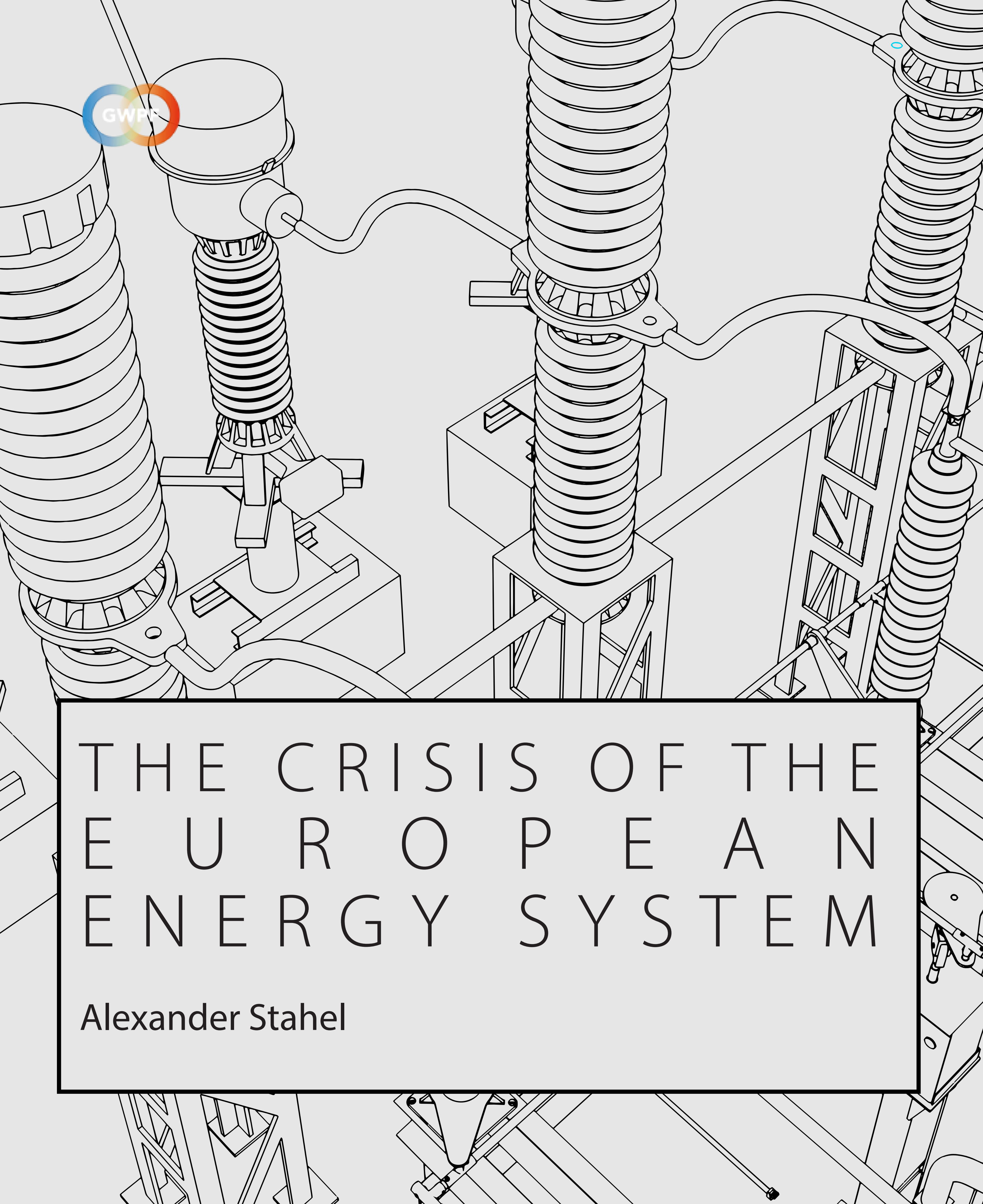


THE CRISIS OF THE EUROPEAN ENERGY SYSTEM

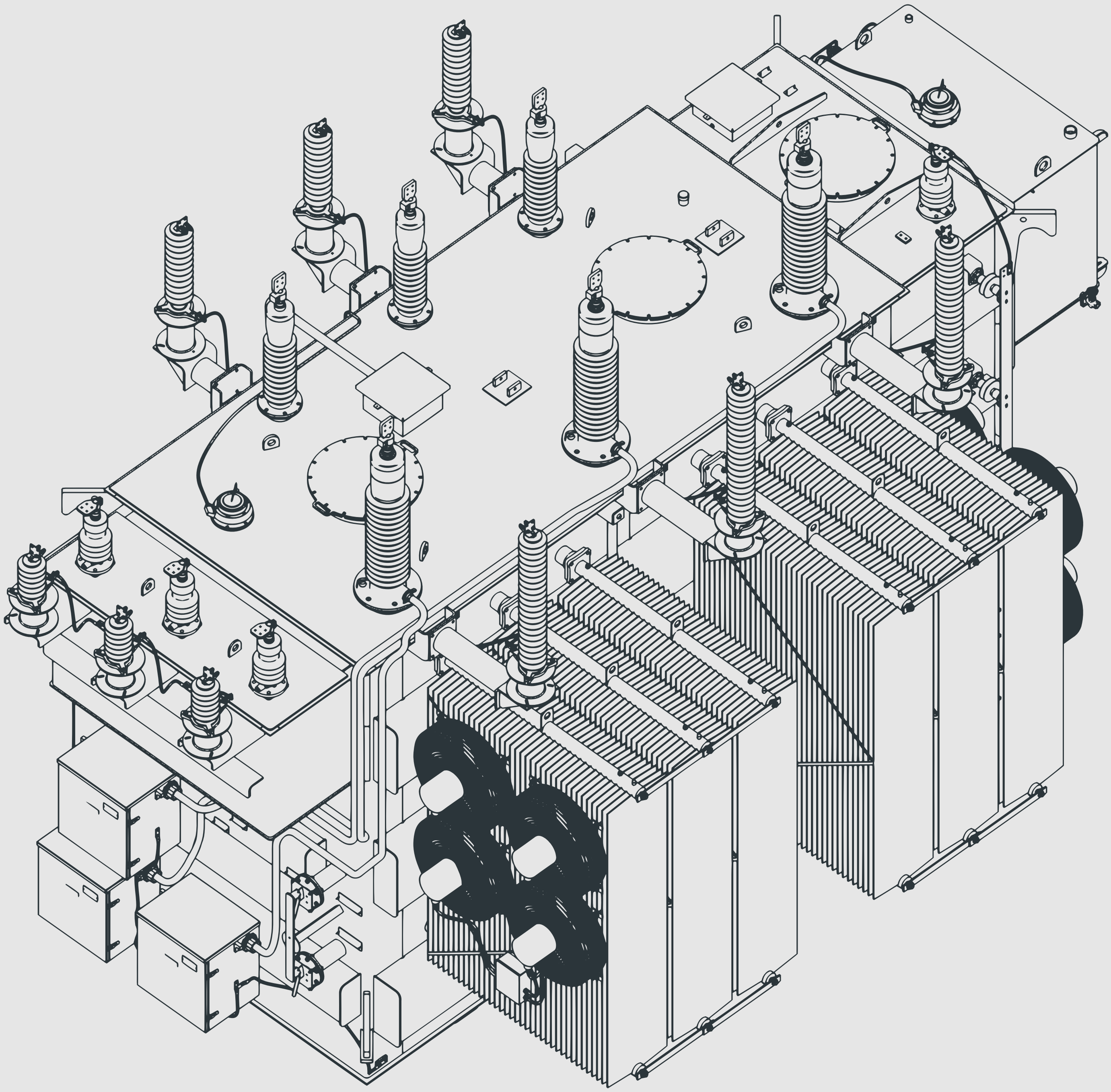
Alexander Stahel

The Global Warming Policy Foundation
Note 35

The Crisis of the European Energy System

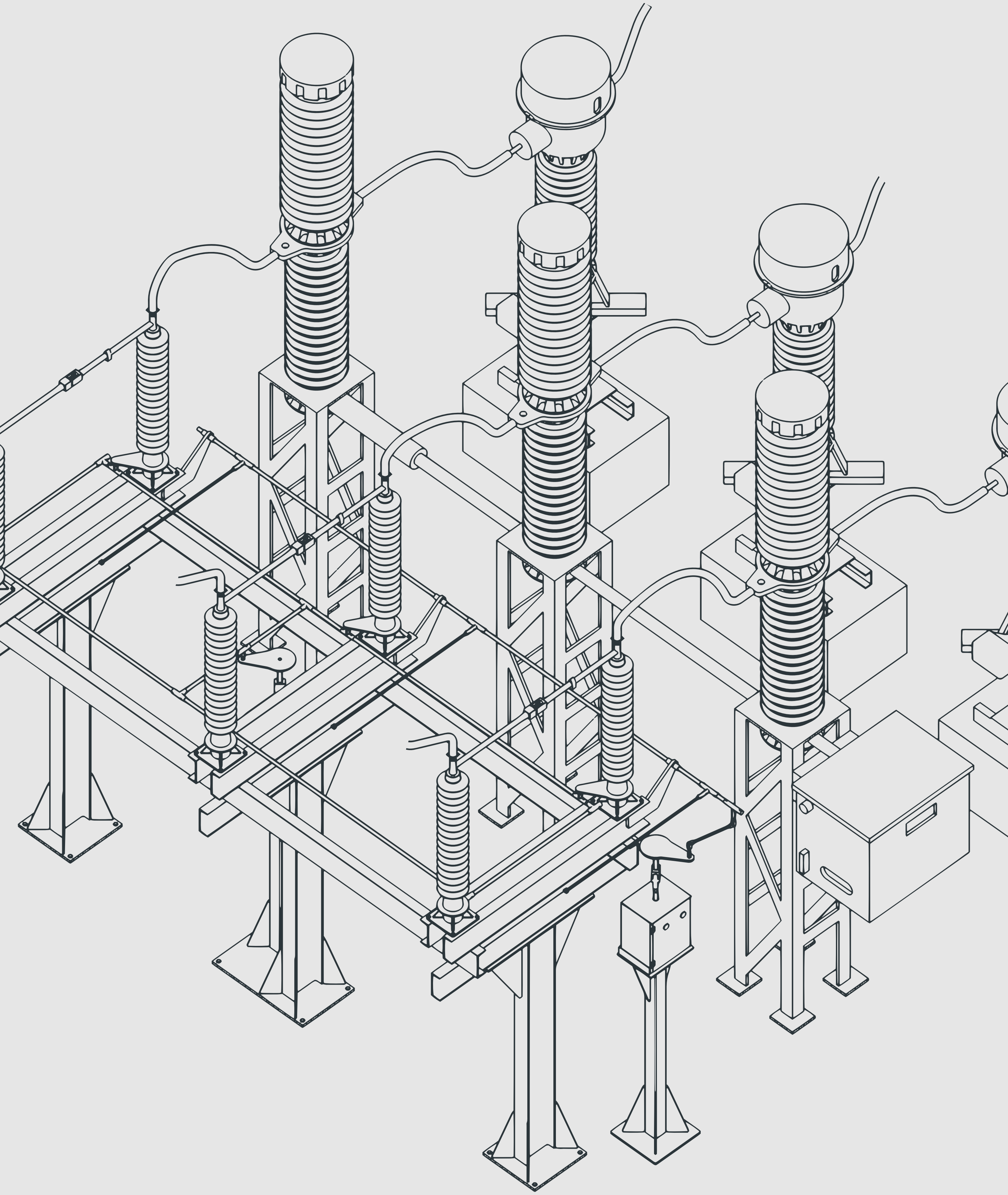
Alexander Stahel

Note 35, The Global Warming Policy Foundation



THE CRISIS OF THE EUROPEAN ENERGY SYSTEM

Alexander Stahel



Contents

About the author v

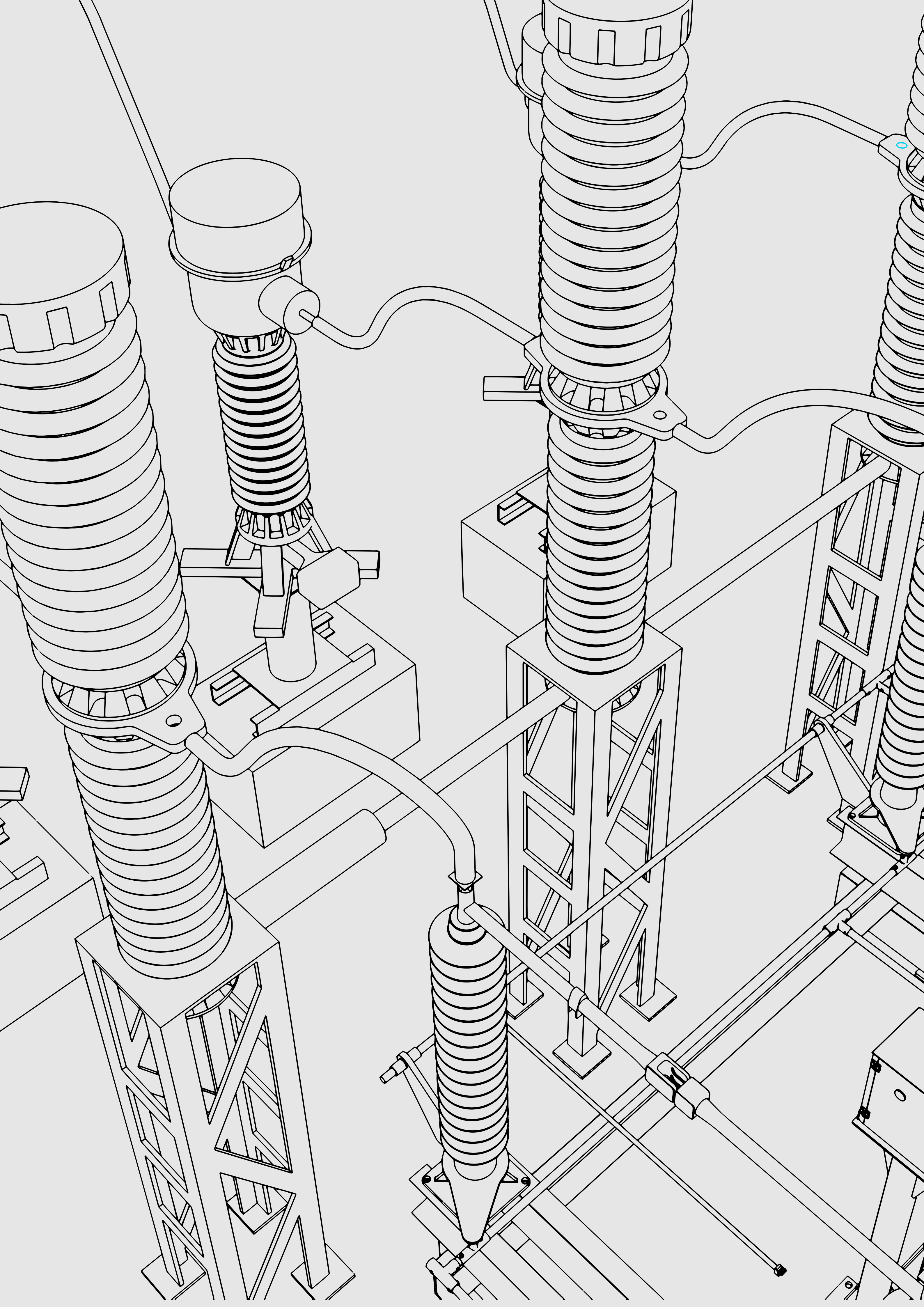
The European energy system crisis 1

'Fit for 55' laws and decarbonising the grid 4

About the Global Warming Policy Foundation 10

About the author

Alexander Stahel is a Swiss-based investor. He is the founder, chairman and CIO of Burggraben Holding AG, which specialises in commodities. He can be found on Twitter at @BurggrabenH.



The European energy system crisis

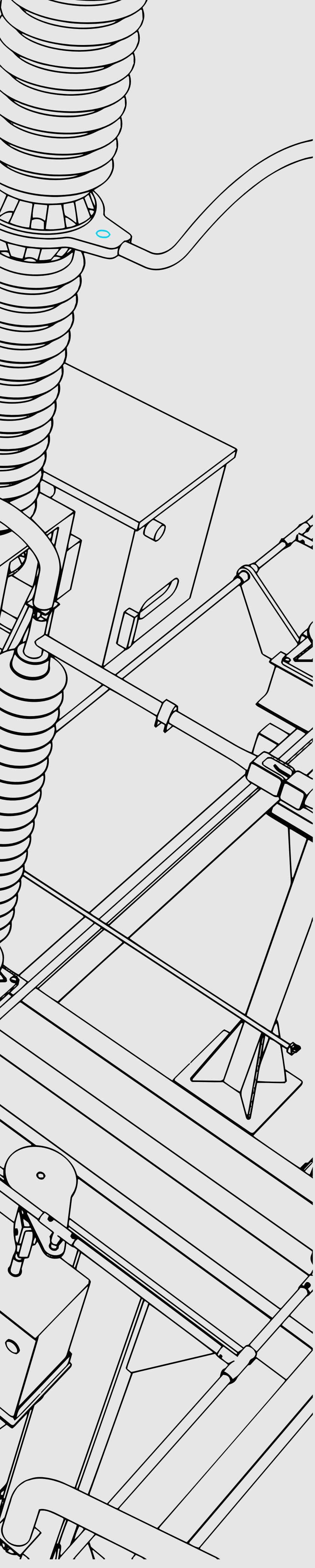
The European electricity grid is a modern miracle. It is the largest synchronous electrical grid (by connected power) in the world. It interconnects 520 million end consumers in 32 countries, including several that are not European Union members, such as Morocco and Turkey. In 2019, total net electricity consumption across the continental grid was 2,635 terawatt-hours (TWh). If you add the countries that are not synchronous but are connected – Great Britain, Ireland, the Nordic and Baltic states – the total rises to more than 3,300TWh. This is a great deal of electricity.

The grid is built on physics, not ideology. For example, one physical law says that the generation of alternating current that flows through the grid must match consumption ('load', in the jargon) at all times – that is, for 525,960 minutes per year – because electricity largely cannot be stored. This simple fact is critical for understanding the problem that faces us.

In order to ensure that supply meets demand across Europe, electrical load is constantly being forecast, in blocks as short 15 minutes long, and thousands of generators bid to meet that demand. The network frequency is the key measure of the health of the grid. Measured locally, but of supra-regional significance, it is the first indicator of an imbalance between supply and demand. It *must* be kept within very narrow bounds; a failure to do so would lead to damage to infrastructure or even the complete shutdown of the system.

Frequency deviations – incidents – happen for many reasons, but have become more common as the share of wind and solar on the grid has increased. Renewables are *not* dispatchable – their output cannot be increased minute to minute to meet a shortage of supply – so from a grid perspective they are unreliable. The impact of their widespread deployment is clear from the fact that frequency incidents have increased from 33 hours in 2020 to over 52 hours in 2021, an increase of more than 50% in just one year. In 2021 alone, the European Grid had two major ('Scale 2') incidents, for which final explanatory reports had to be prepared by an expert panel at the grid operator, Entso-e.

The underlying issue is that the European grid is increasingly unable to supply enough power to meet demand. Figure 1 shows the problem: most countries are net electricity importers, relying on France and Germany, and to a lesser extent the Czech Republic, to make ends meet. In other words, most European countries have not taken responsibility for their own energy security.



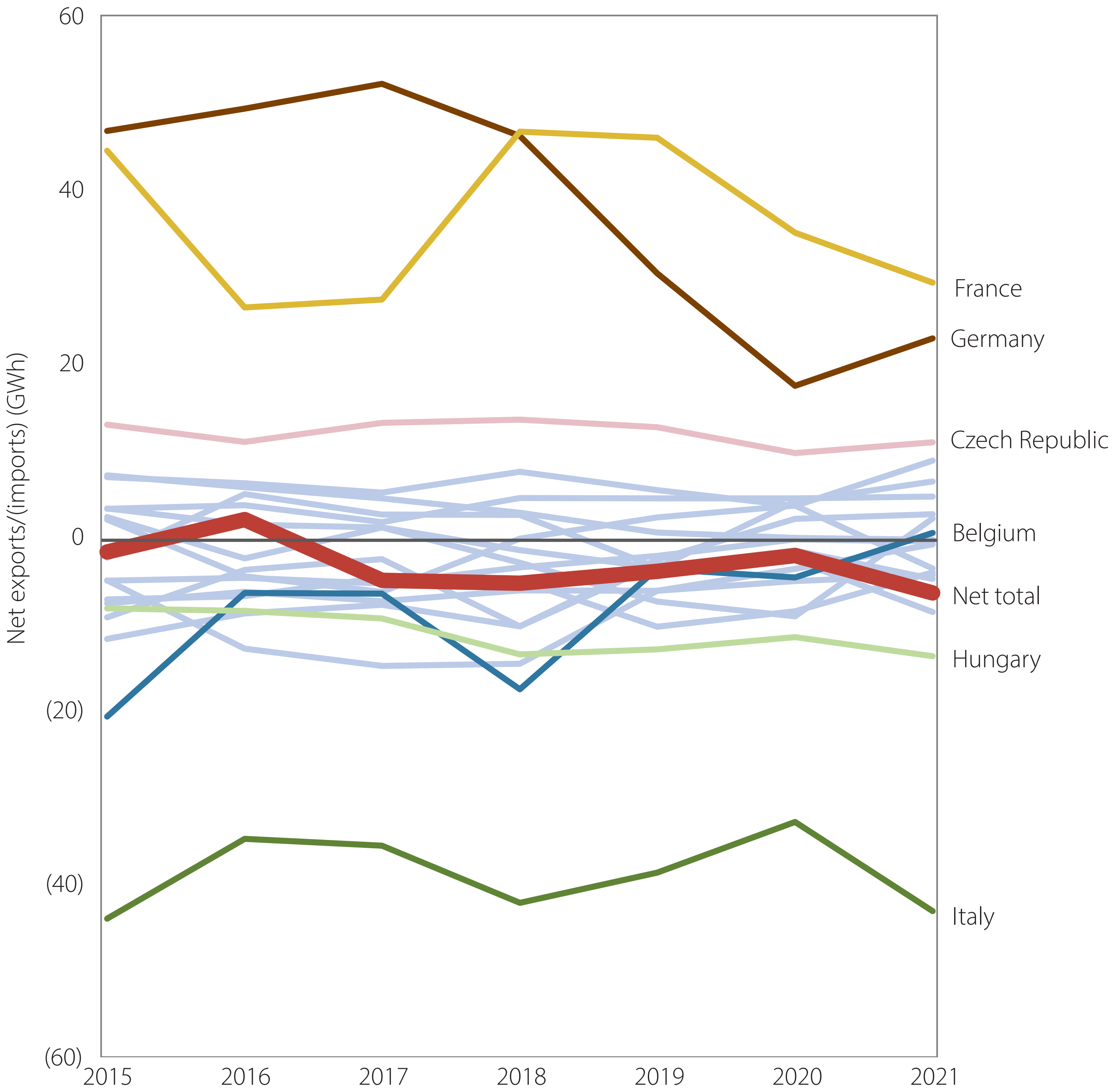


Figure 1: Net electricity imports and exports for selected countries

The analysis covers 18 selected countries. The key ones are highlighted.

A few countries are particularly problematic.

- Italy is by far the worst offender, having closed its nuclear power stations in the 1990s, building only a few onshore windfarms and none offshore at all, and therefore now having an almost complete reliance on natural gas, for which it has failed to secure reliable supply.
- Austria has a mix of hydro and natural gas, but relies on Germany to balance the books. It appears to have escaped the notice of the country's leaders that Germany has been engaged on the *Energiewende* – a shift to renewables and away from nuclear power and fossil fuels – for the last 20 years.
- Hungary relies on Russian supplies of natural gas to fuel its electricity grid.
- Slovakia and Finland have at least managed to bring some new nuclear power onstream, but it has been hard and expensive and the process is yet to be completed.
- The Dutch rely on natural gas, and are sitting on the massive Groningen gas field, but have decided to phase out production there, leaving themselves at the mercy of international LNG markets.

Overall, the European continental grid, once a major exporter of power, now relies on imports from Norway, Sweden and the United Kingdom to keep things running. At the moment, this situation is barely manageable, but there are four major short-term issues, and one gigantic structural long-term problem, that should alarm policymakers across the continent. The short-term issues are as follows.

French nuclear

France, as the European leader in nuclear power, should be able to deliver 450TWh per year. However, corrosion issues have caused its fleet's output to decline alarmingly; it may be as low as 315TWh in 2022, or just 59% of capacity, according to guidance issued by EDF, the nationalised utility responsible for operations. Even delivering this figure may prove difficult, as EDF has a history of overpromising and underdelivering.

As a result, France has recently become a net importer of power for the first time in decades and electricity prices have soared. Output in EDF's reactors in the UK and Belgium have also declined sharply.

German nuclear

EDF's nuclear power stations are badly maintained, but that is not true of Germany, where the fleet has long operated at well over 90% of capacity. Germany is also theoretically secure in its supply of uranium fuel (although not in practice), and of course nuclear power is both zero-carbon and extraordinarily safe. Nevertheless, in 2011, when Angela Merkel's CDU party was under pressure to form a coalition, she took the decision to phase out all of Germany's nuclear plants, eliminating 25% of its electricity output. With the closure of its last four nuclear plants due in December 2022 (representing output of 32TWh), Germany is likely to turn into another net importer of electricity, having long been one of Europe's largest exporters. This will have serious consequences for all the countries that currently rely on its exports to meet a large part of their electricity demand, in particularly Italy, Austria and Luxembourg.

There is an expectation that Germany will replace nuclear with mothballed coal-fired power stations, but it remains unclear how many units can be brought back into operation; Reuters has reported that most are too old to be reactivated. Some power station operators have reported difficulties in obtaining the necessary coal supplies, which would normally come from Russia, and others have declared that the current high coal prices would put an impossible strain on their cash flows. That leaves Germany, and as a result much of Europe, reliant on gas, which is now in very short supply.

Norwegian hydro

With almost every constituent country an importer, and with most of the rest soon to be so, Europe is looking to hydro power from Norway and Sweden to plug the supply gap. However, a lack of snowfall last winter has left reservoir levels so low that the Norwegian government has considered limiting exports. If they do so, then the European grid will be unable to meet demand.

Ukraine

In March, in the wake of the Russian invasion, the European and Ukrainian grids were synchronised. This measure provided important support for the Ukrainian system, but introduced further risks for European energy security.

'Fit for 55' laws and decarbonising the grid

The major strategic issue that threatens the grid is that a handful of people in positions of power have committed us to a dramatic reduction of our carbon dioxide emissions. The European Commission has transformed these commitments into a legal requirement to reduce emissions by 55% from 1990 levels before 2030 – the so-called 'Fit for 55' laws. The scale of change to society that this implies is hard to comprehend.

Can such laws 'save' the planet from global warming? I have my doubts. Global carbon dioxide emissions will be determined by economic growth – particularly in Asian countries – and by population increases, particularly in Africa; from 219 million to a predicted 600 million in Nigeria alone by 2050, for example. So even if Germany or even all of Europe were to de-industrialise overnight – and I mean 100% de-industrialise – global CO_2 emissions would not even be dented. China alone will add 33 GW of new coal-fired plants to the grid by 2023; it needs more electricity as a matter of urgency.

In fact, there is every chance that European emissions will increase rather than decrease. Nuclear fleets across the continent are ageing, and if they are not replaced, the grid will lose another 20 GW of supply by 2030. But if it takes 15 years to replace an aging nuclear power station, we are too late already. Worse, by 2040, another 70 GW will have been retired. Replacing all this capacity with wind power is impossible; 18 GW of nuclear power equates on average to 3,146 15-GW offshore turbines. Solar is worse – in northern Europe, it is little more than a waste of precious mineral resources. Delivering a building programme on the scale required, and in the seven years remaining before the deadline, is an engineering and financial impossibility.

Electricity was never only about energy, and always about timing and location too. So the problems with renewables go deeper. Even if all of the short-term problems set out above were magically fixed, the shift to renewables would still require:

- a doubling of the size of the grid infrastructure, a task that would take decades (because nobody wants to live near a high-voltage transmission line).

- grid-scale chemical storage for when the wind isn't blowing.

Frequency stability dictates that renewables must be accompanied by storage, so that power can be dispatched if and when operators need it to match peak loads. Recall that failure to do this minute by minute will cause damage to infrastructure, and possibly blackouts. Germany used to be able to deal with peak loads on its own account, but it now relies on (rapidly declining) imports of French nuclear power. Where it will go in future remains entirely unclear. Will other European countries, already short of power, build capacity to help Germany? It seems unlikely.

At current levels of electricity demand, and once Germany has abandoned its coal plants as required by law, it will need at least 15 TWh of storage to manage what is known as *Dunkelflauten* – prolonged periods of little to no wind or solar, typically occurring in the winter months and that we see from time to time. As its economy becomes further electrified, that storage requirement will increase over-proportionally.

However, at time of writing, it only has a few megawatts. To emphasise the point, the amount of grid-scale storage would need to be two orders of magnitude higher. According to the European Commission, the EU would need 550 GW of storage to decarbonise the grid, although its rather generous capacity factors suggest a still higher figure would be needed in reality. These numbers and the timescale proposed are, respectively, very large and completely unrealistic.

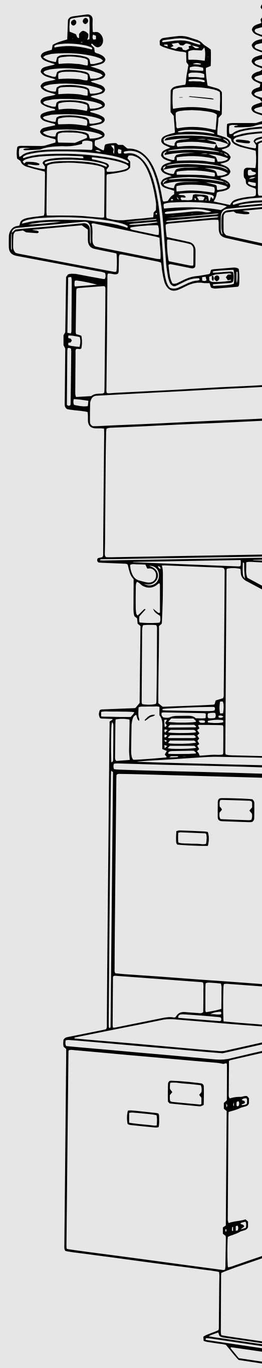
The list of possible storage technologies is long, but the reality is sobering. There is 53 GW of electricity storage in Europe, 95% of which is pumped storage, mostly in the Alps. Pumped storage is a tried and tested approach, but would be hard to expand, because suitable sites are few and far between, and it would take many years to do so, because people object to flooding mountain valleys. The Nant de Drance pumped hydro station in Switzerland cost CHF2 billion (£1.8 bn) and might deliver 1 TWh of power per year. Europe needs the equivalent of 1200 of these units to deliver a renewables grid, so the total cost would run into trillions. Moreover, pumped storage is what is known as mechanical storage that cannot release energy on the very short timescales required for frequency stabilisation. For that, chemical batteries will be required.

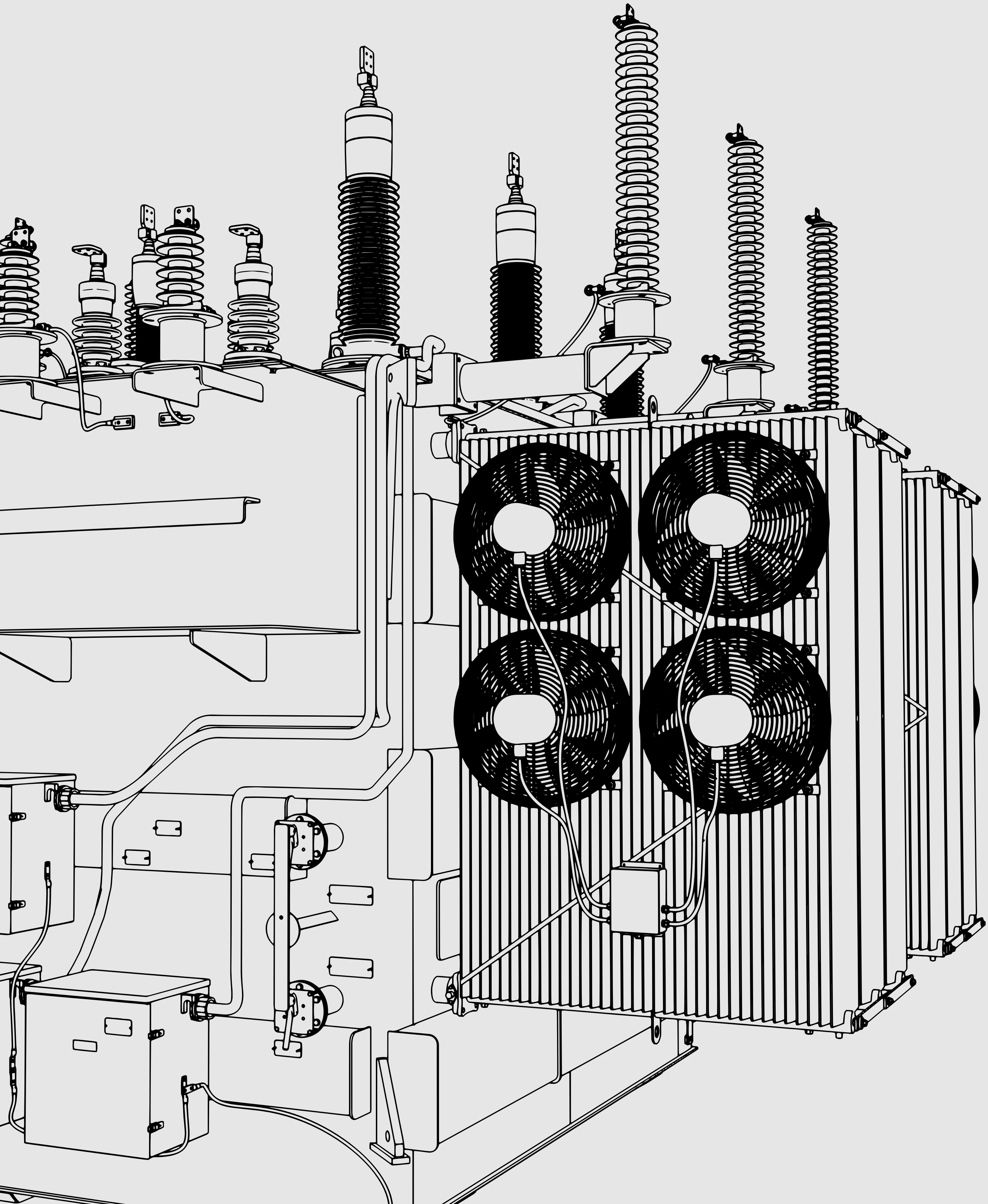
There are just over 4 GW of grid-scale batteries worldwide. The Tesla Gigafactory (once completed) will produce enough batteries each year to store 30 GWh of electricity. This is a lot, but Europe consumes 3,300,000 GWh of electricity every year, so each Gigafactory would deliver only a few minutes of electricity storage.

If a combination of renewables can't help us, can other technologies bail us out? Possibly: Bill Gates speaks of 'energy miracles', and he throws money at countless 'crazy ideas' that might deliver breakthrough technologies in fields from storage, fission, fusion and hydrogen to thermal. You name it, he is involved in it. And we need all of it. But none of this will be ready this decade, and possible not even next decade. It will not help us with the crisis that is almost upon us.

In other words, we have a dilemma that needs addressing by policymakers as a matter of urgency. They have claimed to be decarbonising economies, while in reality, the consumption of hydrocarbons around the world is rising, and Europe is not even close to eliminating them. Meanwhile, the hydrocarbon industry needs US$300 billion of re-investment every year just to maintain current production levels. However, convinced by policymakers that investments in production will become 'stranded', it is not even investing half this amount. The implications for energy prices will become ever more dramatic. European politicians like to blame Mr Putin for high energy prices, but that is only partly true. Constricting production of fossil fuels and replacing reliable sources of electricity with intermittent ones is also to blame, and would eventually have brought the continent to the brink of disaster even without the Russian invasion.

In summary, Europe will *not* deliver on its climate targets. The energy transition is an order of magnitude more complex than can be delivered. This must simply be accepted. Those who put a crash programme of decarbonisation into our laws, based on false claims about what could be achieved using wind and solar, and by when, have brought us to a dangerous juncture. Were they bad people? Of course not. But the road to hell is paved with good intentions.





About the Global Warming Policy Foundation

People are naturally concerned about the environment, and want to see policies that protect it, while enhancing human wellbeing; policies that don't hurt, but help.

The Global Warming Policy Foundation (GWPF) is committed to the search for practical policies. Our aim is to raise standards in learning and understanding through rigorous research and analysis, to help inform a balanced debate amongst the interested public and decision-makers. We aim to create an educational platform on which common ground can be established, helping to overcome polarisation and partisanship. We aim to promote a culture of debate, respect, and a hunger for knowledge.

GWPF NOTES

1	Matt Ridley	A Lukewarmer's Ten Tests
2	Susan Crockford	Ten Good Reasons Not to Worry About Polar Bears
3	Ross McKitrick	An Evidence-based Approach to Pricing CO_2 Emissions
4	Andrew Montford	Climate – Public Understanding and Policy Implications
5	Andrew Montford	Consensus? What Consensus?
6	Various	The Geological Perspective of Global Warming: A Debate
7	Michael Kelly	Technology Introductions in the Context of Decarbonisation
8	David Whitehouse	Warming Interruptus: Causes for the Pause
9	Anthony Kelly	Global Warming and the Poor
10	Susan Crockford	Healthy Polar Bears, Less Than Healthy Science
11	Andrew Montford	Fraud, Bias and Public Relations
12	Harry Wilkinson	UK Shale Developments
13	Peter Lilley	The Helm Review and the Climate-Industrial Complex
14	Constable and Hughes	Bubble or Babble?
15	Patricia Adams	The Road from Paris: China's Climate U-Turn
16	Mikko Paunio	Save the Oceans: Stop Recycling Plastic
17	John Christy	The Tropical Skies: Falsifying Climate Alarm
18	Gordon Hughes	Who's the Patsy? Offshore Wind's High-stakes Poker Game
19	J. Ray Bates	What Caused Hurricane Lorenzo?
20	Andrew Montford	Reducing Emissions Without Breaking the Bank
21	Andrew Montford	£3 Trillion and Counting: Net Zero and the National Ruin
22	David Whitehouse	The Next Solar Cycle and Why it Matters for Climate
23	Gautam Kalghatgi	The Battery Car Delusion
24	John Constable	Who Are They Fooling? The UK Energy White Paper 2020
25	William M Briggs	The Climate Blame Game: Are We Really Causing Extreme Weather?
26	Ross McKitrick	Suboptimal Fingerprinting
27	William M Briggs	How the IPCC Sees What Isn't There
28	J. Ray Bates	Polar Sea Ice and the Climate Catastrophe Narrative
29	Susan Crockford	The State of the Polar Bear 2021
30	Michael Kelly	Achieving Net Zero: A Report from a Putative Delivery Agency
31	Michael Kelly	Net Zero for New Zealand
32	Andrew Montford	Ten Things Everyone Should Know About Climate Models
33	Peter Ridd	The Good News on Coral Reefs
34	William Kininmonth	Rethinking the Greenhouse Effect
35	Alexander Stahel	The Crisis of the European Energy System