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IEA Confirms Second Collective Action to Release Oil Stocks

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The European Commission has Proposed a New Strategy to Boost Europe's Energy Independence

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Highlights

Recent Oil Market Developments

Brent futures, which were already heading upward before the Russia-Ukraine crisis, reached USD 133/b on March 8 before retreating and finishing at USD 98/b on April 11 (at the time of writing) (Figure 1). As sanctions against Russia became more severe, financial institutions began to refuse financing Russia-related transactions, and some companies grew hesitant to purchase Russian crude, global oil markets started to respond to real disruptions and delays in physical short-term markets and threats of longer-term structural challenges.[1] While production losses from Russia would be tolerable up to 1 mb/d in the short term, a more serious supply shock would necessitate a coordinated reaction from the supply side, [2] which paved the way for the U.S. Energy Information Administration (EIA) to estimate that crude oil prices would remain above USD 100 per barrel in the coming months. [3]

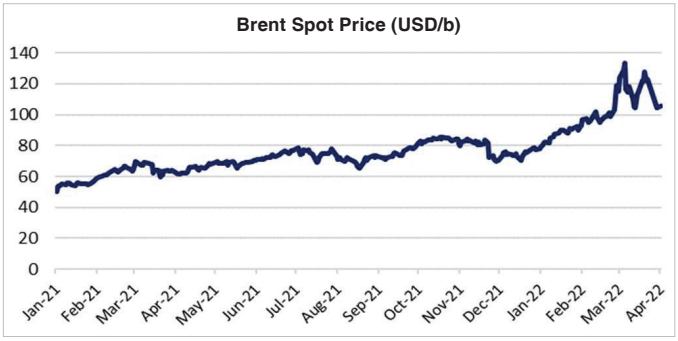


Figure 1. *Brent Spot Price (USD/b) (Source: EIA, 2022 [4])*

The recent surge in oil prices is caused by several factors and is reflected in tighter market fundamentals. These include a strong rebound in demand following economic recovery after Covid lockdowns, OPEC+ returning fewer barrels than envisaged under their existing agreement and OECD crude and product stockpiles continuing to shrink. Oil prices have also been rising due to increased uncertainties about the extent of spare production capacity in a deteriorating geopolitical climate with a larger likelihood of supply interruptions. Additionally, the Russia-Ukraine situation has added a new geopolitical instability to the oil market together with spillovers from other energy markets, notably the gas market, where high gas prices have put further pressure on oil demand owing to gas-to-oil substitution. [5]

Russia's Significance in the Global Oil System

Russia has a significant impact on global oil supply

- It is the world's third largest oil producer after the United States and Saudi Arabia,
- It is the world's second largest crude oil exporter after Saudi Arabia.
- It exports around 5 mb/d of oil, or representing approximately 12% of global trade.

Russia's Major Oil Customers

More than half of Russia's oil exports went to Europe in 2021, which accounted for approximately one third of Europe's imports. Germany was Europe's top consumer of Russian oil, followed by the Netherlands and Poland. China is the single largest importer of Russian oil, purchasing 1.6 mb/d on average in 2021, or around 20% of Russia's exports. Japan and Korea imported 420,000 kb/d from Russia. [6]

Russia is also a major supplier of refined oil products such as diesel, gasoline, and fuel oil. Russia's refined product exports hit 2.7 mb/d in 2021. Exports of refined products have a worldwide reach, with the EU being an important market for Russian diesel (548,000 b/d), naphtha/gasoline (234,000 b/d), fuel oil (223,000 b/d), and gasoil (214,000 b/d). [7]

Russia's Earnings from Oil

In January 2022, revenues from oil and gas-related taxes and export duties were reported to account for 45% of the government budget. Total crude oil and refined product export incomes were around USD 700 million per day. [8]

[1] https://www.energypolicy.columbia.edu/research/qa/qa-how-us-and-international-oil-markets-may-respond-loss-russian-oil-supplies
[2] https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/03/OIES-Oil-Monthly-Issue-12.pdf
[3] https://www.eia.gov/todayinenergy/detail.php?id=51658
[4] https://www.eia.gov/dnav/pet/hist/RBRTED.htm
[5] https://www.oxfordenergy.org/publications/russia-ukraine-crisis-implications-for-global-oil-markets/
[6] https://www.iea.org/articles/frequently-asked-questions-on-energy-security
[7] https://www.oxfordenergy.org/publications/russia-ukraine-crisis-implications-for-global-oil-markets/
[8] https://www.iea.org/articles/frequently-asked-questions-on-energy-security

The IEA Collective Stock Draw

As a response to the short-term oil-supply shock resulting from the military operation launched by Russia against Ukraine, the International Energy Agency's (IEA) Member Countries decided on March 1, 2022 to release 60 mb from their emergency stockpiles to convey a unified and strong message to global oil markets that there will be no shortage of supply as a result of the Russia-Ukraine crisis. [9]

"I am pleased that the IEA has come together today to act. The situation in energy markets is very serious and demands our full attention. Global energy security is under threat, putting the world economy at risk during a fragile stage of the recovery," said IEA Executive Director Fatih Birol. "I am grateful that IEA member countries made available the initial 60 million barrels to provide stability to oil markets," Dr Birol added.[10] Dr. Birol further defined the 60 million barrels as "an initial response," and stressed that "it is only 4% of our stocks. If there's a need, if our governments decide so, we can bring more oil to the markets, as one part of the response." [11]

In an update on the contributions of IEA member countries to the IEA Collective Stock Draw on March 9, member countries have made roughly 62.7 mb of emergency oil available. [12] More than two-thirds of this comes from public stocks and almost one-third from the reduction of the stockholding requirements imposed on businesses. [13]

Following the first release, the U.S. Department of Energy (DOE) issued a second emergency notice for the sale of crude oil from the Strategic Petroleum Reserve on April 1, 2022, stating that "the first 90 million barrels will be released between May and July, through two notices of sale totaling 70 million barrels, and 20 million barrels already scheduled to be released in May 2022. The remaining 90 million barrels will be released between August and October 2022." [14]

In order to further reduce market volatility, IEA member countries agreed to an additional release of emergency oil stocks on April 1, 2022. According to a press release, "the IEA Governing Board confirmed today that the total amount committed to date stands at 120 million barrels, making it the largest stock release in IEA history, demonstrating strong unity." [15]


Dr. Fatih Birol

"The unprecedented decision to launch two emergency oil stock releases just one month apart, and on a scale larger than anything before in the IEA's history, reflects the determination of member countries to protect the global economy from the social and economic impacts of an oil shock following Russia's aggression against Ukraine," [16] said IEA Executive Director Fatih Birol.

[9] hhttps://www.iea.org/news/iea-member-countries-to-make-60-million-barrels-of-oil-available-following-russia-s-invasion-of-ukraine
[10] https://www.iea.org/news/iea-member-countries-to-make-60-million-barrels-of-oil-available-following-russia-s-invasion-of-ukraine
[11] https://www.reuters.com/business/energy/iea-is-ready-bring-more-oil-market-birol-2022-03-09/
[12] https://www.iea.org/news/an-update-on-member-countries-contributions-to-iea-collective-stock-draw
[13] "Each IEA country has an obligation to hold oil stocks equivalent to at least 90 days of net oil imports and to be ready to collectively respond to severe supply disruptions affecting the global oil market, in accordance with the Agreement on an International Energy Program."
[14] https://www.energy.gov/articles/doe-announces-second-emergency-notice-sale-crude-oil-strategic-petroleum-reserve-address
[15] https://www.iea.org/news/iea-confirms-member-country-contributions-to-second-collective-action-to-release-oil-stocks-in-response-to-russia-s-invasion-of-ukraine?utm_content=bufferb6d88&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer
[16] Ibid.,

The table below indicates the breakdown of the oil that each of the member countries will make available (Table 1).

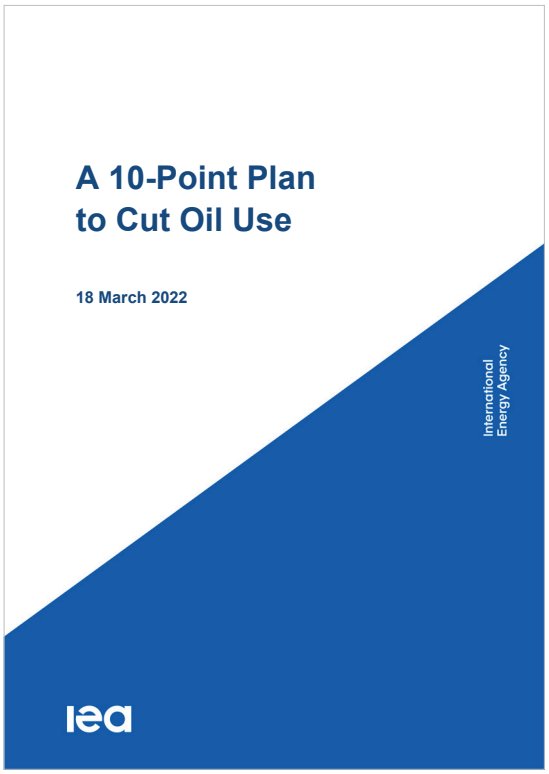
Country	kb
Australia	1 608
Estonia	74
Finland	369
France	6 047
Germany	6 480
Greece	624
Hungary	531
Ireland	451
Italy	5 000
Japan	15 000
Korea	7 230
Lithuania	180
Netherlands	1 600
New Zealand	483
Poland	2 298
Spain	4 000
Turkey	3 060
United Kingdom	4 408
United States	60 559
Total IEA	**120 000**

Table 1. *Contributions to the IEA Collective Stock Draw Agreed on 1 April 2022 (kb) (Source: IEA, 2022* [17] *)*

The IEA has taken collective action five times in its history, including:

- "During the buildup to the Gulf War in 1991;
- After Hurricanes Katrina and Rita damaged offshore oil rigs, pipelines and refineries in the Gulf of Mexico in 2005;
- In response to the prolonged disruption of oil supply caused by the Libyan Civil War in 2011"[18]
- The aforementioned two releases in March and April 2022.

A 10-Point Plan to Cut Oil Use [19]



A new plan entitled "A 10-Point Plan to Cut Oil Use" released by the IEA on March 10 starts with a promising target by stating that if fully implemented in advanced economies, the steps advocated by the IEA's plan would reduce oil demand by 2.7 mb/d within four months (Figure 2). This figure is equivalent to the oil used by all cars in China.

Dr. Fatih Birol: "The world may well be facing its biggest oil-supply shock in decades, with huge implications for our economies and societies." [20]

Because transportation accounts for the bulk of current oil demand, the IEA's 10-Point Plan focuses on how to use less oil to transport people and goods, building on specific initiatives that have already been implemented in a variety of nations and cities. The plan also provides recommendations for governments and individuals to take immediate action to shift from the 10-Point Plan's short-term emergency efforts to long-term measures that would place oil demand in a structural fall compatible with a route to Net-Zero Emissions by 2050. [21]

[17] Ibid.,
[18] https://www.iea.org/areas-of-work/ensuring-energy-security/oil-security
[19] https://www.iea.org/reports/a-10-point-plan-to-cut-oil-use
[20] https://www.iea.org/news/emergency-measures-can-quickly-cut-global-oil-demand-by-2-7-million-barrels-a-day-reducing-the-risk-of-a-damaging-supply-crunch
[21] https://www.iea.org/reports/net-zero-by-2050

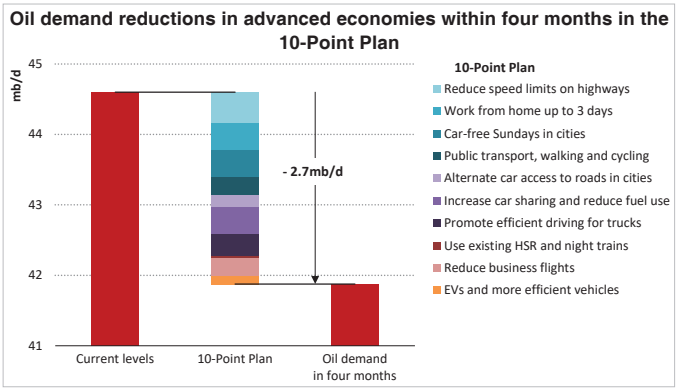


Figure 2. *Oil-Demand Reduction in Advanced Economies within Four Months in the 10-Point Plan (mb/d) (Source: IEA, 2022)*

According to the plan, lowering oil use should not be a one-time move. Sustained reductions are critical not just for improving energy security, but also for combating climate change and lowering air pollution. Governments have several tools to reduce oil consumption in future years, and the plan outlines the most important ones, such as accelerating the adoption of electric cars.

The plan proposes short-term solutions such as reduced speed limits, working from home, periodic limitations on automobile access to city centers, cheaper public transportation, increased carpooling, and other efforts – as well as increasing the use of high-speed rail and online meetings rather than air travel (Figure 3).

Figure 3: *A 10-Point Plan to Cut Oil Use (Source: IEA, 2022)*

IEA-Oil Market Report [22], March 2022

- The latest monthly oil market report released by the IEA addresses the key issues impacting the oil market as commodity prices soar to new highs and the Ukrainian crisis has pushed energy security back to the top of political agendas.
- The report points out that while it is too early to predict how events will evolve, the possibility of widespread interruptions in Russian oil production threatens to trigger a worldwide oil supply shock.
- Because of the current crisis, the IEA has reduced its estimate for global oil demand by 1.3 mb/d for 2Q22-4Q22, resulting in 950 kb/d slower growth on average for 2022. Total demand is now expected to reach 99.7 mb/d in 2022, up 2.1 mb/d from 2021.
- Estimated global refinery throughput for 2022 has been reduced by 860 kb/d. Global refinery intake is expected to increase by 2.9 mb/d to 80.8 mb/d in 2022. Despite a drop in demand, product markets remain constrained, with more stock draws projected throughout the year.
- It is also reported that OPEC+ is adhering to its agreement to boost production in small monthly increments. The report underlined that only Saudi Arabia and the UAE have significant spare capacity that might instantly help offset a Russian deficit.
- The report stressed that the ramifications of Russia's possible reduction of world oil shipments cannot be ignored. Russia is the world's largest oil exporter, exporting 8 mb/d of crude and processed oil products to consumers around the world.
- Regarding the question of Russia's oil flow, the report pointed out that Russian oil is still flowing for the time being because of term arrangements and swaps signed before military actions into Ukraine, but prospective business has all but stagnated.

[22] https://www.iea.org/reports/oil-market-report-march-2022

Recent Developments in Global Natural Gas Market

The gas price surge in 2021 was caused by a combination of fundamental supply and demand dynamics both in the global LNG market and the European regional gas market. The worldwide LNG market became significantly tighter in 2021 as demand outpaced supply growth.[23] Asian demand was mainly fueled by the requirement for space heating during the winter season, China's sustained strong growth, and the desire to keep LNG storage tanks filled up throughout the summer. Whereas in South America, low hydroelectricity generation and a decline in local gas supply have resulted in increasing LNG demand. [24]

As a result, the global LNG market tightened considerably, and less volume was available for Europe to import. Drop in accessible LNG quantities, along with other supply constraints caused by plummeting European gas production and declining total pipeline imports, resulted in a reduction in overall supply to the European market. Moreover, not only were storage stocks significantly depleted in the first quarter of 2021, but also replenishment in the second and third quarters was also slower than in previous years, having left Europe with smaller stocks as winter approached. These fundamentals elevated worldwide LNG and European gas prices in 2021, with European prices hitting new highs in late September. [25]

Despite the significant constraints experienced in 2021, Europe, as a gas balancing market, has been able to absorb most of the market's shocks with increasing prices. Figure 4 illustrates TTF gas prices in 2021. [26]

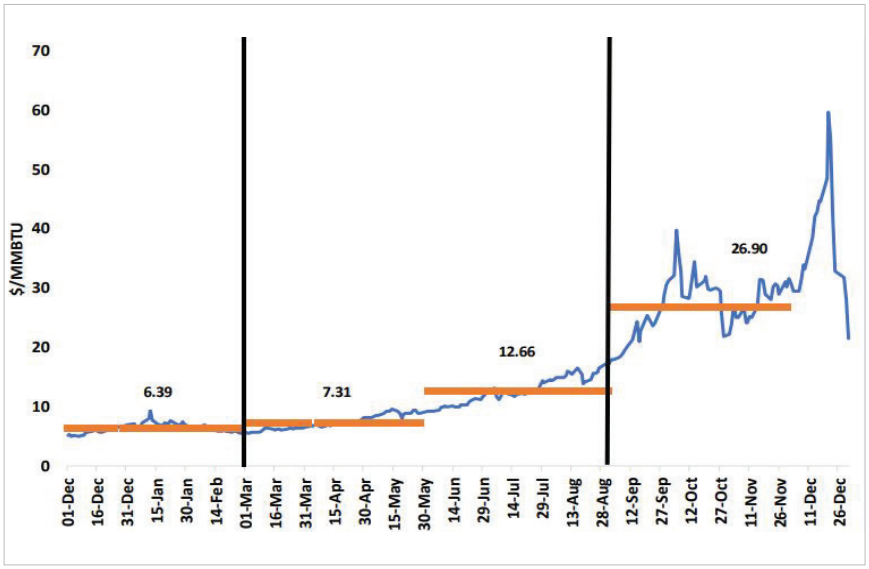


Figure 4. *TTF Month-Ahead Prices 2021 ($/MMBtu) (Source: OIES, 2022)* [27]

The rise in gas prices globally and particularly in Europe in 2021 developed in three stages. Severe winter weather in the northern hemisphere and supply limits from European production tightened around 18 billion cubic meters (bcm) of gas in Q1. However, the impact on TTF pricing was minimal since European gas storage was ample and could manage the higher withdrawals reasonably well. TTF prices averaged USD 6.39/MMBtu in Q1 (Figure 4).

However, in the Q2/Q3, the sustained high LNG demand in Asia and Central and South America in the summer, along with persistent supply restrictions for LNG and European output, meant that Europe was unable to refill its stocks even at a usual rate, putting increasing pressure on TTF prices. The market tightening was significant but with storage at low levels and surplus stocks being removed, prices progressively climbed during the summer, hitting an average of USD 12.66/MMBtu in Q3 (Figure 4).

The main shock to the market, however, occurred in Q4, when pipeline gas from Russia through the Yamal Europe route fell significantly to less than a third of typical levels. Even without the drop in flows along this path, the market was still in a precarious balance, with LNG demand expanding around the world and persistent LNG supply and European production limits. Lower Yamal Europe flows, on the other hand, put the market in danger, and instead of being in the USD 15 to USD 20 per MMBtu range, TTF prices climbed to an average of USD 26.90/MMBtu in Q4 (Figure 4).

[23] https://www.energypolicy.columbia.edu/research/qa/qa-russian-invasion-ukraine-and-global-energy-market-crisis
[24] https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/01/Surging-2021-European-Gas-Prices-%E2%80%93-Why-and-How.pdf
[25] https://www.oxfordenergy.org/wpcms/wp-content/uploads/2021/09/Why-Are-Gas-Prices-So-High.pdf
[26] The Dutch TTF Gas future is the most liquid contract and more indicative of the underlying supply-demand balance in the European market.
[27] https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/01/Surging-2021-European-Gas-Prices-%E2%80%93-Why-and-How.pdf

The Short-Term Impact of Russia-Ukraine Conflict on Gas Markets

Following the military operation launched by Russia against Ukraine, natural gas prices throughout Europe and elsewhere dramatically increased. The reason for this reaction was related to the fact that the market appears to be anticipating a partial or complete reduction of Russian gas flows into Europe, notably through the Nord Stream 1, Yamal-Europe, and Ukrainian transit lines.

Russia in Global Natural Gas

- Russia is the world's second biggest gas producer behind the United States, producing 761 bcm in 2021 and accounting for 18% of global natural gas supply.
- Russia is the world's largest gas exporter, with exports of roughly 250 bcm in 2021, with 210 bcm transiting through pipelines and 40 bcm delivered as LNG. [28]
- Taking current market pricing into account, the export value of Russian piped gas to the EU alone amounts to USD 400 million per day.
- There are four main (and other much smaller routes) for Russian pipeline gas into Europe:
  - Nord Stream 1 through the Baltic Sea to Germany,
  - Yamal-Europe pipeline through Belarus and Poland to Germany,
  - Various Ukraine routes to Slovakia, Hungary, Romania, and Poland,
  - Turk Stream, with onward connections to Bulgaria, Serbia, and Hungary[29].
- Supplies through Ukraine represented over 9% of Russia's total of 155 bcm (140-bcm pipeline and over 15-bcm LNG) exported to the European market in 2021.

Over the last decade, the EU and UK have grown more reliant on Russian gas supplies. Natural gas consumption in the EU and the UK remained largely unchanged in aggregate throughout this time, while output declined by a third with rising imports filling the gap. The Netherlands, Norway, and UK were the top producers. However, over the last ten to fifteen years, UK natural gas production has begun to fall, while the Netherlands has expedited the decrease of the Groningen field's gas flow, which was once Europe's largest field. [30] As a result, Russian gas supplies surged from 25% of total gas demand in 2009 to 32% in 2021 (Figure 5). Meanwhile, Ukraine's relevance as a transit country has diminished owing to the expansion of other transit channels transporting Russian piped gas to the EU and UK (e.g. TANAP and Nord Stream).

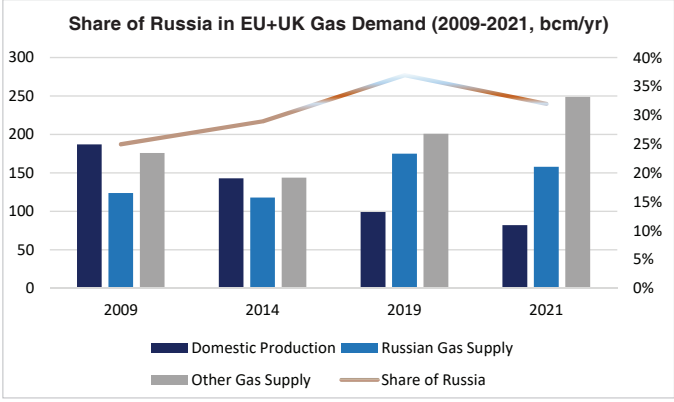


Figure 5. *Share of Russia in EU and UK Gas Demand (2009-2021, bcm/yr) (Reproduced by IICEC; Source: IEA, 2022* [31] *)*

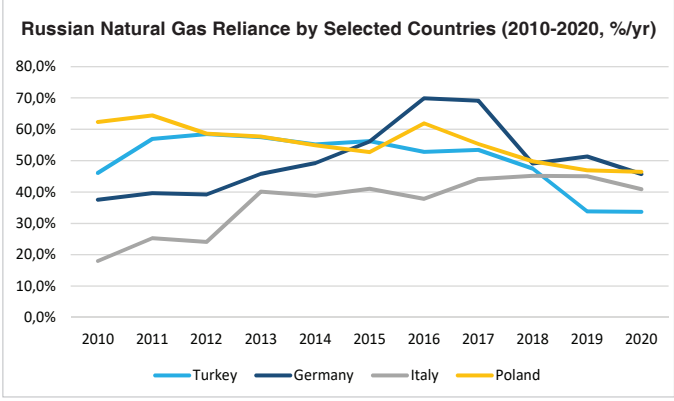


Figure 6. *Russian Natural Gas Reliance by Selected Countries (2010-2020, %/yr) (Reproduced by IICEC; Source: IEA, 2022* [32] *)*

[28] https://www.iea.org/articles/frequently-asked-questions-on-energy-security
[29] https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/02/Gas-Quarterly-Review-Issue-16.pdf
[30] https://www.energypolicy.columbia.edu/research/interview/qa-europe-s-dependence-russian-gas
[31] https://www.iea.org/reports/russian-supplies-to-global-energy-markets/gas-market-and-russian-supply-2
[32] https://www.iea.org/reports/russian-fossil-fuel-reliance-data-explorer

Through supply source and route diversification together with reliable supply infrastructure and an increasing share of underground storage, gas providers in Germany worked towards assuring supply security and reducing its heavy reliance on Russian gas. To offset the risks associated with the dominant pipeline provider (Gazprom), Germany moved forward with plans to enable LNG imports, which have played a significant part in the country's gas-security policy. Even though Russia is expected to remain the leading gas supplier to the German gas market, an LNG terminal would likely increase Germany's bargaining power. [33]

Poland has long sought to reduce Russia's share of its gas market and thus has been expanding its LNG options (such as importing more LNG from the United States) and constructing a Baltic pipeline. As a result, from 2010 to 2020, Russian gas reliance declined from 62% to 46%. The current gas contract with Russia is set to expire in 2022, and officials in Poland have stated that they do not intend to extend it. [34]

Italy has also diversified its import sources in recent years. Algeria's gas supplies to Italy increased 76% in 2021, reaching 21 bcm, second only to Russia's 29 bcm. The Trans-Adriatic Pipeline (TAP), the final section of the Southern Gas Corridor, transported more than 8 bcm of Azeri gas into Europe, with around 6 bcm ending up in Italy in 2021. Italy also expects to get additional gas from Azerbaijan via the TAP. [35]

Due to high dependence on gas imports to satisfy Turkey's natural gas demand, enhancing supply security with route and source diversification has been the main policy priority for the natural gas sector. As thoroughly examined in the Turkey Energy Outlook 2020, Turkey's security of gas supply has improved with enhanced network flexibility, including more LNG, storage and pipeline withdrawal capacities, a strongly diversified range of suppliers especially with increasing LNG volumes, and high LNG-import capacities to deal with any disruptions in supply. As a result of these strategic investments, the share of Russian gas declined from 46% in 2010 to 33% in 2020. (Figure 6.) Additionally, the recent gas findings in the Black Sea will also alter this balance with prospects for plausible new additions to the resource base in the coming years.

For further information on Turkey's Natural Gas Sector, please click here.

Natural Gas Storage Should Improve

As a result of low inventory levels at the start of the heating season and a steep reduction in Russian pipeline supplies to the EU, gas-storage levels have fallen below their functional storage capacity. At the start of the heating season, storage sites owned or operated by Gazprom had especially low storage levels, with just 25% of their functional storage capacity full. Despite accounting for just 10% of the EU's total active storage capacity, Gazprom storage accounted for half of the EU's five-year storage shortfall [36] (Figure 7). As of March 8, according to the EU Commission's RePowerEU, "the storage filling level across Europe is just under 30%." [37]

Without the significant rise in LNG imports since October, European storage levels would be less than 15% full by now, putting Europe in a far more vulnerable position in the event of late cold periods and/or supply interruptions. This exemplifies the importance of underground gas storage and LNG regasification capability in ensuring gas-supply security.

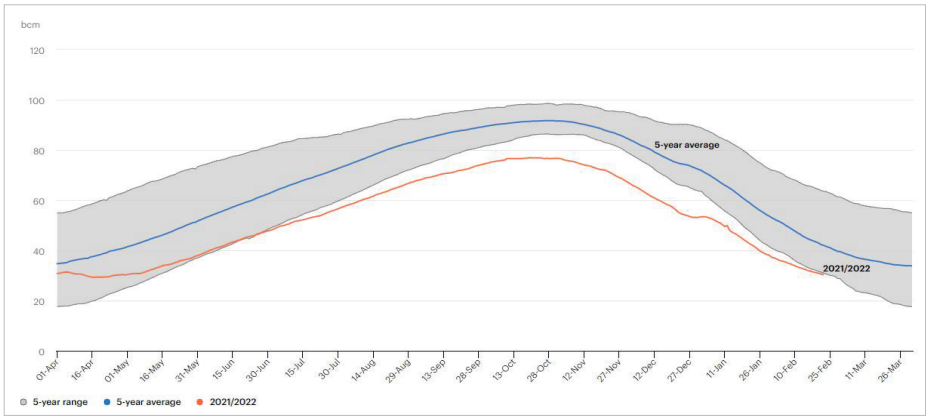
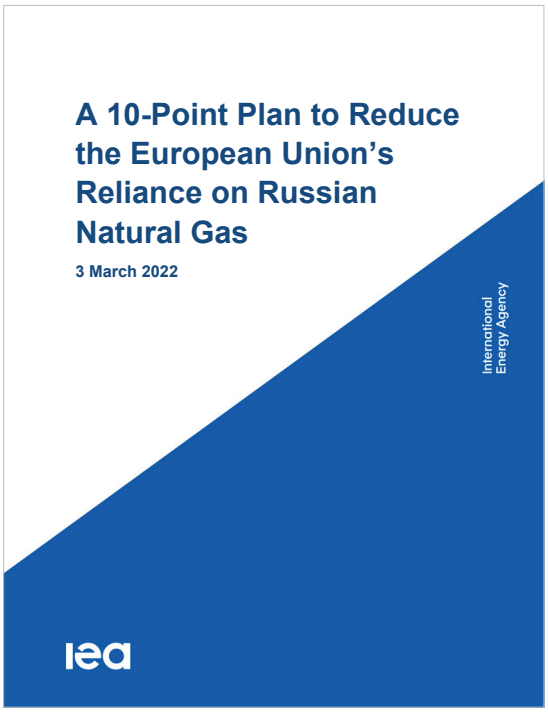


Figure 7. *Inventory Levels in EU Underground Storage Sites (2016-2022, bcm/yr) (Source: IEA, 2022* [38]*)*

[33] https://www.iea.org/reports/germany-2020
[34] https://www.ft.com/content/d1b9d764-febd-11e8-aebf-99e208d3e521
[35] https://www.reuters.com/business/energy/italy-wont-find-it-easy-kick-russian-gas-habit-2022-03-03/
[36] https://www.iea.org/reports/russian-supplies-to-global-energy-markets/gas-market-and-russian-supply-2
[37] https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_1512
[38] https://www.iea.org/reports/russian-supplies-to-global-energy-markets/gas-market-and-russian-supply-2

A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas [39]



On March 3, 2022, the IEA Secretariat issued a 10-point plan outlining how European nations may reduce their Russian gas imports. The plan outlines that the measures adopted this year have the potential to reduce Russian gas by more than 50 bcm within a year. The IEA's 10-Point Plan suggests a set of urgent changes that might be adopted to minimize dependency on Russian gas while improving the EU gas network's near-term resilience and easing burdens for vulnerable users.

The 10-Point Plan is compatible with the EU's climate aspirations and the European Green Deal, as well as the outcomes reached in the IEA Net-Zero Emissions by 2050 Roadmap, in which the EU completely removes the need for Russian gas imports by 2030.

The essential initiatives include:

- Avoiding new gas contracts with Russia,
- Maximizing gas supply from other sources,
- Boosting solar and wind deployment,
- Maximizing existing low-emission energy sources (including nuclear), and
- Increasing energy-saving measures (Figure 8).

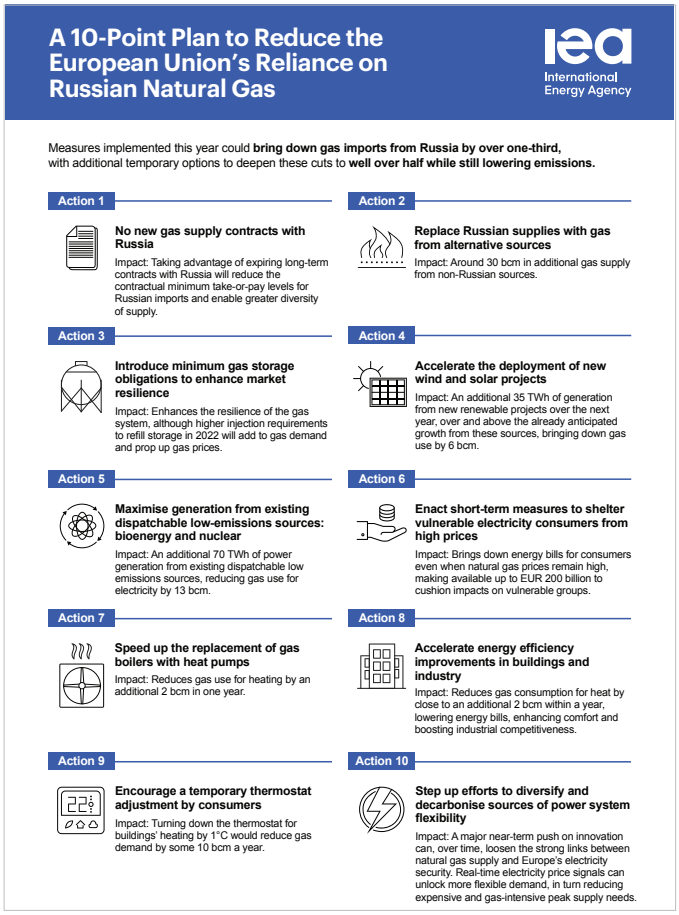


Figure 8: *10-Point Plan to Reduce the EU's Reliance on Russian Natural Gas*

[39] https://www.iea.org/reports/a-10-point-plan-to-reduce-the-european-unions-reliance-on-russian-natural-gas

REPowerEU: Joint European Action for More Affordable, Secure, and Sustainable Energy

EUROPEAN COMMISSION

Strasbourg, 8.3.2022
COM(2022) 108 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

REPowerEU: Joint European Action for more affordable, secure and sustainable energy

On 8 March 2022, the European Commission published a communication entitled Joint European Action for more affordable, secure, and sustainable energy.[40] It was stated that in light of the Russia-Ukraine crises, the European Commission's strategy is to make Europe independent of Russian fossil fuels by 2030, beginning with natural gas.

The communication also noted that this strategy includes a number of initiatives to respond to rising European energy prices and to refill gas reserves for the coming winter. REPowerEU plans to diversify gas suppliers, accelerate the deployment of renewable gases, and substitute gas in heating and power generation. According to the accompanying press release, the action plan has the potential to cut EU demand for Russian gas by two-thirds by the end of the year.

"We need to act now to mitigate the impact of rising energy prices, diversify our gas supply for next winter, and accelerate the clean energy transition. The quicker we switch to renewables and hydrogen, combined with more energy efficiency, the quicker we will be truly independent and master our energy system." European Commission President Ursula von der Leyen

The communication pointed out that EU gas imports from Russia reached 155 bcm in 2021 (pipeline and LNG combined) and that this could be decreased by two-thirds. It is proposed that the EU can reduce its reliance on Russian fossil fuels far earlier than 2030. To that end, the Commission proposes a REPowerEU strategy based on two pillars that would strengthen the resilience of the EU-wide energy system:

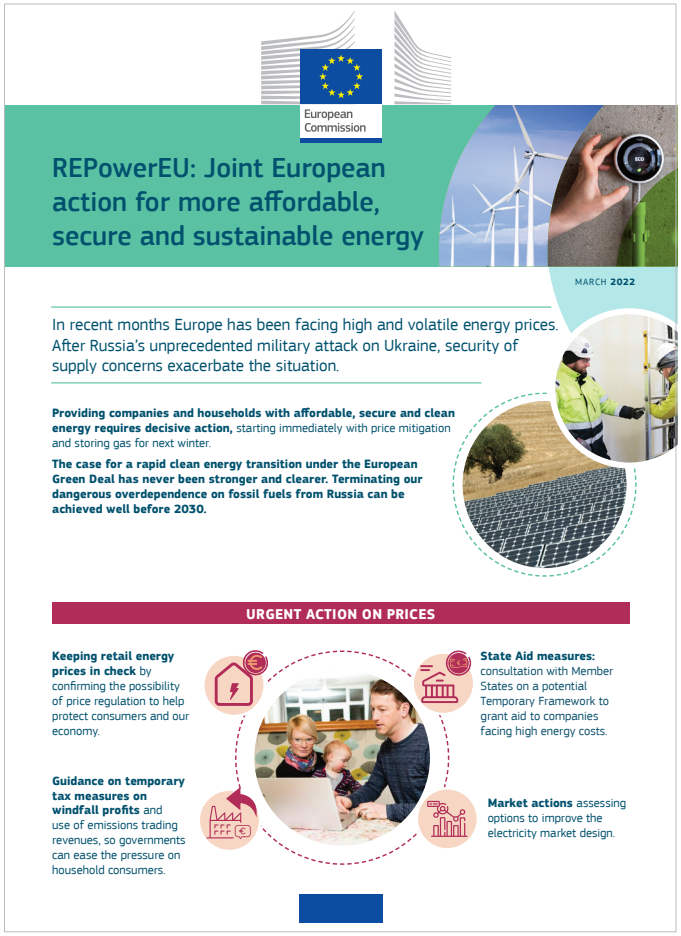
- Diversifying gas supply by increasing LNG and pipeline imports from non-Russian providers, as well as increasing hydrogen levels.
- Reducing the EU's reliance on fossil fuels at the household, building, and industrial levels, as well as at the power system level, by enhancing energy-efficiency improvements, expanding renewable energy contribution, and eliminating infrastructural bottlenecks (Figure 9).

Meanwhile, the communication stated, "the Commission will make a legislative proposal by April so as to ensure an annual adequate level of storage. This proposal will require that existing storage infrastructures in the EU are filled up to at least 90% of their capacity by 1 October each year."

In order to reach the objectives defined in the Joint European Action, the communication proposed the following projections:

- On an annual basis, the EU could import 50 bcm more of LNG (for example, from Qatar, the United States, Egypt, and West Africa).
- By deploying wind and solar, the EU can reduce gas consumption in the power industry by 20 bcm.
- EU-wide energy savings, such as turning down the thermostat for building heating by 1°C, can save as much as 14 bcm.
- Diversification of pipeline suppliers (for example, Azerbaijan, Algeria, and Norway) might result in an additional 10 bcm of savings on Russian gas imports each year.
- Increasing biomethane output cuts gas demand by 3.5 bcm.
- Rooftop solar and heat pumps reduce gas demand by 2.5 bcm and 1.5 bcm, respectively.

[40] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511



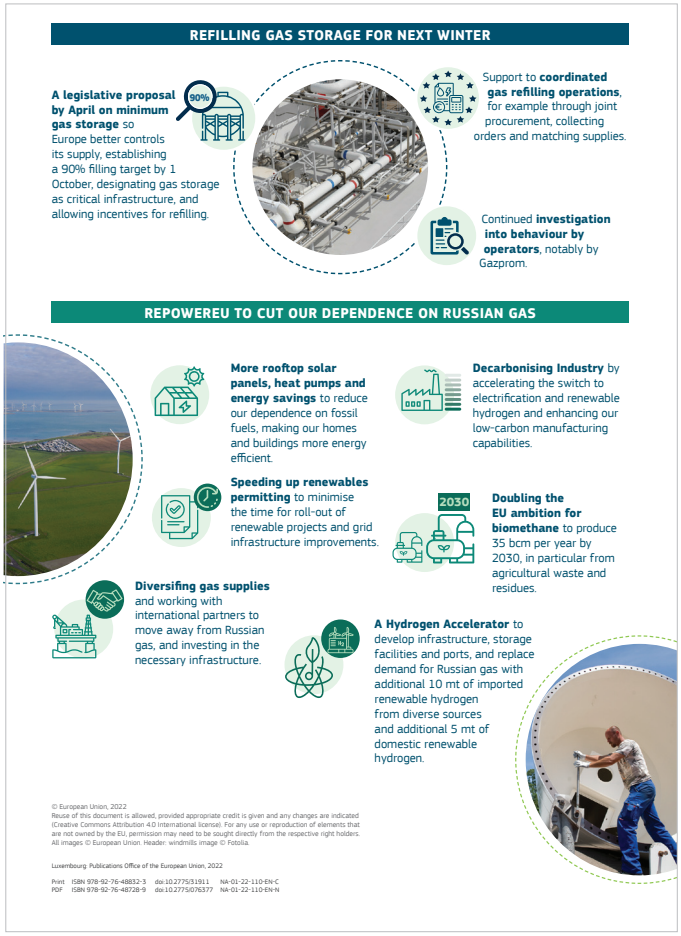


Figure 9. *REPowerEU-Factsheet: Joint European Action for More Affordable, Secure and Sustainable Energy (Source: EU Commission, 2022* [41]*)*

- The Oxford Institute for Energy Studies' (OIES) newly published analysis[42] examined the plan's components and drew conclusions on the feasibility of the Commission's strategy. The analysis concludes that while certain portions of the program are clearly attainable, others are far more ambitious.
- On the supply side, the study claims that an additional 50 bcm of LNG imports per year would not only absorb the projected rise in global LNG supply in 2022 but would also entail a redirection of cargoes from Asia to Europe, implying that European prices must stay high to lure such cargoes to the continent.
- The rise in non-Russian pipeline imports appears feasible, assuming that present import levels are maintained through the summer.
- On the demand side, the analyses remarked that the anticipated gas demand decrease looks doable on principle but meeting the objective would be difficult. For the objective of the EU plan to be realized, the study stated that a combination of market factors, specialized actions, favorable external circumstances (such as availability of wind and hydro), and additional coal/nuclear in the generating mix would be required.

[41] https://ec.europa.eu/commission/presscorner/detail/en/fs_22_1513
[42] https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/03/Insight-110-The-EU-plan-to-reduce-Russian-gas-imports-by-two-thirds-by-the-end-of-2022.pdf

Changing Electricity Security Paradigm in the Midst of Rising Prices and Clean Energy Aspirations

2021 put unprecedented strain on the world's electricity markets. Strong economic growth, along with more severe weather than in 2020, increased worldwide power consumption by more than 6%. It was the highest yearly increase in absolute terms (nearly 1,500 TWh) and the largest relative increase since the recovery from the financial crisis in 2010. [43]

The rapid recovery in overall energy demand also put pressure on supply systems for coal and natural gas, driving up wholesale power prices, despite the remarkable increase of renewable energy, coal and gas electricity generation both reached new highs. The dramatic increase in wholesale energy prices in several countries in 2021 was mostly due to rising gas and coal prices.

In the final quarter of 2021, wholesale prices in France, Germany, Spain, and the UK were more than four times greater than the last quarter average from 2016 to 2020. This was mostly due to the sharp climb in gas costs, along with growing demand, while EU ETS prices more than doubled in 2021 relative to 2020. Wholesale prices in the United States climbed at a slower pace than in Europe, owing in part to lower natural gas costs. Prices were over 75% higher in the fourth quarter of 2021 than they were in the final quarter of 2016-2020. [44] Japan's wholesale prices climbed in 2021, following a supply shortage-related high during the first quarter and a subsequent decline in the second quarter. The average price in the fourth quarter of 2021 was 80% higher than the average from 2016 to 2020. In Australia, coal-fired generating outages and higher demand resulted in a 174% rise in wholesale prices year-over-year in the second quarter of 2021. India's total power generation sold on short-term power exchanges has also climbed significantly. Prices increased by 70% year-over-year in the second half of 2021. The major cause was a coal-supply deficit, with 80% of coal-fired power units running out of fuel in less than a week by mid-October [45] (Figure 10).

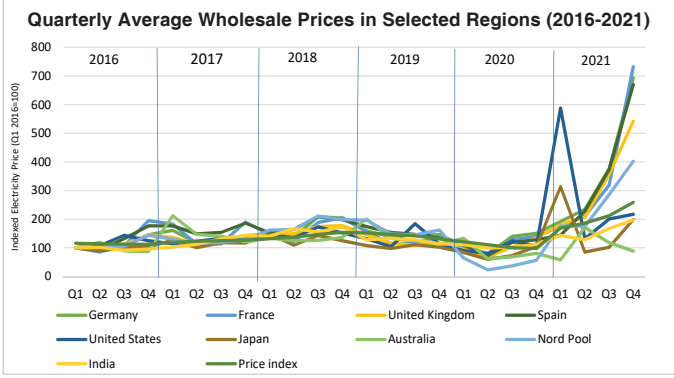


Figure 10. *Quarterly Average Wholesale Prices in Selected Regions, (2016-2021) (Reproduced by IICEC; Source: IEA, 2022* [46]*)*

The IEA Governing Board at the 2022 IEA Ministerial Meeting[47] endorsed a comprehensive Ministerial Communiqué. One of the critical points issued was "electric-power security," emphasized under the title of "Ensuring Energy Security During the Energy Transition," which was covered extensively in the IICEC Energy Market Newsletter (Issue 25) [48] published on March 31, 2022.

"We agree to deepen work on electric-power security, the resilience of electricity systems and broader energy infrastructure to extreme weather events and intentional incidents (cyber and physical), and the opportunities that can be harnessed from integration of very high shares of renewable energy into these systems, supported by appropriate electricity market designs and policy frameworks. We recognize that flexible supply and demand resources need to be secured in the transition of power systems and that this flexibility can be enhanced by greater energy storage, demand response, digital and smart grids, hydrogen, ammonia, and increased regional grid connections and trading," [49] according to a joint communiqué.

[43] https://www.iea.org/reports/electricity-market-report-january-2022
[44] Ibid., 28
[45] Ibid.,
[46] https://www.iea.org/data-and-statistics/charts/quarterly-average-wholesale-prices-in-selected-regions-2016-2021
[47] https://www.iea.org/news/at-iea-ministerial-meeting-global-energy-leaders-vow-to-strengthen-energy-security-and-accelerate-clean-energy-transitions
[48] https://iicec.sabanciuniv.edu/sites/iicec.sabanciuniv.edu/files/2022-03/IICEC_Energy_Market_Newsletter_25.pdf
[49] https://www.iea.org/news/2022-iea-ministerial-communique

Energy Transitions Entail New Approaches to Power System Planning

As variable renewable energy sources such as solar and wind grow more prevalent, power systems will have to become more adaptable. Variable renewable generators rely on the availability of the sun and wind, necessitating the use of complementing technologies to guarantee that the supply-demand balance is always maintained.

New technologies, particularly batteries and other forms of energy storage, biomass, and thermal plants will therefore make a significant contribution in supplying this flexibility. Increasing power usage and new demand sources, on the other hand, provide a significant potential to build a society where flexible demand is as vital as flexible supply technologies. Such a system will appear significantly different from today's power sector, and these changes necessitate a shift in how we design a safe electricity system.

A recent IEA article examines how system planning, including evaluations of system adequacy, will need to adapt and evolve in order for power systems to continue providing "secure and affordable electricity supply during energy transitions." [50] Achieving electric security, power system planning must address operational security and resilience in addition to system adequacy. Maintaining operational security necessitates both system stability and the capacity to ramp up and down as needed to keep supply and demand in balance. With climate change predicted to increase the frequency and severity of extreme weather, resilience will become an even more crucial component of power system design to withstand short- and long-term shocks (Figure 11).

Figure 11. *Components of Electricity Security (Source: IEA, 2022)*

Countries and regions are rapidly moving to more advanced techniques to adequacy assessment, such as probabilistic Monte Carlo analyses. Some countries, such as Australia, Belgium, and France, are already conducting comprehensive Monte Carlo analyses, as is an EU-wide study conducted by ENTSO-E. Although the approaches are still changing and vary by location, these analyses might point to areas where governments seeking to move toward probabilistic assessments should concentrate their efforts. These techniques are especially crucial to consider for emerging economies that are expected to deploy large amounts of renewable energy in future decades. [51]

A Monte Carlo analysis simulates the power system under a wide range of situations to determine the risk of particular loads not being serviced while accounting for the uncertainty of various input variables.

This uncertainty can take many forms, including:

- "The extent and timing of unplanned generation and transmission outages;
- Inter-annual variability in demand and renewables supply based on weather incidents;
- Deeper structural uncertainties such as longer-term shifts in weather patterns due to climate change and evolving electricity demand." [52]

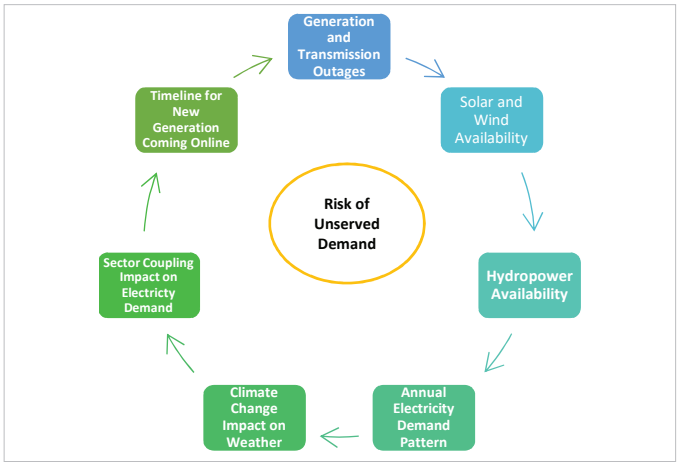


Figure 12. *Probabilistic Modelling Assessments in Addressing Power System Uncertainties (Source: IEA, 2022)*

[50] https://www.iea.org/articles/energy-transitions-require-innovation-in-power-system-planning
[51] Ibid.,
[52] Ibid.,

Wider use of data analytics and digitalization will be one of the key enablers in more efficient and sustainable growth of the Turkish power sector. Several tools and technologies such as AI and machine learning have already demonstrated benefits and will be delivering value for market operations and investment actions supported by a vast set of data generated in the power sector. Digitalization presents a strong potential for optimizing power consumption across demand sectors. Increased connectivity opportunities by digital technologies would further allow for increased efficiency at the system level by matching evolving patterns in supply and demand. The benefits to the overall system will be multi-fold including optimized investments in generation and grid due to demand side flexibility, reduced unplanned outages, improved electricity quality and reliability, and integration of distributed generation and prosumers.

Evolving into a more efficiency and technology oriented structure, the grids will remain the backbone of the Turkish power system. Transmission and distribution networks will further increase their role as more variable and distributed supply and demand units penetrate the system. The electricity system will transform into a more decentralized structure mainly driven by rooftop PV developments supported by global technological advances, Turkey's favorable solar irradiation characteristics and Turkey's supporting policies.

Urbanization and road electrification are key drivers for power demand growth and necessitate sustained investments in expanding the distribution grids as well as enhanced collaboration and coordination among the distribution companies, municipalities and the electric mobility ecosystem. An effective regulatory investment framework should persist in order to advance the distribution grid to satisfy quality and reliability needs in modernizing electricity services. Future regulatory frameworks for distribution networks should continue to encompass a progressive technology perspective that incentivize increased efficiency actions and innovative business models while the grid infrastructure advances into a more mature level. In managing the grid, battery storage solutions would become a more feasible solution during this decade, first at grid scale and then via increased deployments at behind-the-meter. All these developments would be supportive for modernization of the Turkish energy economy by increased electrification and decentralization.

Adding to security and reliability objectives, power system flexibility will become a major issue for the Turkish electricity economy with strong uptake in intermittent generation capacities and increasingly variable demand services. Effective utilization of existing peaker natural gas units would be the most effective option based on economic and technical merits. A suite of other solutions including pumped storage hydro plants and battery storage will also be needed to manage generation and loads in a more flexible system structure. Smart grids and demand side platforms also provide value in expanding flexibility resources for improved load balancing. In an increasingly sophisticated generation and grid architecture, a system level perspective should be pursued to sustain power security and reliability while awarding value propositions from flexible supply and demand technologies.

Monte Carlo analyses draw their statistics from potentially thousands of simulations and quantify the hazard of unserved energy via several reliability measures. Monte Carlo analyses provide several advantages, including the ability to analyze variable renewables more correctly in the context of the energy demand profile. In addition, the sophisticated modeling technique enables sector linkage, such as electrification and demand response. For systems with a large proportion of renewables, probabilistic adequacy evaluations provide more data. These analyses have the capacity to provide comprehensive information regarding adequacy concerns due to the simulation technique, offering information on all different aspects that may impact the acceptability of unserved energy.

Risk Preparedness Plans in the Electricity Sector

Figure 13 summarizes the risk preparedness plans and elements of a crisis affecting the power industry filed by France in 2022 in accordance with Regulation (EU) 2019/941. For further reading on EU Member States' power sector risk preparedness plans, please click here.

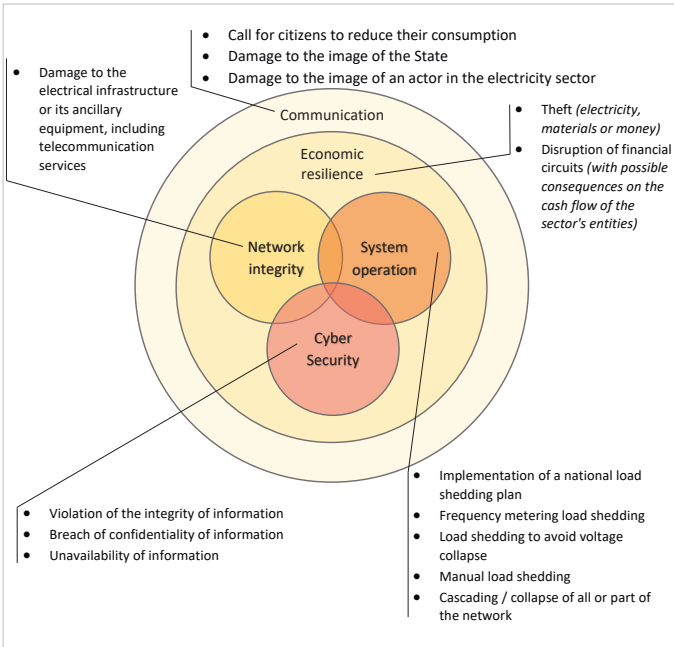


Figure 13. *Different Dimensions of a Crisis in the Electricity Sector (Source: European Council, 2019* [53] *)*

Security of Critical Minerals for Clean Energy Transitions

Rapid deployment of low-carbon technologies in the context of clean-energy transitions entails a rise in demand for critical minerals. Solar PV facilities, wind farms, and electric vehicles (EVs) require more minerals than their fossil fuel-powered equivalents. As an example, a typical electric vehicle necessitates six times the mineral inputs as a conventional vehicle, while an onshore wind farm necessitates nine times the mineral intakes as a gas-fired power plant. [54]

The likelihood of a substantial surge in demand for critical minerals raises concerns about supply availability and reliability. Current supply and investment plans are tailored around a future of sluggish and insufficient climate change action, increasing the risks of supply falling behind expected demand in climate-driven scenarios.

The challenges in critical mineral are aggravated by the following factors:

- Long lead periods for new project development,
- Diminishing resource quality,
- Increased scrutiny of environmental and social performance, and
- A lack of regional variety in extraction and processing activities. [55]

Clean-energy technologies such as solar PV and wind are thought to be undeterred by geopolitics. Although the threats are smaller, the supply chains for these technologies are nevertheless vulnerable to numerous risks associated with trade in equipment and raw materials.

[53] https://energy.ec.europa.eu/system/files/2022-03/FR_RPP_electricity.pdf
[54] https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions
[55] https://www.iea.org/reports/world-energy-outlook-2021

Critical minerals are of special importance since many renewable energy technologies are mineral-intensive, and mineral supply is limited in a smaller number of countries. The combination of a limited market size and increased degrees of regional concentration raises concerns, particularly as demand for key minerals grows. For example, the top three producing countries control more than three-quarters of worldwide output for lithium, cobalt, and rare earth elements. Processing operations are considerably more concentrated, with China having a significant position across the board. [56]

An energy system powered by clean-energy technologies needs significantly more minerals, notably:

- "Lithium, nickel, cobalt, manganese and graphite for batteries,
- Rare earth elements for wind turbines and electric vehicles motors,
- Copper, silicon and silver for solar PV,
- Copper and aluminum for electricity networks." [57] (Figure 14)

There is no lack of natural resources, but recent price increases for cobalt, copper, lithium, and nickel underscore how supply may struggle to cope with the world's climate objectives.

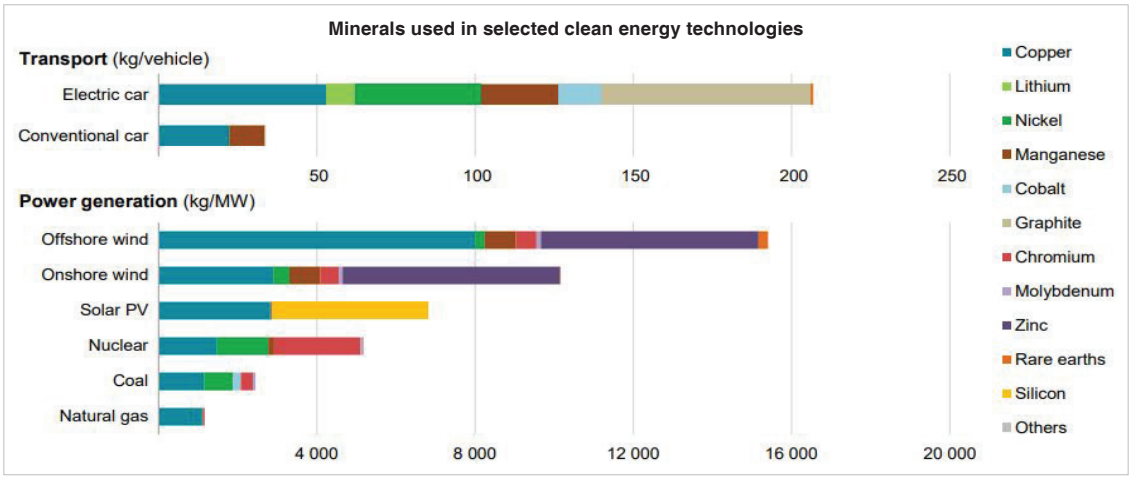


Figure 14. *Minerals Used in Selected Clean-Energy Technologies (kg/vehicle & kg/MW) (Source: IEA, 2021)*

Because of the increased impetus behind sustainable-energy transitions, the problem of critical minerals has moved up the policy agenda. Although uninterrupted supplies are a common element of the plans, exact orientations and policy goals differ based on national or regional conditions. Meanwhile, in recent decades, China has been identified as a prominent power in global supply chains for critical minerals and renewable-energy technology. The country's ascension to the top of renewable-energy supply chains has been substantially supported by long-term industrial strategies.

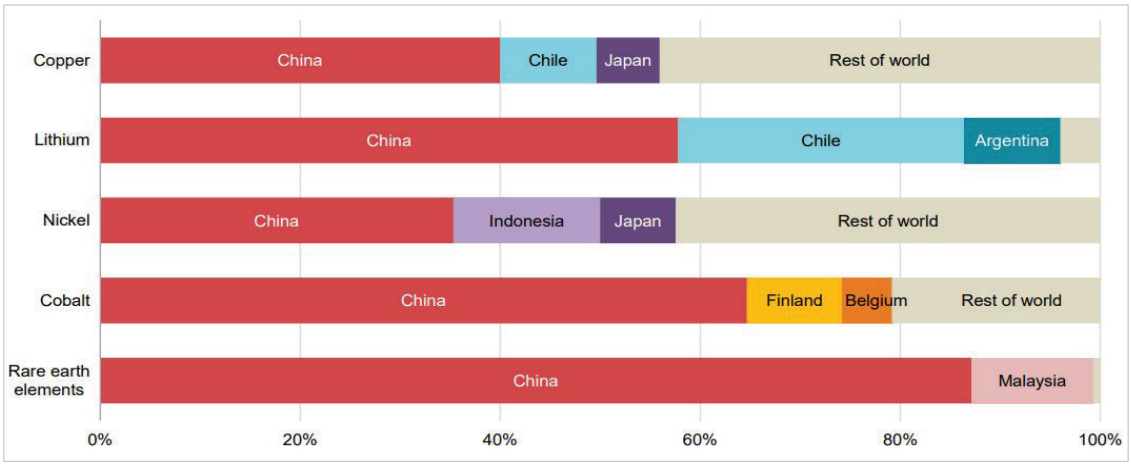


Figure 15. *The Share of Processing Volume by Country for Selected Minerals, 2019 (%) (Source: IEA, 2021)*

[56] https://www.iea.org/reports/world-energy-outlook-2021
[57] https://iea.blob.core.windows.net/assets/9d6f9b13-c478-41c6-9ffe-6a05f3ab73ef/Criticalmineralslaunchslides.pdf

Processing businesses are similarly concentrated, with China having a substantial position across the board as detailed in the selected critical mineral examples below (Figure 15)

- **Lithium:** Lithium chemical production is heavily concentrated in a few regions in the world. In terms of refining, China accounts for over 60% of worldwide lithium chemical output.
- **Cobalt:** The high reliance on the Democratic Republic of the Congo (DRC) for production and China for processing (China processes roughly 70% of mined cobalt worldwide) is expected to continue, since just a few projects are under development outside of both nations. Through major investments in the DRC's mining industry, China is believed to possess or have control over half of the DRC's cobalt output today. Today, lithium-ion batteries are the most common use for cobalt. As with lithium, the fast surge in EV deployment in the mid-2010s rattled the comparatively smaller cobalt market and fueled price volatility
- **Rare Earth Elements:** China dominates the rare earth element value chain, from mining through processing and magnet manufacture. Separation and refining operations are highly concentrated in China, accounting for about 90% of the market in 2019 (Figure 15)

Speaking at the IICEC Conference, Electric Vehicles Outlook Global & Turkey, [58] Dr. Fatih Birol, the Executive Director of the IEA, said the following: "Critical elements are needed for the manufacturing of batteries. Lithium is one of them. Others include magnesium and cobalt, which can be found in many parts of the world. However, three-fourth of these elements are concentrated in only a few countries. It is not possible to consider this fact independently from the security of energy supply.

"Today, the data shows a looming mismatch between the world's strengthened climate ambitions and the availability of critical minerals that are essential to realizing those ambitions. The challenges are not insurmountable, but governments must give clear signals about how they plan to turn their climate pledges into action. By acting now and acting together, they can significantly reduce the risks of price volatility and supply disruptions. Left unaddressed, these potential vulnerabilities could make global progress towards a clean energy future slower and more costly." [59] Dr. Fatih Birol, Executive Director of the IEA.

Dependence on critical minerals is a serious problem, and it is not only where minerals are located but also where they are processed and refined that matters. Currently, 90% of refining capacity is in one country, China. Many countries are negotiating with each other to establish a new system of security of critical energy supply under the leadership of the International Energy Agency." [60]

The IICEC Conference: "Electric Vehicles Outlook Global & Turkey," [61]

[58] https://iicec.sabanciuniv.edu/event/iicec-conference-electric-vehicles-outlook-global-turkey
[59] https://www.iea.org/news/clean-energy-demand-for-critical-minerals-set-to-soar-as-the-world-pursues-net-zero-goals
[60] https://iicec.sabanciuniv.edu/sites/iicec.sabanciuniv.edu/files/2022-01/Press%20Release%20IICEC%20Conference%2C%2028%20December%202021.pdf
[61] https://iicec.sabanciuniv.edu/event/iicec-conference-electric-vehicles-outlook-global-turkey

Emphasizing the importance of the critical minerals that are used to produce batteries by discussing the traditional risks, as featured in the IICEC Energy Market Newsletter No:24, Dr. Fatih Birol, the Executive Director of the IEA, reminds the audience about oil prices, oil's availability in markets, and highlighting some geopolitical tensions surrounding it, stated that "critical minerals such as lithium, magnesium, and cobalt will play a crucial role in the future as they are used in batteries," [62]

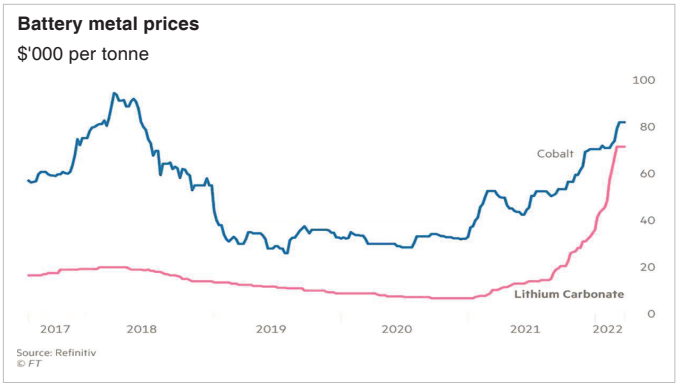


Figure 16. *Battery Metal Prices ($/'000 per tonne) (Source: FT, 2022)*

The competition for battery supplies is driving raw material costs higher. In 2022, spot prices for lithium carbonate have almost doubled to historic highs of more than USD 70,000/t (Figure 16). Commodity expenses have contributed 5% to 6% to the total price of EVs as of mid-March 2022. As a result of rising material prices, for instance, Tata Motors' battery costs have increased by 20%. Similarly, Tesla increased retail prices for its vehicles by 5 to 10% earlier this month. [63]

Dr. Fatih Birol, speaking at the IICEC Conference, Electric Vehicles Outlook Global & Turkey [64]

"Despite electric vehicles' rapidly growing market share, there are still certain problems, mainly arising from batteries and prices. Since the manufacturing cost of an electric vehicle is higher than that of an internal combustion engine-vehicle, any reduction in the cost of a battery is good news for all of us." [65]

For further reading on EVs, please click here to read IICEC Energy Market Newsletter No:24, to read IICEC Turkey Electric Vehicles Outlook Executive Summary click here and to watch the IICEC Conference on Electric Vehicles Outlook Global & Turkey, click here.

[62] https://iicec.sabanciuniv.edu/sites/iicec.sabanciuniv.edu/files/2022-02/IICEC_Energy_Market_Newsletter_24__1.pdf

[63] https://www.ft.com/content/94b79cc6-88e5-4377-a706-06dabd667761?accessToken=zwAAAX_fdEFhkdOUt5zGiOVDd9OnBgbavWZ3YQ.MEYCIQC672m_luqmqkGK31VnxASwS43U1MpvreXrNnW68NZH-gIhAL84Rmq8pP1r4-pV33Tmg7fLnsMOPrBK-KCR 4HIS5Aj&sharetype=gift?token=042e4894-11e3-4d52-8df9-21d3ad50f608

[64] https://iicec.sabanciuniv.edu/event/iicec-conference-electric-vehicles-outlook-global-turkey

[65] https://iicec.sabanciuniv.edu/sites/iicec.sabanciuniv.edu/files/2022-01/Press%20Release%20IICEC%20Conference%2C%2028%20December%202021.pdf

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