# EUROPEAN FOSSIL FUELS

## RESOURCES AND PROVEN RESERVES

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NETZERO WATCH

# European Fossil Fuels: Resources and Proven Reserves

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## About the author


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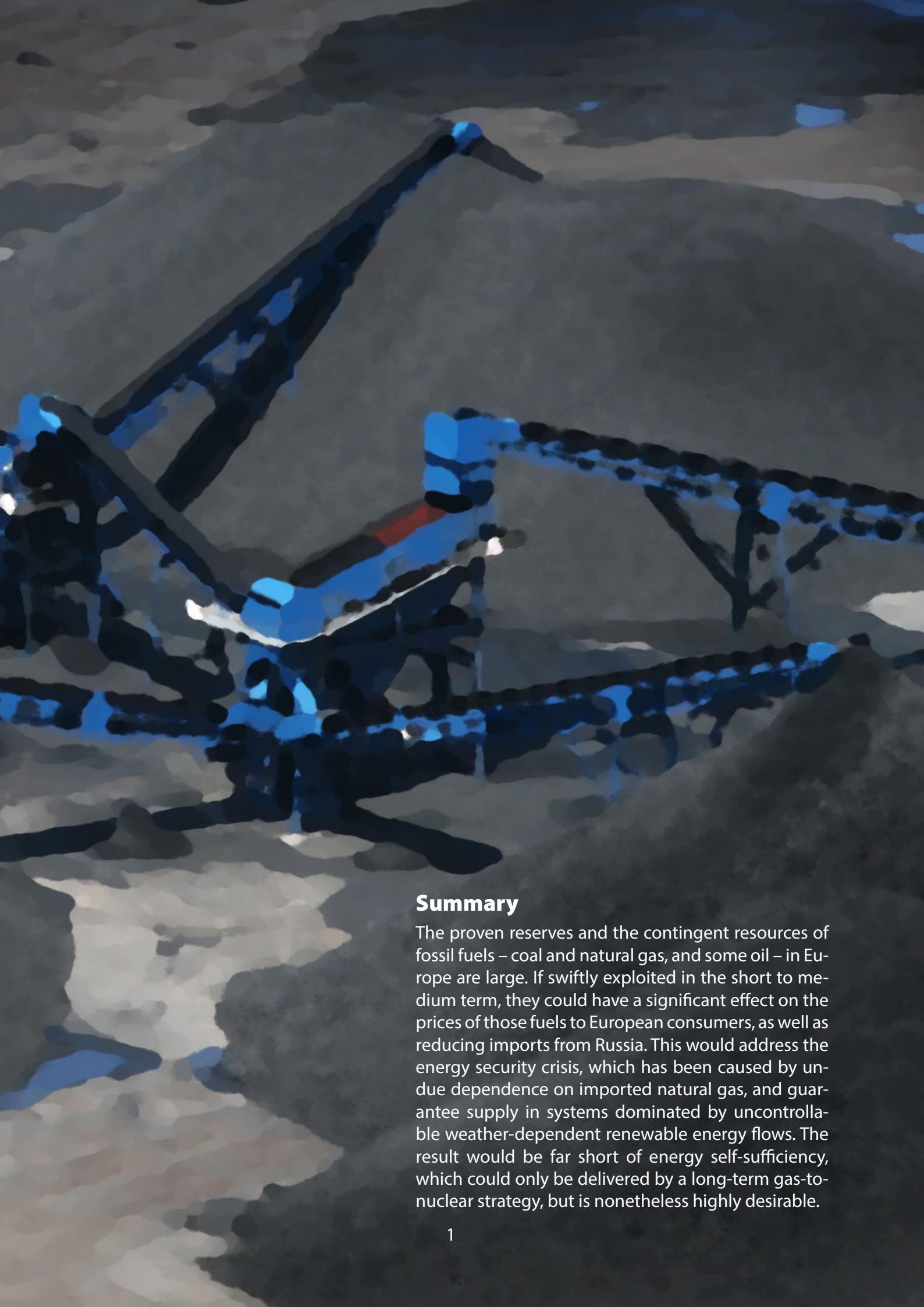



## Summary

The proven reserves and the contingent resources of fossil fuels – coal and natural gas, and some oil – in Europe are large. If swiftly exploited in the short to medium term, they could have a significant effect on the prices of those fuels to European consumers, as well as reducing imports from Russia. This would address the energy security crisis, which has been caused by undue dependence on imported natural gas, and guarantee supply in systems dominated by uncontrollable weather-dependent renewable energy flows. The result would be far short of energy self-sufficiency, which could only be delivered by a long-term gas-to-nuclear strategy, but is nonetheless highly desirable.

## The current energy crisis

Europe is in the midst of the worst energy crisis for a generation or more, a crisis that has been in the making for many years and was beginning to become acute even before the Russian invasion of Ukraine accelerated the process. Mr Putin had a clear intention to capitalise on the weakness in European energy supply, something that has now been made manifest in the intimidatory sabotage of the Nordstream 2 pipeline.

There is very little that the European states can do in the short run, but it is of critical importance that the causes of the current crisis are correctly identified, otherwise counterproductive remedial measures will result. The naïve, indeed dangerously ignorant and unrealistic conclusion is that dependence on natural gas justifies still greater emphasis on renewable energy. In fact, it is the renewables policies have that resulted in this gas dependency. The energy and economic system must have a thermodynamically competent fuel somewhere in the scheme, and this inevitably has been natural gas for most European states, since both solar and wind are of such low entropic quality that they contribute little or less than nothing to security of supply. Yet, in a bizarre paradox, European policymakers, notably those of Germany and the European Union, have systematically deprecated fossil fuels since 1990s in an effort to seize international leadership on climate change, while at the same making the remaining fossil fuel of natural gas the sole thread by which economic and societal stability hands. Forceful promotion of renewable energy through instruments coercing consumers to buy its output at above market prices has not only cost European consumers an additional €770 billion in subsidies to green energy since 2008, but has discouraged exploration for fossil fuels and the development of available resources of coal, oil and natural gas, and made the European markets increasingly dependent on imports, imports that must be bought on the short-term markets because the output from the wind and solar fleet varies over all timescales from seconds to decades. The EU's policy could not have been more damaging to the interests of the European states if it has been drafted in the Kremlin itself.

Similar effects across Europe were also seen in relation to oil and coal, where policy discouraged production without removing the need for these thermodynamically superior fuels. The result was increased imports of all fossil fuels, particularly from Russia.

In 2021, as the world's economy recovered after the global pandemic, international competition for fossil fuels began to grow, and the lack of fuel diversity in the European region became apparent. The problem was brought

sharply into focus by a slump in wind power output, which was much lower than in 2020, down by nearly 20% in the UK for example, leaving many countries scrambling for additional imports of natural gas. High regional prices resulted.

The subsequent invasion of Ukraine compounded these difficulties. It also confirmed the anxieties raised in 2014, after Russia's annexation of the Crimea, namely that relying on Moscow as a supplier of natural gas might represent a strategic liability, as well as being deeply unpalatable because of the income that gas sales generate for the Kremlin.

The naïve response to the crisis is to suggest that Europe should add yet more renewable energy to its supply in the hope of reducing fossil fuel demand. But as already noted, the lack of fuel diversity and the extreme dependency on the availability and price of imported natural gas to guarantee security of electricity supply is the result of policies favouring (inferior quality, high entropy) energy sources such as wind and solar, while suppressing domestic production of (high quality, low entropy) fossil fuels.

Net Zero Watch has argued that the correct and indeed the only possible short-term response to the acute aspects of the current crisis is as follows:[1]

- Move as quickly as possible to increase domestic production of fossil fuels, in the North Sea for example.
- Simultaneously reduce renewable energy generation, thus stabilising demand for natural gas, enabling traders to obtain longer-term supply contracts from non-Russian sources at less disadvantageous prices.
- Speedily upgrade CCGT fleets to the latest models, which are more thermally efficient and therefore use significantly less gas per unit of electricity generated.
- Permit exploratory fracking for natural gas and oil, the full potential of which is unknown, but deserves verification, as will be seen when the scale of the resources is touched on below.

In the longer term, Europe should clearly be aiming to build new fleets of advanced nuclear reactors for electricity and, in particular, for high-grade heat for industrial purposes, a function currently supplied by natural gas and coal.

We also noted that it would be wise on security grounds to recognise that the development of nuclear energy might be delayed and that plans should be prepared to instal advanced supercritical coal fired power stations for the generation of electricity.

## Proven reserves of fossil fuels in Europe

The urgent need to increase fossil fuel availability from non-Russian sources, and ideally from sources in Europe itself, raises the obvious question as to what quantities of fossil fuels are available in the European region. These may be:

- reserves (deposits that are known to be economic to extract with current technology and at current market prices)
- contingent resources, discovered and understood with a high degree of confidence, but dependent on a higher price to become economic
- prospective resources (deposits that are believed to exist but are as yet unexplored)

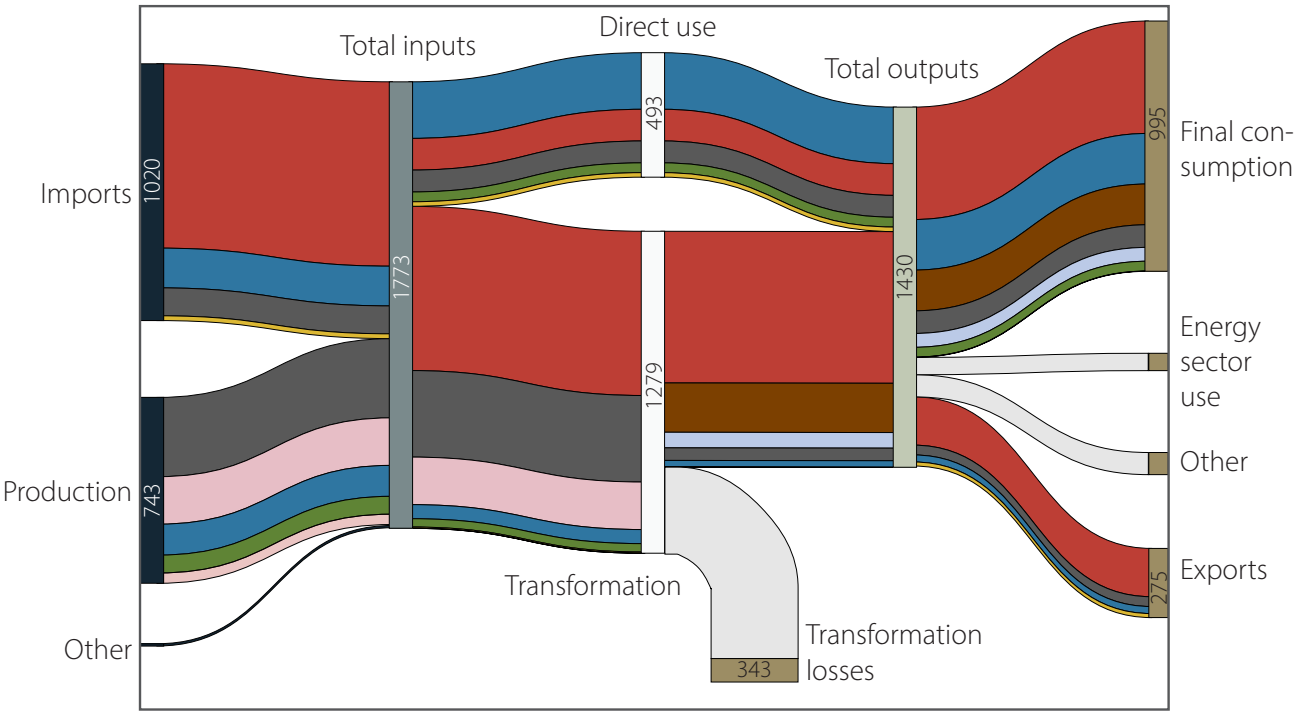
Table 1 summarises data from the *BP Statistical Review of World Energy* (2021), reporting the *proven reserves* of coal, oil and natural gas in Europe, proven reserves being 'those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions'. These are what Europe currently has immediately to hand in spite of more than twenty years of policies discouraging exploration and development. Had the policies not been in place, the proven reserves available today would almost certainly be greater still, as the market responded to the signal of rising prices. But even so, they are far from trivial, with European coal reserves amounting to nearly 13% of the global total, and sufficient to support current, admittedly low, levels of production for nearly 300 years. Europe's oil reserves amount to a little under 1% of the global total, and its gas reserves to just under 2% of the world total, but would still be sufficient to meet current production levels for more than ten years, and more than fourteen years respectively. There is headroom for increased production.

It is, of course, true that European production of fossil fuels is only a small fraction of its total requirements at present, but it is equally clear that both reserves and production would certainly have been higher in the absence of climate policies, and that the current levels of both could be readily increased, with useful effects on prices and security. This can be appreciated by comparing energy flow diagrams for the European Union in 1990 and in 2019 (Figure 1).

Table 1: Proved fossil fuel reserves in Europe.
Reserve/production ratio is calculated by dividing the proved reserves at a given point in time by the production in that year. Source: BP Statistical Review.

| | 2020 | Fraction of global total | Reserve/production ratio (years) |
|---|---|---|---|
| Coal (million tonnes) | 137,240 | 12.8% | 299 |
| Oil (billion barrels) | 13.6 | 0.8% | 10.4 |
| Natural gas (trillion cubic metres) | 3.2 | 1.7% | 14.5 |

(a) 1990




(b) 2020

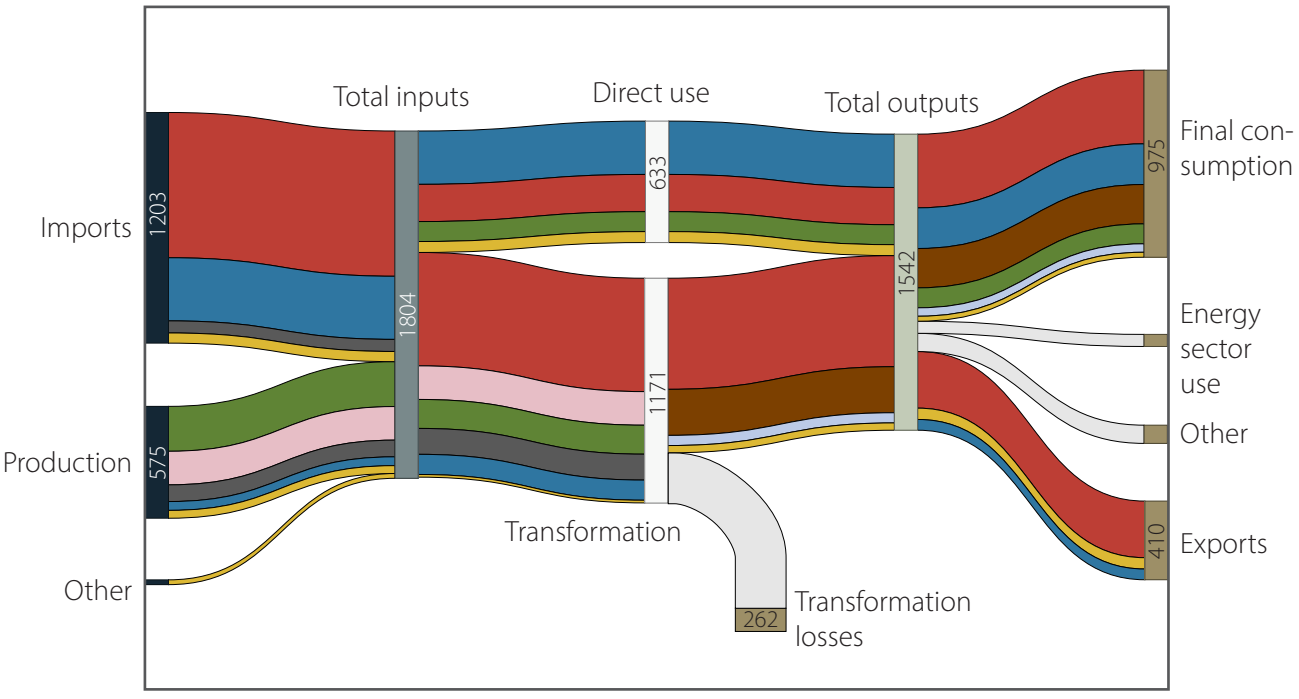




**Figure 1: EU27 energy flows.**

(a) 1990; (b) 2020. Millions of tonnes of oil equivalent. Source: Redrawn from Eurostat data.

In 1990, the countries of the European Union were producing more coal than they imported, and domestic production of gas was nearly equivalent to imports. Oil production was, however, a small fraction of total demand and was dwarfed by imports.

By 2019, consumption of coal had fallen dramatically, with imports and domestic production still roughly balanced. Domestic production of renewable energy had grown significantly, giving the impression that overall import dependency was more or less constant in spite of falling fossil fuel production. In 1990 total energy input to the European Union amounted to about 75.5 million terajoules (TJ), of which 50.3 million TJ, or about 67%, were imported. In 2019, total supply amounted to 82.9 million TJ, of which 56.7 million TJ were imported, or about 68%.

However, as noted above, renewables contribute little or nothing to security of supply because they are weather dependent. *Security has therefore become increasingly reliant on natural gas, giving particular significance to the sharp fall in European production, which is now dwarfed by imports.*

Fortunately, about 16% of the European Union's imported natural gas is obtained from Norway, a stable democratic state, which also has just under half of the European region's proven reserves. On the other hand, 41% of EU natural gas imports come from Russia. Moscow also supplies 27% of the EU's oil and 47% of its solid fuel, although the latter is a relatively small absolute quantity.[2]

In this context, even modest increases in proven reserves and levels of production within the European region could have considerable economic and geopolitical benefits.

## Resource estimates

The potential for increases in proven reserves and levels of production can be gauged from estimates of the contingent and prospective resources of these fuels. Such estimates are inherently uncertain, but they provide a reasonable indication of the order of magnitude of a potential fuel resource.

### Coal resources

Table 2 summarises data on resources and proven reserves of coal published in 2012 by the European Commission. The study estimates that resources plus proven reserves for the EU 27 amounted to over 800 billion tonnes. As noted above, BP's *Statistical Review* estimated that proven reserves in 2020 amounted to about 140 billion tonnes. Thus the EU 27's coal resources are very approximately four times larger than its proven reserves, and could last for many centuries, even at increased levels of consumption. It should be noted that this estimate does not nclude the very large additional coal resources believed to lie under the North Sea, as reported recently in the industry press.[3]

It is interesting to note in passing that the same study reported very substantial resources of hard coal in Ukraine.

In summary, proven reserves are very substantial, and contingent and prospective resources are still greater. There is a great deal of coal in Europe, and even if consumption were increased considerably there would be sufficient for several centuries.

Table 2: European coal as at 2012.

Sum of resources and reserves.

| | Hard coal Mt | Brown coal Mt |
|---|---|---|
| Austria | — | 333 |
| Belgium | 4,100 | — |
| Bulgaria | 4,112 | 4,574 |
| Czech | 9,946 | 16,627 |
| France | 160 | 114 |
| Germany | 82,921 | 77,000 |
| Greece | — | 6,430 |
| Hungary | 5,351 | 7,717 |
| Ireland | 40 | — |
| Italy | 610 | 29 |
| Netherlands | 3,247 | — |
| Poland | 176,738 | 228,183 |
| Portugal | 3 | 66 |
| Romania | 2,446 | 9,920 |
| Slovakia | 19 | 1,061 |
| Slovenia | 95 | 656 |
| Spain | 4,231 | 319 |
| Sweden | 5 | — |
| UK | 187,071 | 1,000 |
| Total EU 27 | 481,095 | 354,029 |
| | | |
| Croatia | — | 300 |
| Macedonia | — | 632 |
| Albania | — | 727 |
| Bosnia | 630 | 4,182 |
| Norway | 78 | — |
| Serbia | 855 | 31,012 |
| Turkey | 1,190 | 12,114 |
| Ukraine | 81,045 | — |
| Total other European countries | 83,798 | 48,967 |

Source: EU Commission DG Energy (2012). https://ec.europa.eu/energy/sites/ener/files/documents/20121217_eu_co_res_report.pdf.

## Shale gas resources

In 2014, and in response to an earlier phase of the Ukraine crisis, the European Union undertook research into regional energy security.[4] This reported work by the German Federal Institute for Geosciences and Natural Resources to the effect that technically recoverable shale gas resources in Europe amounted to some 14 trillion cubic metres, between four and five times greater than the proven reserves of natural gas reported for 2020 in the BP *Statistical Review* quoted above. Most of these resources are thought to be concentrated in France and Poland, but the figures for the UK, Germany, the Netherlands and Denmark add up to a substantial additional resource, equivalent to about half of the French total.

This substantial resource remains all but completely unexplored at present, due to successful campaigning by environmental pressure groups.

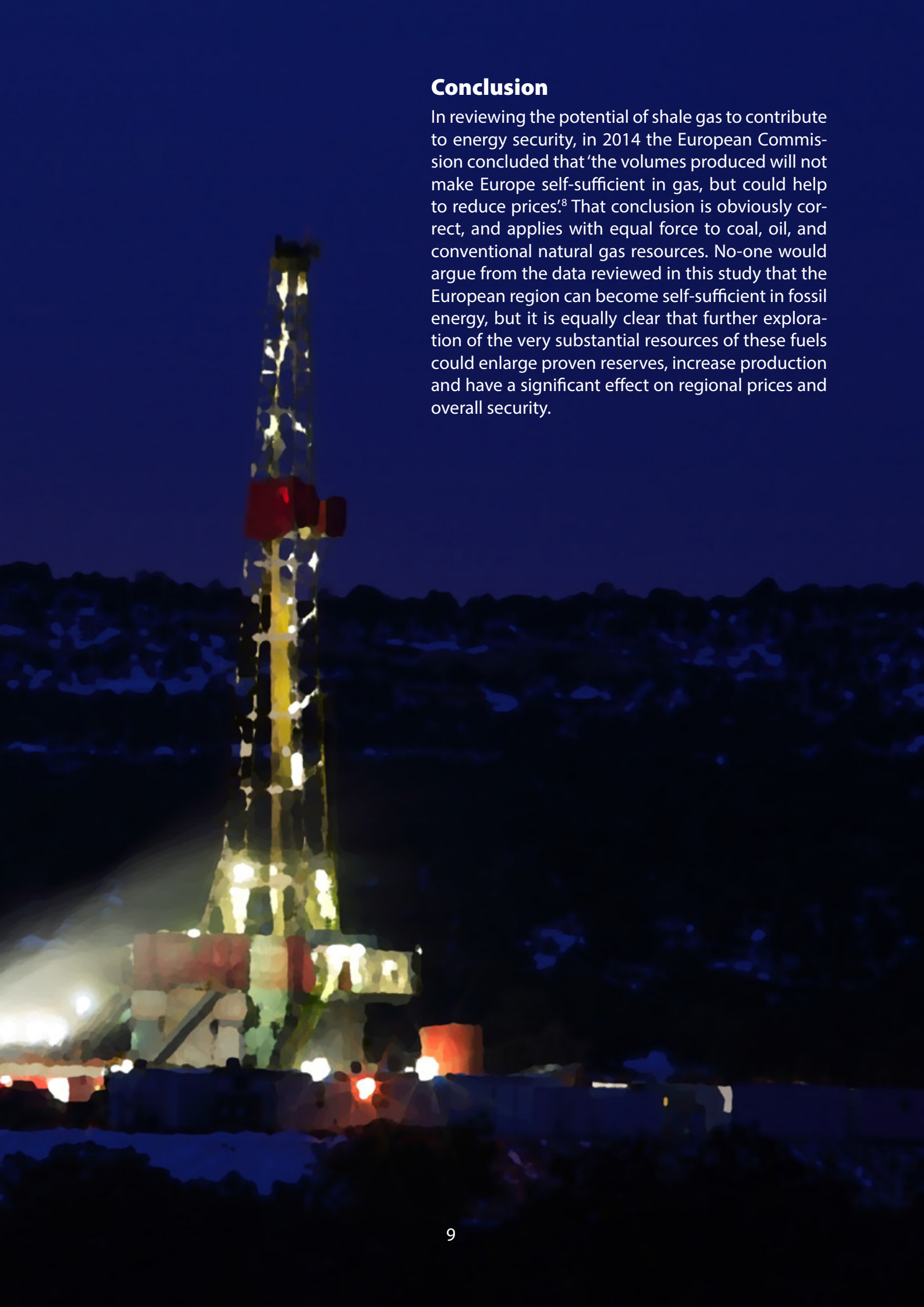
## North Sea oil and gas resources

The two most significant holdings of oil and gas in the North Sea are in UK and Norwegian waters. BP's *Statistical Review* reports, for 2020, proven reserves of 7.9 billion barrels of oil and 1.4 trillion cubic metres of natural gas in Norwegian waters, and 2.5 billion barrels of oil and 0.2 trillion cubic metres of natural gas in UK waters.

Norwegian Petroleum reports that contingent resources in fields and discoveries and undiscovered resources probably amount to about 2.5 times proven reserves of oil, and about 1.6 times proven reserves of gas.[5]

The UK's Oil & Gas Authority (recently renamed the North Sea Transition Authority) reports that its contingent resource level of 6.8 billion barrels of oil equivalent of oil and gas (of which about 70% is oil and 30% gas) is about one and a half times larger than the proven reserves that could sustain UK Continental Shelf production to 2030, implying that another decade or more of production at current levels might be sustained from these resources.[6]

In passing, it is interesting to note that other sources report natural gas reserves in Ukraine only slightly smaller than those of Norway.[7]



## Conclusion

In reviewing the potential of shale gas to contribute to energy security, in 2014 the European Commission concluded that 'the volumes produced will not make Europe self-sufficient in gas, but could help to reduce prices'.[8] That conclusion is obviously correct, and applies with equal force to coal, oil, and conventional natural gas resources. No-one would argue from the data reviewed in this study that the European region can become self-sufficient in fossil energy, but it is equally clear that further exploration of the very substantial resources of these fuels could enlarge proven reserves, increase production and have a significant effect on regional prices and overall security.

## Notes

1. https://www.netzerowatch.com/radical-plan-to-end-the-energy-crisis/.
2. https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html#carouselControls?lang=en.
3. https://www.worldcoal.com/coal/31032014/coal_discovered_in_north_sea_674/.
4. https://ec.europa.eu/energy/sites/ener/files/documents/20140528_energy_security_study.pdf.
5. https://www.norskpetroleum.no/en/petroleum-resources/resource-accounts/.
6. https://www.nstauthority.co.uk/media/7764/rr-report_final-22-september-2021.pdf.
7. https://hir.harvard.edu/ukraine-energy-reserves/.
8. https://www.europarl.europa.eu/RegData/etudes/BRIE/2014/542167/EPRS_BRI(2014)542167_REV1_EN.pdf.

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