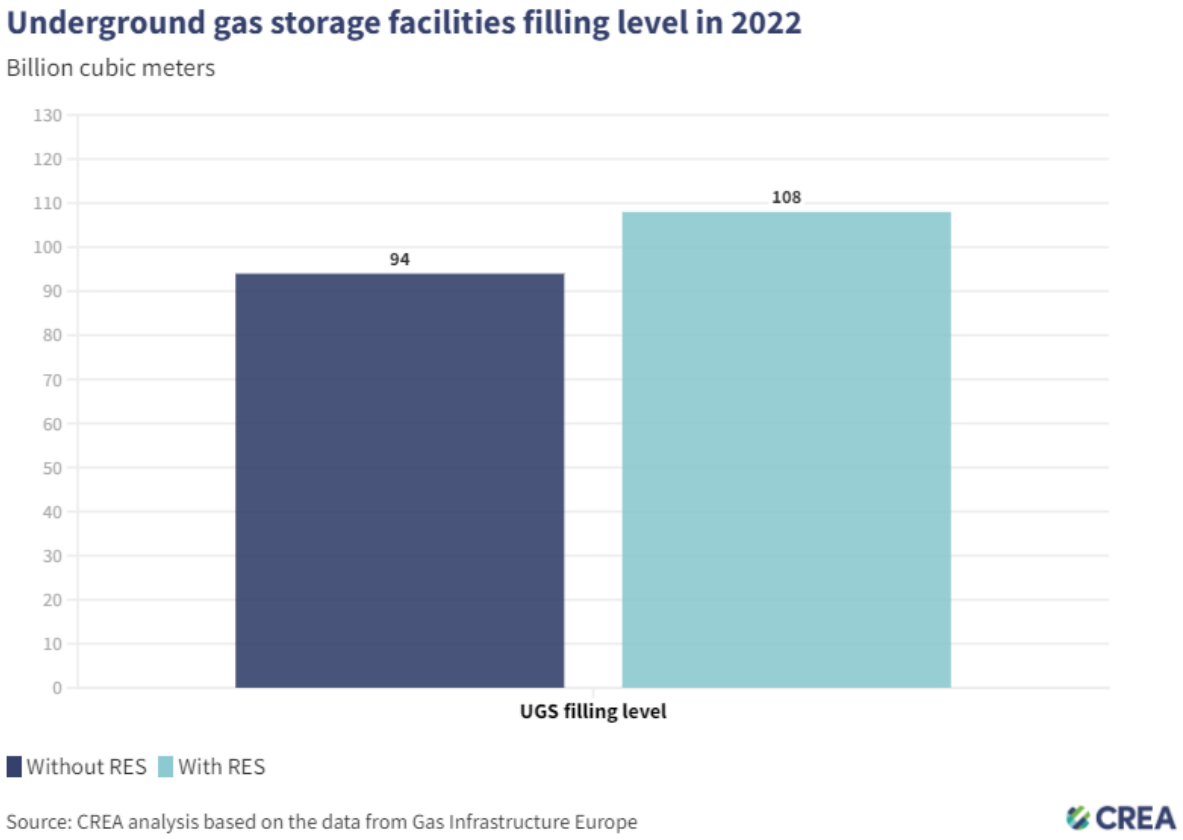


EU countries that generate electricity from fossil gas are more dependent on imports from third countries. With import disruptions, electricity generation and the entire electricity system could be at risk.

Our analysis shows that Italy generates most of its electricity from gas. Fossil gas generates as much as 50.8% of the country's electricity demand. Greece is in second place, generating 45.1% of its total electricity demand from gas. The Netherlands follows Greece, with gas generating 43.6% of electricity.

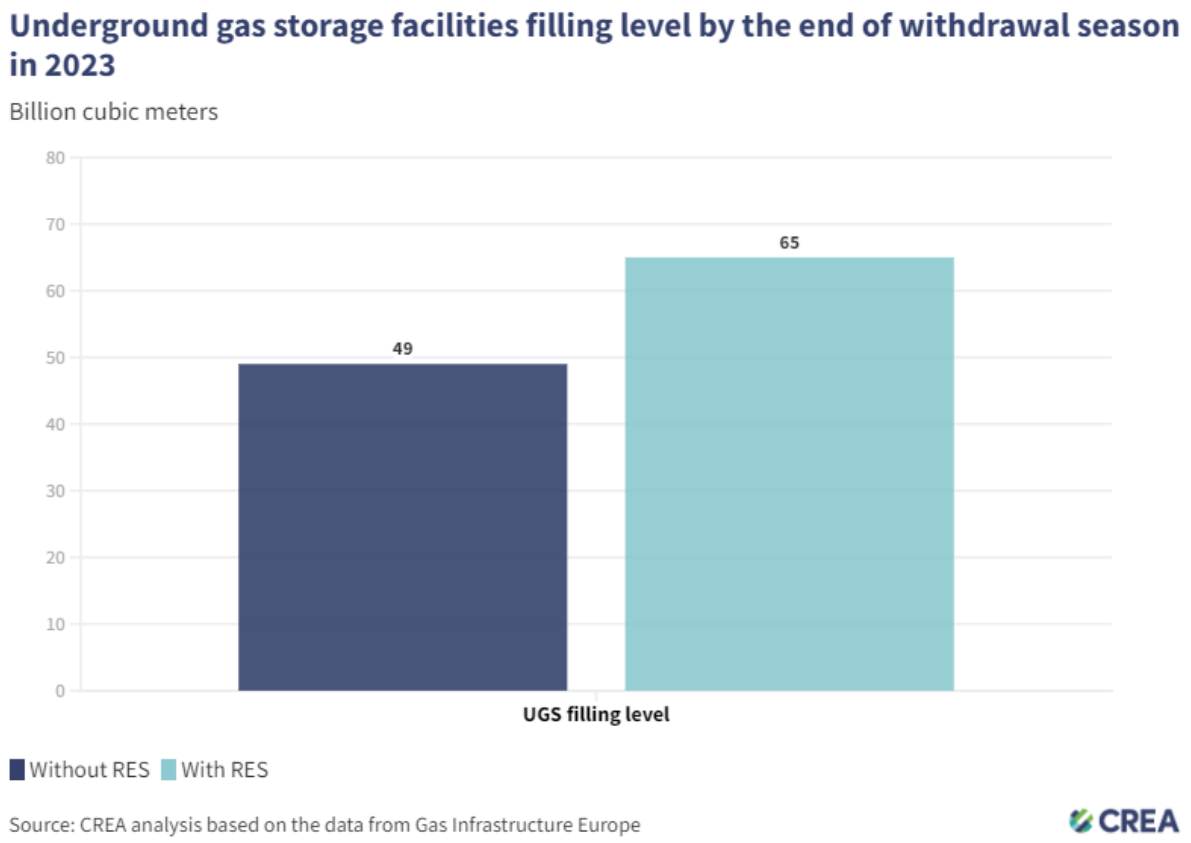
Additional solar and wind generation helped achieve a 90% underground gas storage filling level

To best prepare for the 2022/2023 winter season, the aim was to fill the UGS as much as possible and to achieve a 90% or 102 bcm fill rate. This level was necessary to ensure an uninterrupted heating season since Russia could reduce the remaining gas supply. Hence, gas savings and renewable electricity generation became critical factors in achieving adequate gas storage filling rates.



Our analysis demonstrates that increased solar and wind generation saved 14 bcm of gas and helped to reach a safe 95% filling rate and be prepared for the then upcoming winter. Without this additional generation, the filling rate would have been 82%. Such a level

could threaten the EU's energy security and could be used by Russia as leverage in possible future negotiations on lifting the sanctions, if the union was still highly dependent on Russian gas.



The gas savings not only helped to ensure a safe start to the 2022/2023 heating season but also contributed to saving fossil gas stocks ahead of the 2023 gas injection season. The IEA has predicted that the 2023/2024 heating season could be even more challenging due to possible tensions in the gas market, so every cubic metre of gas saved is essential. As a result, due to the unusually mild weather and the additional solar and wind power generation, gas UGS remained high ahead of the kick-off of the injection season in 2023, at 65 bcm, or 57% of the maximum filling level. Without additional solar and wind electricity generation, storage levels in 2023 would reach 43% or 49 bcm.

Policy recommendations

- EU governments should further invest in clean energy and clean heating, to reduce dependence on fossil fuels and their imports from third countries. This helps not only to decrease dependence on other regions and increases the EU's energy security but helps to achieve net-zero greenhouse gas emissions faster.
- The industrial sector, affected by high fossil gas prices in 2022, should reduce its dependence on fossil fuels in industrial processes through electrification and by switching to clean energy sources.
- EU governments should institute price caps and/or import restrictions for pipeline gas and LNG from Russia.

Methodology

The period analysed in this review is from 1 January 2022 to 31 March 2023. The data used for electricity generation by fuel type is from EMBER. Gas-fired power generation is assumed to have an average net thermal efficiency of 50%. Therefore, an electricity output of 1 MWh implies a 2 MWh gas demand. Gas imports from Russia to the EU are calculated for pipelines and liquefied fossil gas. Gas imports into the EU are estimated on the basis of data from the ENTSOG and KPLER platforms and prices are calculated using the CREA pricing model.

The gas storage capacity data is extracted from Gas Infrastructure Europe (gie.eu). Calorific value of 35.7 MJ/m3 is used in all calculations.

About CREA

Centre for Research on Energy and Clean Air (CREA) is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the solutions to air pollution. CREA uses scientific data, research, and evidence to support the efforts of governments, companies, and campaigning organisations worldwide in their efforts to move towards clean energy and clean air, believing that effective research and communication are the key to successful policies, investment decisions, and advocacy efforts. CREA was founded in December 2019 in Helsinki and has staff in several Asian and

European countries. Our work is funded through philanthropic grants and revenue from commissioned research. In our statement of support for Ukraine, CREA absolutely condemns the Russian military's unprovoked and unjustified attack against another sovereign nation, Ukraine. The assault goes against the fundamental values of human well-being, safety, and dignity that our organisation seeks to advance. We urgently call for an end to the assault and stand in solidarity with the Ukrainian and Russian people calling for just peace.