Energy

The first global energy crisis

The war in Ukraine has sent many nations scrambling for energy security. **Adam Vaughan** asks what it will look like

IN JUST over a month, Russia's invasion of Ukraine has displaced millions of people and killed thousands on both sides. At the same time, the war has triggered historic shifts in the world of energy. Many countries have long depended on oil and gas from Russia, which is one of the world's top exporters of fossil fuels. But with those exports now politically toxic, they are scrambling to find other ways to meet their energy needs.

The European Union has committed to cutting imports of Russian gas by two-thirds by the end the year. Frans Timmermans, first vice-president of the European Commission, has said it would be hard but possible.

The world's energy systems have been going through a slow transition to lower-carbon fuels for decades. But the war in Ukraine has changed everything and energy security is now the most pressing priority. A crucial question is how this will play out for the environment. Will it mean a renewed race towards renewables, or a rush to exploit domestic fossil fuels and new suppliers of oil and gas?

Even before the war, the world had energy problems. Gas production outages and increased demand from the post-covid-19 economic bounceback saw oil and gas prices rising fast by last September. The shocks were felt around the world. In the UK, some petrol stations ran out of fuel in October and electricity prices quadrupled in 2021.

The pandemic itself had also provided an opportunity for changes to our energy systems. As many cars remained parked and planes grounded in 2020, global carbon emissions fell steeply. There was plenty of talk about building on this with a "green recovery", by injecting government funds into green technology and jobs. But this opportunity has been missed. Only 6 per cent of the $860 billion of global stimulus designed to kick-start economies was funnelled into emissions-cutting measures.

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A protest in Boston, US, on 6 March highlighted the issue of Russian oil

Better news came when nearly 200 countries at the COP26 climate summit in November 2021 promised to "phase down" coal, a first for the UN climate talks. But so far that hasn't happened. High gas prices meant coal-burning in 2021 reached its highest level ever. This has seen emissions jump to above where they were before the pandemic.

> **"Even before the war in Ukraine, the world was facing an energy crisis"**

This was the backdrop as Russia invaded Ukraine in February. Events moved fast. Germany has shelved a major new gas pipeline from Russia. Along with the EU measures, the UK and US announced plans to end imports of Russian oil and gas. Many energy companies also chose to "self-sanction": Shell apologised and ceased sourcing oil from Russia after criticism for buying a shipment of Russian crude.

"In my view, it is the first global energy crisis," says Fatih Birol, the executive director of the International Energy Agency. "It will be a turning point by any means. The question is, in which direction are we going to turn?"

He sees two possibilities. On the one hand, he says, climate change is already "sliding down the policy agenda in many governments". On the other, countries could repeat the energy innovation that came out of the 1970s oil price shocks, with increased energy efficiency, more nuclear power and an increase in spending on low-carbon technologies.

To see which way things might go, a good starting point is the EU's new energy strategy, released on 8 March. It doubles down on energy efficiency, wind and solar power, with more ambition than under the existing climate plan, and it includes those cuts to Russian gas. But most of that gas will simply be swapped for gas from elsewhere, sourced through pipelines from Africa and shipments of liquefied natural gas (LNG) from countries such as the US. The EU isn't ditching gas, it is just diversifying its sources.

Other emergency responses to the crisis may also be bad news for emissions. Coal is a particular danger because it is incredibly dirty but now cheaper than gas. The UK government is reportedly

talking to energy firms about postponing the planned closure of coal-fired power plants.

Dash for gas

In Asia, many nations have been lowering their emissions by switching from coal to gas, a cleaner if still problematic fuel. But Europe is now looking for more shipments of LNG, prices are going up and those Asian countries will end up burning more coal, says Jason Bordoff at Columbia University in New York. That is important, because Asia has been driving the majority of global emissions growth recently.

The trouble is that the US, UK and countries in the EU need a solution to this energy crisis fast, certainly before the return of their winter at the end of 2022. Dependence on gas can be reduced by switching to heat pumps, insulating houses and building more wind farms, but that takes time.

In the short term, countries are considering whether to increase domestic production of oil and gas to help curb price rises. UK prime minister Boris Johnson has recently met with energy firms to talk about boosting investment in oil and gas projects in the North Sea and how the UK government can speed up extraction.

Indeed, many people see a distinction between the short and long-term implications of this energy crisis. Chris Stark, head of the Climate Change Committee that advises Johnson, says this moment holds the potential to "get people more sharply focused on our dependence on fossil fuels", which would be good in the long run. "But the biggest concern is that we run the risk of locking in fossil fuel use, fossil fuel production especially, and actually blowing entirely the budget for [the] Paris [Agreement]."

70
Amount of hydrogen, in millions of tonnes, produced globally each year

15
Amount of extra hydrogen, in millions of tonnes, the EU wants to produce per year under its new energy security plans

Further into the future, things may be brighter. "In the long term, the energy security agenda aligns very well with the decarbonisation agenda," says Thijs Van de Graaf at Ghent University in Belgium. Adair Turner, chair of the Energy Transitions Commission, an international group funded by major energy companies, says that insulation, heat pumps and wind farms will all see more investment over the next five years because of today's crisis.

One practical step the UK and EU are exploring is how to remove planning system hurdles for renewables projects. Birol hopes there will be major leaps in energy efficiency, renewables, electric cars, hydrogen and small modular nuclear reactors. "There's no reason it cannot happen," he says.

Hydrogen and nuclear power are two technologies that can help decarbonise the energy sector and provide greener power for heavy industry. Will these help fend off energy woes?

When produced in the right way, hydrogen is a relatively clean fuel and it is a key part of the EU's plan for weaning itself off Russian gas.

A worker repairs an oil pipeline owned by Russian firm Gazprom

ANDREY RUDAKOV/BLOOMBERG VIA GETTY IMAGES

An extra 15 million tonnes of renewable hydrogen per year is planned by 2030, 10 million imported and 5 million made in Europe.

That is huge, and possibly unrealistic. Renewable hydrogen production today is minuscule. Only 70 million tonnes of hydrogen are produced globally per year and almost all of this is made from fossil fuels through a process called steam reformation, which releases carbon dioxide. "I am missing the implementation, the policies that are going to make that possible," says Anne-Sophie Corbeau at Columbia University.

It will also be expensive, and it is unclear how imports will be transported, she says. The EU's strategy had embraced hydrogen produced through gas-powered steam reformation and the clean process of making hydrogen from water using electrolysis. But Corbeau thinks high gas prices mean the strategy will now evolve to favour the latter.

"This crisis will be a turning point. The question is: which direction are we going to turn?"

Under pressure to switch to cleaner fuels, Russia had been planning a pivot to supply Europe with hydrogen in future. But another implication of the war, says Corbeau, is that this idea has had a "first-class funeral".

What this crisis means for nuclear power is less clear. Nuclear plants in Europe are ailing. A new plant in Finland is nearing full output, but it is 13 years behind schedule. France has a large fleet of nuclear power stations, but they are ageing and output forecasts have been revised down this year due to some reactors being offline. It is a mixed picture elsewhere, ›

too. Belgium is weighing whether to postpone planned closures of its nuclear power stations. But Germany has ruled out delaying its scheduled nuclear exit at the end of the year.

Stark says extending the life of nuclear plants makes sense, if they are safe. "Globally, definitely we should be looking again at plans to close nuclear power stations early." UK prime minister Johnson has called for a "lot more nuclear", suggesting that proposals for a new plant in the east of England could get the go ahead.

"Politicians are talking more in the language of energy self-sufficiency"

Politicians are also talking more in the language of energy self-sufficiency. Germany's finance minister, Christian Lindner, has called renewables "the energy of freedom". Johnson recently said "now is the time to unleash an extraordinary programme of energy independence".

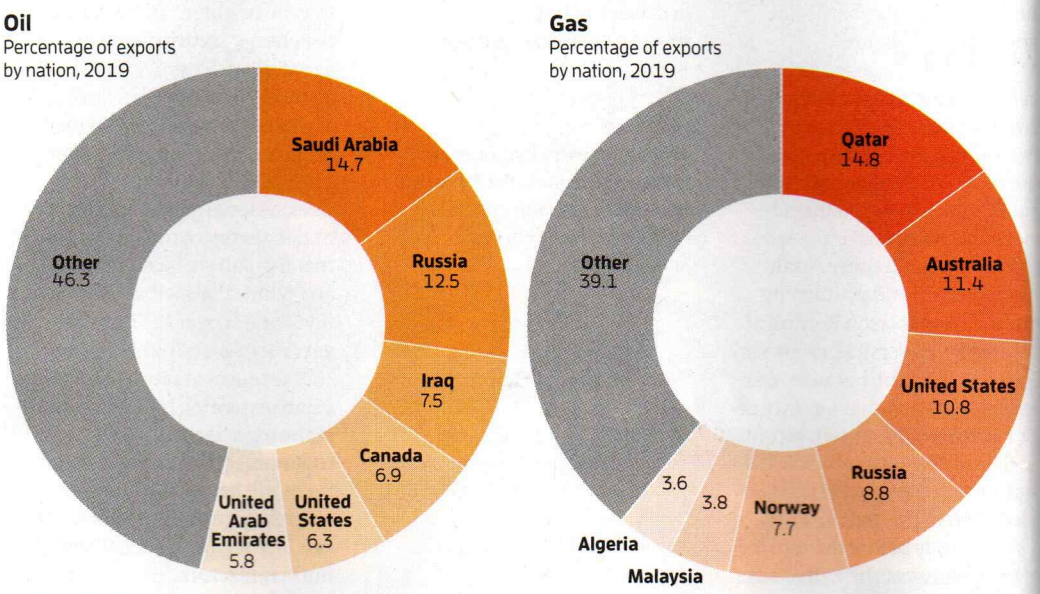
Would energy independence be a good thing? It might seem like an attractive idea, with nations shielded from the impacts of world events. But it isn't so simple.

For starters, true energy self-sufficiency is impossible. "Energy independence never worked. The idea that you can isolate yourself from shocks is wishful thinking," says Bassam Fattouh at the Oxford Institute for Energy Studies.

Russia is a major producer of oil and gas, but it is far from the only one (see charts, above). The UK sources only about 4 per cent of its gas from Russia. The price of gas is set internationally, however, and gas is still a bedrock of UK electricity generation and heats most UK homes, so the UK is still exposed to the shock: a typical annual energy bill is projected to reach nearly £3000 from October.

The oil and gas giants

A few nations dominate the export of oil and gas, and Russia is a big player in both industries



SOURCE: OBSERVATORY OF ECONOMIC COMPLEXITY

£3000

The projected annual price of a typical UK household energy bill by October 2022

Even for big energy-producing countries like the US, the idea that they could become energy islands is a fantasy, says Bordoff. Some in the US have argued that the country should detach from international markets to keep US oil and gas cheap, but he says that would reduce resilience, removing the safety net of imports when hurricanes hit the Gulf of Mexico and halt domestic oil production.

Connection not isolation

"Energy security comes not from being disconnected and isolated, but actually from more interconnection and integration," says Bordoff. Ottmar Edenhofer at the Potsdam Institute for Climate Impact Research in Germany agrees: "Energy security means diversification of imports, not necessarily less imports."

That said, today's energy crisis will probably fuel deglobalisation, with supply chains and manufacturing kept within borders, a trend that had been boosted already by the pandemic. "We have had these two accelerating moments now, all pointing to the same direction," says Van de Graaf. Even pre-covid-19, European countries had taken steps to encourage battery factories to set up within their borders, to reduce manufacturers' reliance on Asian battery plants.

The issue could soon get more complex. Batteries contain a witches' brew of chemical elements sourced from around the world. Russia itself is a major producer of nickel, an important ingredient in lithium-ion batteries. "The supply chain resilience conversation was already on the go because of the pandemic, but this will just amp it up to 11," says Jeff Colgan at Brown

University in Providence, Rhode Island. Of course, it isn't just energy that is affected by supply chain issues (see "The price of bread", below).

In a few years, we might be living in a world where new clubs of nations have formed, with fresh links between countries on the basis of sharing renewable energy, for example. "The supply of sunshine and wind is not evenly distributed across the world, but it's much more evenly distributed than fossil fuels," says Turner.

He envisages a significant amount of international trade even after oil and gas use comes down. High-voltage, long-distance electricity cables linking renewable energy projects in Morocco to the UK, and Australia to Singapore, are already being planned. Connections like these could smooth the variable nature of wind and solar power. "In a logical, peaceable world, we'd be linking up grids all over the place," says Turner. "I think that will occur and should occur."

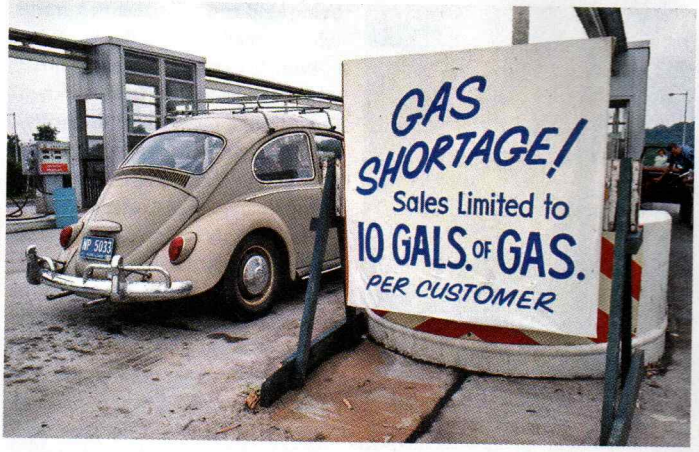
The 1970s oil shock prompted a massive rise in public spending on research and development in energy. Nuclear, hydrogen, solar power and fuel efficiency in cars all benefited. Will history repeat? "I think the answer is probably yes," says Bordoff.

Corbeau thinks the focus will be on technologies that are essential for decarbonisation – such as carbon capture and storage and hydrogen – and how to scale them up. Yet she is sceptical that governments, with public finances stretched by covid-19 and financially insulating consumers from energy prices, will have the resources for it.

One route in the UK is the "high-risk, high-reward" Advanced Research & Invention Agency, which starts in May with an £800 million budget to 2024.

Turner says research into energy storage will be crucial. There are times when it isn't windy or sunny for days or weeks on end. Batteries can't help in such cases, because they don't have enough capacity to last that long at scale.

So if countries are to become more self-sufficient, and use low-carbon energy, they will need new forms of long-duration power storage. That will mean investing in existing technologies such as pumped hydro, which involves pumping fluids uphill, storing them there, and then letting them flow downwards to turn a turbine and generate power when needed. It may also involve more embryonic forms of storage, such as compressed air.



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The energy crisis of the 1970s led to shortages at the petrol pumps

"The tools we need to decarbonise our energy systems can also provide energy security"

In another shift towards independence, Bordoff thinks research spending will increasingly be aligned with countries' industrial strategies, so that jobs and supply chains are within their borders. Denmark's push to jump from being an oil exporter to cementing its lead in wind power is one such example.

Most observers think it is too early to say which direction the world will take from the current energy crossroads, but they largely agree on two things.

First, the tools we need to decarbonise our energy systems can also deliver energy security. And second, the importance of energy security will be elevated for a long time, after two decades of low prices and abundant supplies of energy in Europe and the US. "Suddenly, people have realised energy security is not something that could be forgotten," says Corbeau. ▮

The price of bread

Food prices were at record highs even before Russia's invasion of Ukraine and the war is likely to push them up even further. The UN's food price index was at an all-time high of 140.7 points in February, beating the previous record from 2011. Back then, a food price crisis sparked riots across the Middle East and south Asia.

The reasons the war is making food prices spike are twofold. The first is supply. Russia and Ukraine together export about 30 per cent of the world's wheat, more than half its sunflower oil, and Russia is also a major producer of fertilisers. Just as Russia's oil and gas are no longer deemed viable imports for Western nations (see main story), so supply of foods is being affected too.

The second factor driving up food prices is a global one. Gas and oil prices are soaring everywhere as a result of the war and this also hits farming.

Farm machinery needs fuel to keep running. And making fertiliser is an energy-intensive process, involving a high-pressure chemical reaction called the Haber process. Earlier in March, Norwegian fertiliser company Yara temporarily curbed production in France and Italy due to high gas prices.

The impacts of rising prices will be felt unevenly across the globe, with lower-income countries and communities hit hardest. Iraq has already seen protests erupt in early March over food prices. Hungary banned exports of grains on 4 March over food security concerns. Ronald Kers of 2 Sisters, a major UK food manufacturer, has said consumers in the country should expect food price rises of up to 15 per cent this year.