The Global State of Repowering



REPOWER

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Foreword

It is easy to be pessimistic about climate change and the persistence of coal in the global energy mix.

There are currently over 6,500 coal-fired power generation units in operation across the world.[1] They are responsible for 29% of the world's CO_2 emissions.[2] If they continue to operate for their full lifespan, they will emit 330 billion tonnes of CO_2.[3] That is almost double the remaining global carbon budget.[4]

But I set up the Repower Initiative to tackle exactly the kind of pessimism such statistics encourage. I had one objective in mind: to reframe coal power plants as opportunities for tackling climate change, rather than the intractable problems the energy and policy community tends to think of them as.

Coal power plants are polluting, yes. But they also represent one of the largest stocks of capital in the global energy sector. And, as the Repower Initiative has helped show over the past decade, it is possible to use that capital stock to generate clean power, rather than polluting coal power.

When I set up the Repower Initiative I had one objective in mind: to reframe coal power plants as opportunities for tackling climate change, rather than the intractable problems the energy and policy community tends to think of them as.

Repowering, in fact, as this report will show, is an extremely simple concept. Take a coal power plant and existing infrastructure, permits, and people, and find the best way to convert it to run on a clean energy source. Depending on local conditions, you can often reuse both a lot of the physical infrastructure as well as the human capital. This saves both time and money, compared to the permitting and construction of a greenfield clean power project.

Since the Repower Initiative was set up, we have helped fund research that has demonstrated the feasibility of repowering coal-fired power plants with nuclear energy. We have also watched with satisfaction as the Polish government has made repowering part of its energy transition strategy. And, across the world, we now see projects to repower coal plants in various stages of development.

Repowering, in other words, has moved from an academic premise to a real-world energy investment. Next, it needs to move on to the global policy map and take a place in toolkits for fighting climate change.

We do not suggest repowering is a magic bullet. Each coal plant is unique, meaning repowering is not yet the type of easily repeatable project that investors prefer to fund. Local environmental conditions may also rule out certain clean energy alternatives—solar, for example, may not be suitable for repowering a coal plant in an area with little sunlight. And the coal transition overall is a complex process that needs to take into account myriad priorities including energy security, affordability, and reliability.

But we argue that it would be unwise for governments and investors to ignore the capital stock and assets that coal plants represent, especially at a time when greenfield power projects face multi-year waits to connect to the grid due to shortages of infrastructure, like transformers, which are already in place at coal plants.[5]

In this, our first Global State of Repowering report, we present an in-depth case for coal plant repowering, alongside brand new data on where and to what extent repowering is taking place around the world. The final chapter has practical guidance on how different stakeholders can accelerate this process. If you are persuaded, we invite you to join us, whatever your role in the energy ecosystem, in putting repowering on the map.

Staffan Qvist
Founder and Chairman of the Board, Repower CIC

Executive summary

This report presents the Repower Initiative's first thorough scan of the global coal fleet assessed against a deliberately demanding test. To qualify as repowering, a project must:

- replace the coal-fired heat source with one that cuts lifecycle emissions by at least 90%;
- carry over at least one qualifying asset from the existing generating plant; and
- remain on the original site.

Four projects meet the repowering definition on the evidence available, and all four are nuclear. The last three are under consideration.

Bull Run, Tennessee, US:
a fusion prototype in a repurposed section of a retired single-unit coal plant, with a 350 MW pilot plant planned. In development.

Poland's second large nuclear plant, at Bełchatów or Konin:
both named as preferred sites in June 2026.

Wanakbori, Gujarat, India:
shortlisted for nuclear on a coal site.

Belews Creek, North Carolina, US:
an early site permit application for new nuclear near the station.

One more project is awaiting data verification: **Angamos, Chile**, a proposed molten salt conversion.

A further 22 projects exhibit some characteristics of repowering or have been taking steps to make themselves "repower-ready":

10 plan to or have already substituted all or part of their heat source but have not shown that the 90% threshold is met, including five completed biomass conversions that publish no plant-level lifecycle data.

8 coal plants in China have inserted or plan to insert thermal energy storage between the furnace and the steam cycle, partially decoupling heat production from generation, a step towards heat source substitution.

4 reuse a coal site without altering its heat source at all.

None of these is repowering as we define it. Each demonstrates part of what repowering depends on, and several are a few steps away from qualifying. Three nuclear and fusion projects on demolished coal sites, Cottam and West Burton A in Nottinghamshire, UK, and Doicești in Romania, are classified as site repurpose: they capture each site's grid connection and consents, but not its generating plant. Haiyang-1, in China's Shandong province, is not a repowering project but provides a good example of reimagining an entire district heating network to run on nuclear instead of coal.

To scale repowering, its advocates must engage policymakers, financiers, asset owners, civil society, and local communities to standardise the project development process, create certainty and predictability in timelines and outcomes, and build and amplify the evidence base around repowering's effectiveness.

Report outline

This report is structured to take the reader from problem to solution. It explains the challenge that clean energy repowering of coal plants seeks to address and then how repowering works, before it charts global progress and makes recommendations to accelerate it. Readers already familiar with parts of the argument may wish to jump to specific sections:

In **chapter 1** we lay out the scale of coal power generation and the challenge it poses to net-zero ambitions. We also identify the limitations of the two principal strategies for reducing dependence on coal power:

- The rapid retirement and replacement of coal plants with greenfield clean power generation
- Continued reliance on coal with the reduction of emissions through carbon capture, utilisation, and storage (CCUS)

In **chapter 2** we explain the clean repowering of coal plants as a concept: retaining the power block of a coal plant but repowering the boiler with a clean energy source. We explain the advantages of repowering from cost and time savings, to maintaining jobs and power-dependent industries in coal communities.

In **chapter 3** we explain and compare the main routes to repowering coal fired power plants with clean energy, taking into account generating capacity, costs, and technology readiness. We consider:

- Conventional nuclear reactors
- Small modular reactors (SMRs)
- Geothermal energy
- Concentrated solar power (CSP)

We also explain the potential for the installation of thermal energy storage (TES) at coal plants to pave the way for a later clean energy repowering.

In **chapter 4** we survey clean energy repowerings of coal plants that are already complete or in progress across the world, as well as the installation of thermal energy stores at Chinese coal plants. We explain how these projects can form the beginning of a pipeline of investable projects, which can draw in private capital.

In **chapter 5** we provide actionable recommendations that proponents of repowering can take, no matter what role they play in the energy ecosystem. These include:

- Working with asset owners to make the case for the repowering of individual power plants
- Working with fund managers and capital allocators to structure repowering as a standardised and repeatable process that is attractive to investors
- Putting repowering on the agenda of policymakers so that it becomes part of the energy transition strategies of individual governments and international organisations
- Securing public consent for the technologies behind repowering
- Creating financial incentives for repowering

1

The coal **dilemma**

Coal is the single largest source of energy-related emissions in the world today, responsible for around 40% of the total.[6] It is also the most emissions-intensive fossil fuel when burnt to generate electricity.[7]

Power generation accounts for two-thirds of coal consumption globally and therefore is the main driver of coal demand trends, according to the International Energy Agency (IEA).[8]

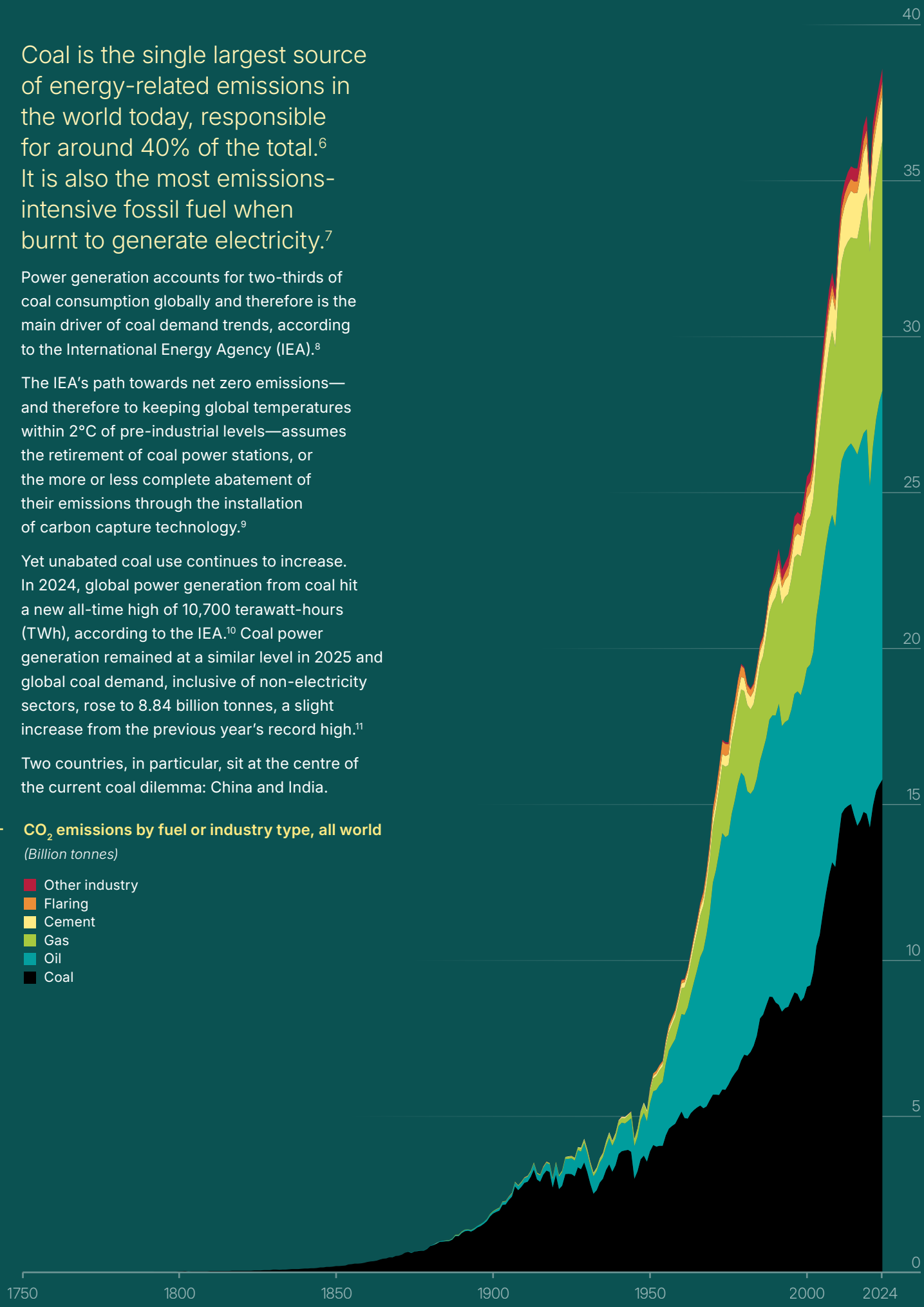
The IEA's path towards net zero emissions—and therefore to keeping global temperatures within 2°C of pre-industrial levels—assumes the retirement of coal power stations, or the more or less complete abatement of their emissions through the installation of carbon capture technology.[9]

Yet unabated coal use continues to increase. In 2024, global power generation from coal hit a new all-time high of 10,700 terawatt-hours (TWh), according to the IEA.[10] Coal power generation remained at a similar level in 2025 and global coal demand, inclusive of non-electricity sectors, rose to 8.84 billion tonnes, a slight increase from the previous year's record high.[11]

Two countries, in particular, sit at the centre of the current coal dilemma: China and India.

CO_2 emissions by fuel or industry type, all world

(Billion tonnes)



Source: Hannah Ritchie, Pablo Rosado, and Max Roser. "CO_2 and Greenhouse Gas Emissions", Our World in Data, 2023. https://ourworldindata.org/co2-and-greenhouse-gas-emissions

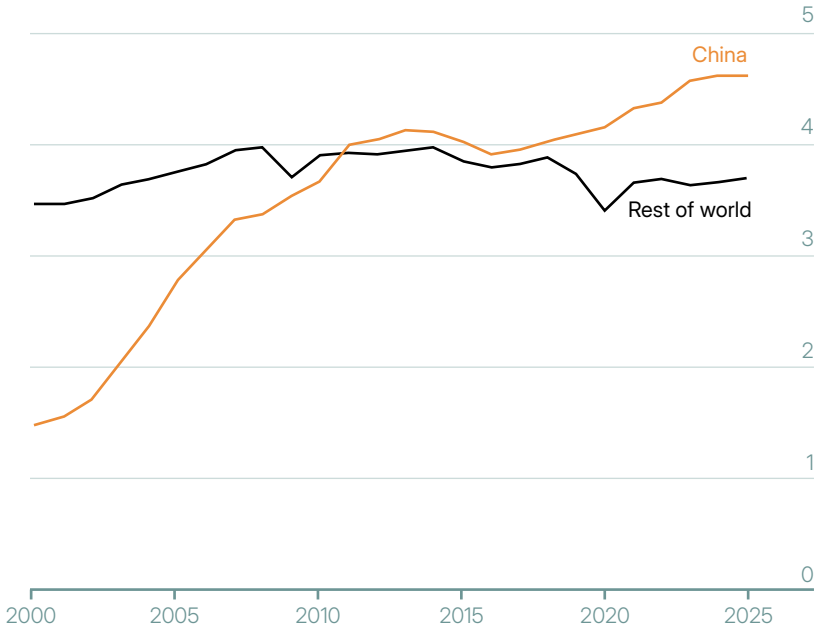
Asian economic giants

China and India, the second and sixth largest economies in the world by GDP,[12] are by some distance also its largest consumers of coal. In 2025, **China** consumed more coal than the rest of the world combined for the 15th consecutive year, while in **India**, coal remains the single most important fuel in both the overall economy and power generation.[13,14,15]

When it comes to carbon, India's coal-related emissions now match the US peak in 2007, while China's are several times higher still.[16]

China uses more coal than the rest of the world combined

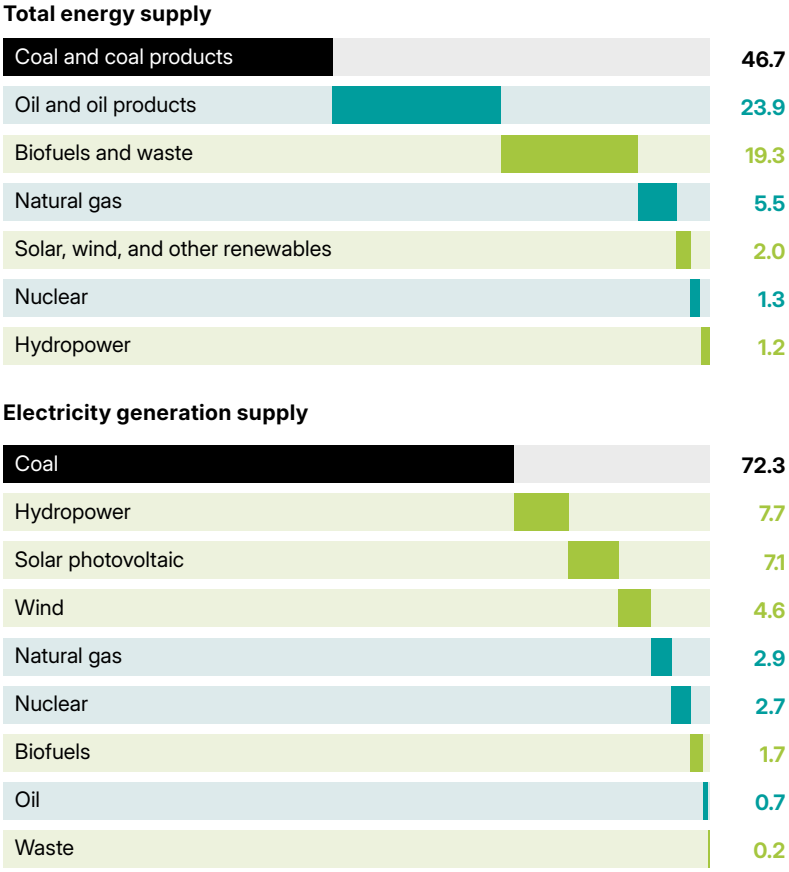
(Billion tonnes)



Source: Olivia Rudgard, "How Coal Is Winning a Net Zero Role in China's Energy Transition", Bloomberg, 3 July 2026. https://www.bloomberg.com/news/newsletters/2026-07-03/how-coal-is-winning-a-net-zero-role-in-china-s-energy-transition

Energy mix, India 2024

(Percentage)



Source: "India - Energy sources and mix", International Energy Agency, 2024. https://www.iea.org/countries/india/energy-mix

These facts must be put in context, however. First, it is important to remember that the rise of the West, from the Industrial Revolution in Europe to America's rapid growth in the 20th century, owed a great deal to the burning of coal in an era before emissions were counted. Second, significant shares of both India and China's giant populations still live in poverty, meaning there would be significant human consequences if growth were to be curtailed in the pursuit of emissions reductions. Finally, in terms of emissions per capita, India still lags behind rich countries.[17]

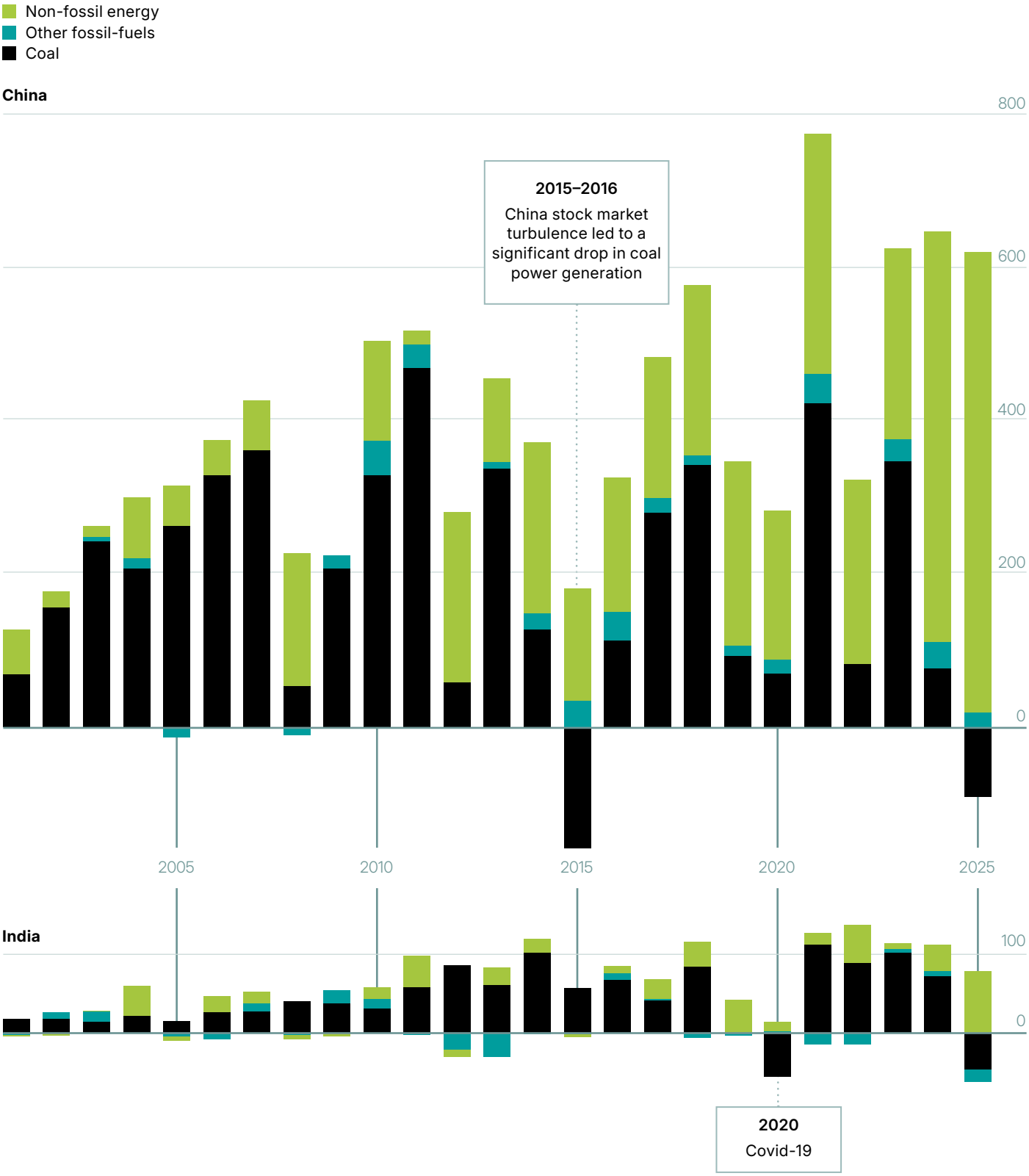
China also leads the world in developing alternatives to coal, with the country at the forefront of the global build-out of renewable technology and capacity. Although coal remains integral to Chinese power generation, it now plays a "supporting and regulating" role, with plants fired up when intermittent wind and solar generation are unable to meet demand. Utilisation rates for coal plants are falling as a result, and in 2025 China actually saw coal-fired power generation drop for the first time in a decade, suggesting coal power-related emissions may have peaked, five years ahead of the government's 2030 target for an overall peak in emissions.[18,19]

India also saw record clean power capacity additions in 2025 and a fall in coal power generation, marking the first time this century that both giant Asian economies reduced coal-powered generation.[20,21] In fact, it was only increased demand for coal from the US power generation sector that maintained global coal power generation at record levels.[22]



Change in power generation by source and year

(TWh)

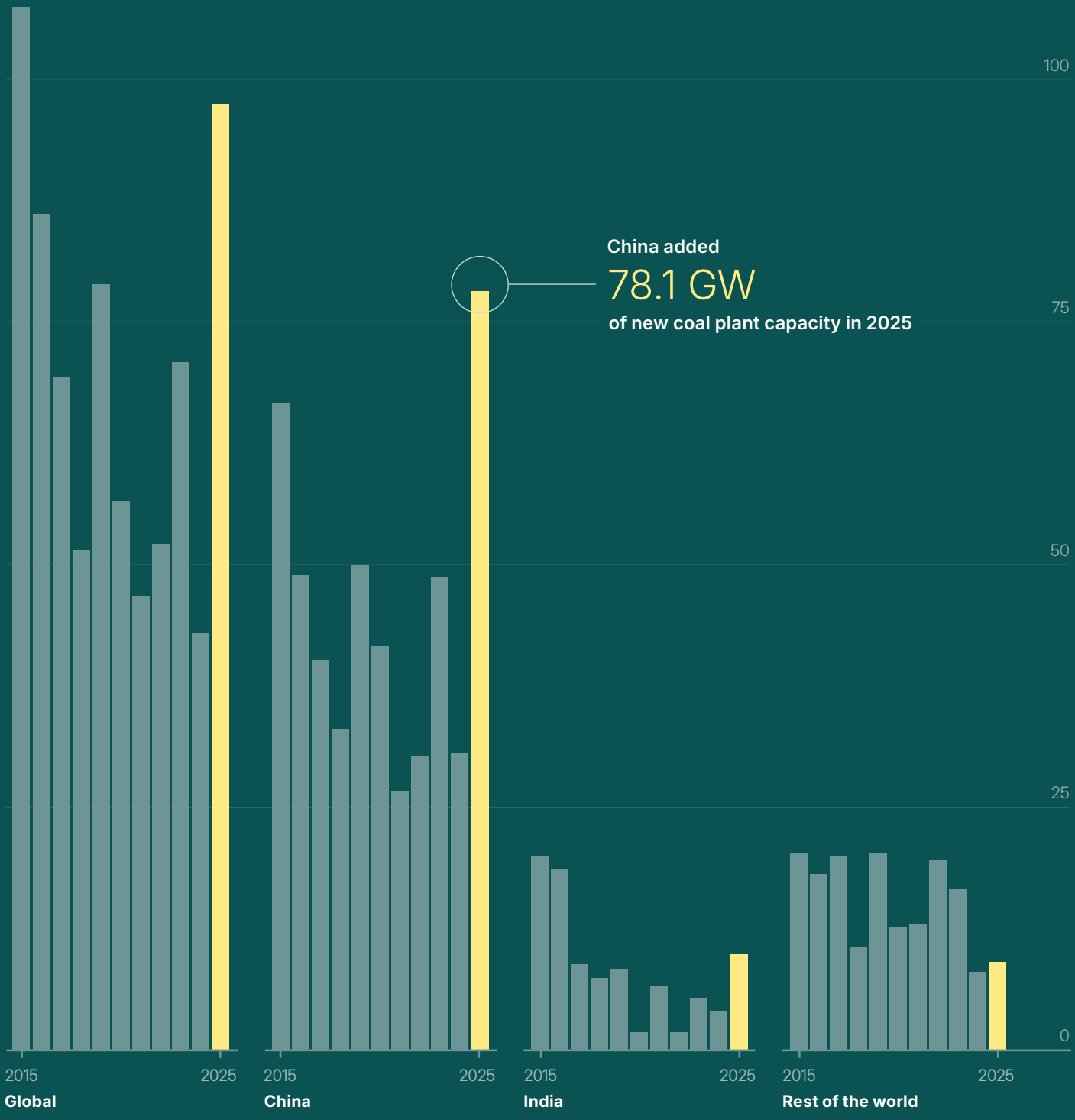


Source: Lauri Myllyvirta, "Coal power drops in China and India for first time in 52 years after clean-energy records", Carbon Brief, 13 January 2026. https://www.carbonbrief.org/analysis-coal-power-drops-in-china-and-india-for-first-time-in-52-years-after-clean-energy-records

This progress is cause for celebration, but coal power generation needs to fall significantly, rather than simply stall, to keep temperature rises in check. And there the signs are less hopeful.

Both India and China continue to invest heavily in new coal power generation capacity. In 2025, China added 78.1 GW of new coal plant capacity, the most in at least a decade, while India added 10 GW—the most since 2016. Global added capacity totalled 97 GW, the second-highest year on record, behind only 2015.[23]

New coal plant additions reach a decade high, driven by China
(Coal-fired power capacity that began operating by year and region, in GW)



Source: "Boom and Bust Coal 2026", Global Energy Monitor, May 2026. https://globalenergymonitor.org/research/boom-and-bust-coal-2026

500.6

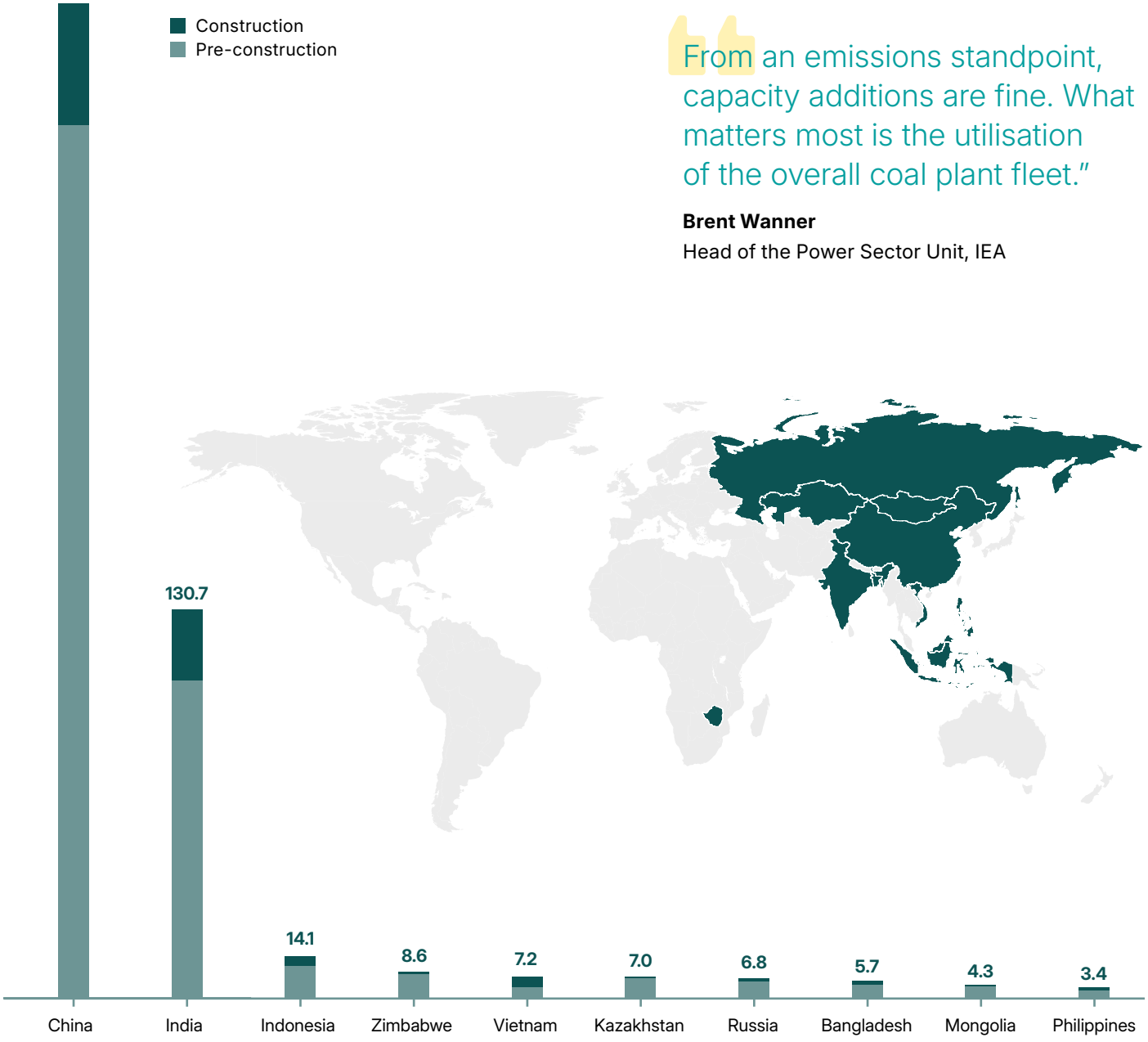
Indonesia and Bangladesh, two other Asian countries with large populations, are also expanding coal generation capacity at a rapid clip. Indonesia is self-sufficient in coal and a significant exporter, meaning coal power provides energy security benefits, and the country's operating captive capacity has grown tenfold in the past decade.[24,25] Asian countries are not alone: the US government has committed funds to keep 13 existing coal power plants open and even build two new ones in Alaska and West Virginia, partly in response to the rise in electricity demand due to the build-out of artificial intelligence (AI) data centres. They would be the first coal plants to open in the US since 2013.[26]

All told, global coal generation capacity grew by 3.5% in 2025, up from 2,175 GW in 2024.[27,28]

"From an emissions standpoint, capacity additions are fine," says Brent Wanner, head of the power sector unit at the IEA. "What matters most is the utilisation of the overall coal plant fleet." In essence, however, new plants represent billions of dollars of capital invested on the assumption of returns. They create a significant interest in burning more coal.

Coal capacity under development by the top 10 countries

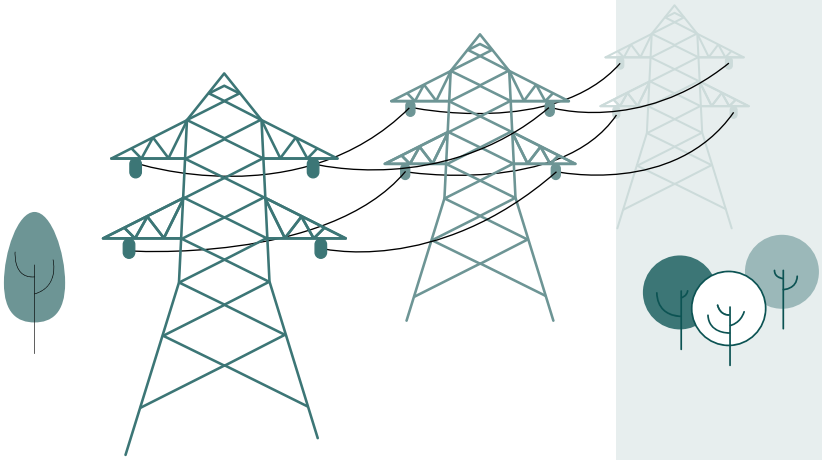
(Coal-fired power capacity in pre-construction (announced, pre-permit, permitted) and construction status by country, in GW)



> From an emissions standpoint, capacity additions are fine. What matters most is the utilisation of the overall coal plant fleet."
>
> **Brent Wanner**
> Head of the Power Sector Unit, IEA

Source: "Boom and Bust Coal 2026", Global Energy Monitor, May 2026. https://globalenergymonitor.org/research/boom-and-bust-coal-2026

Why quitting is so hard



Demand for electricity is rising—everywhere.

The standard narrative around coal plant retirement assumes that a combination of renewable power generation and batteries will seamlessly replace coal as green technologies improve and become ever cheaper. But that narrative is incomplete. Wind and solar power generation are growing, but global demand for electricity is now also rising rapidly thanks to the increasing electrification of transport and industry, the construction of AI data centres, and economic growth in emerging markets.[29,30] That means renewable generation is largely meeting new demand, rather than significantly displacing fossil fuel power generation: despite a 50% increase in renewable power generation since 2019, the amount of electricity generated from coal globally has plateaued but not fallen.[31]

Global demand for electricity is now rising rapidly thanks to the increasing electrification of transport and industry, the construction of AI data centres, and economic growth in emerging markets.



The rapid build-out of data centres to power AI models means growth in demand for power is now also spreading to mature markets where electricity consumption was long thought to have peaked. In the US, electricity consumption barely increased during the 2010s, but surging demand from data centres, which now account for 5.9% of total electricity consumption, has led to a sharp increase in demand in recent years.[32,33,34] This dynamic, already apparent in China, will also likely emerge to a lesser extent in other developed markets, including Europe and Japan, according to the IEA.[35]

More than just power

Even without the challenge of meeting growing demand for power, retiring coal power plants would be exceptionally complicated. That is because they play a far greater role in the energy ecosystem than their headline power generation capacity alone would suggest. Coal plants have four distinct properties that supplement their electricity generation:

1. Baseload power

Coal plants can run continuously, providing a reliable floor of supply regardless of weather or the time of day. This contrasts with wind and solar, for example, which only generate electricity when environmental conditions allow. Battery storage creates the potential for intermittent renewable power sources to contribute meaningfully towards intra-day peak energy supply, but long duration storage to cover extended periods of low renewables output requires significant construction time and capital commitments.[36]

2. Dispatchability

Coal plants can be instructed to increase or decrease power output on demand. Wind and solar, by contrast, cannot shift on command, because their output follows the weather. Again, batteries offer a potential solution.

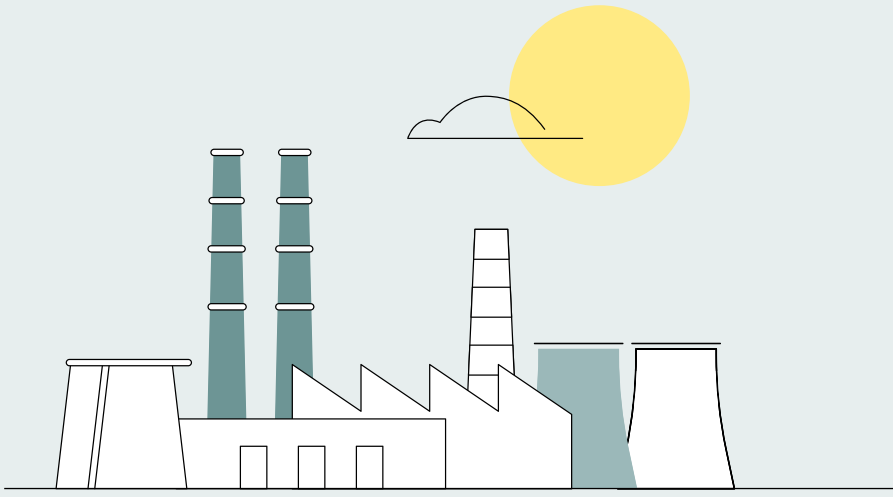
3. Grid stability

The large spinning generators of fossil fuel and nuclear power plants provide physical inertia: if one power plant drops out of supply, synchronised generators at every other plant slow down, with the inertial energy of the rotating masses of turbines and generators buffering the grid against a sudden frequency shock. This buys operators crucial seconds to respond, preventing a cascading set of circuit outages that could shut down the entire grid and create a blackout. As more fossil plants exit, this buffer diminishes, making grids more vulnerable to cascading failures. Although wind turbines spin, their speed is not synchronised to the frequency of the grid, while conventional photovoltaic (PV) solar panels have no moving parts at all.

4. Heat

Perhaps the most underappreciated dimension of coal plants is that they generate heat as well as electricity. In China, for example, coal plants can supply entire district heating networks in cities and continuous high-temperature industrial steam to local factories. Wind turbines and PV solar panels may be able to replace the power generated from a coal plant, but not its heat.

Beyond energy, coal plants play a crucial socio-economic role in the towns, cities, and districts where they are located. Across the world, 7.8 million people worked in coal-related activities in 2022, fully half of those in China.[37] Coal-fired power stations often support nearby clusters of industrial consumers or residential heating systems, making them integral to local economies. Rapid coal plant closure, therefore, threatens mass unemployment and intense, localised economic downturns, repeating the painful lessons of European and American deindustrialisation from the 1970s and 1980s.



CCUS

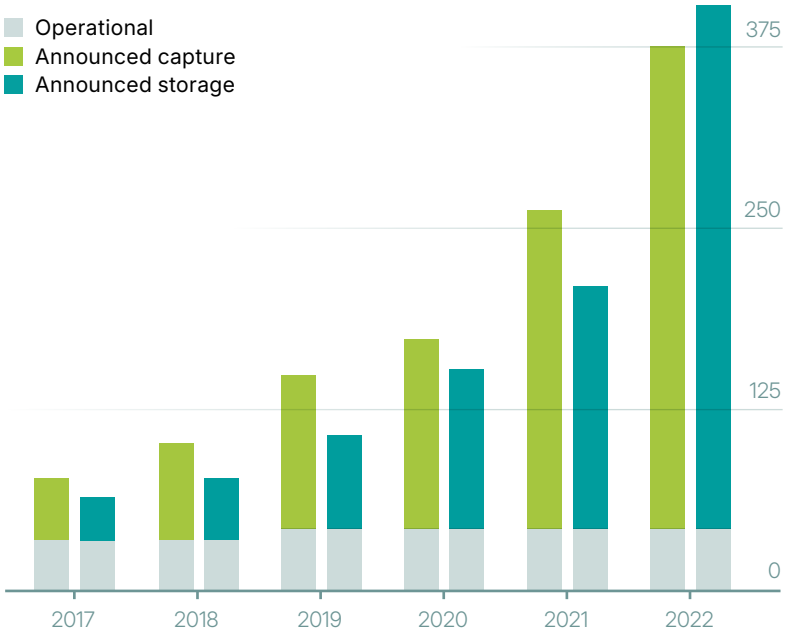
In pathways to net zero, an often-pursued alternative to coal plant retirement is retrofitting plants with carbon capture, utilisation, and storage (CCUS) technology. That would allow plants to continue to burn coal, with waste carbon dioxide captured at source and transported away to storage, rather than released into the atmosphere.

The technology is proven, and spending on CCUS has increased from around $300 million in 2020 to over $5 billion by 2025, with projects in development across the world. But that spending is still far short of the $200 billion per year the IEA's most recent Net Zero Emissions scenario says will be required by 2035.[38]

Despite ambitious new project announcements, the amount of operational carbon capture and storage barely shifted between 2017 and 2022, a trend which has continued into 2025.[39,40]

CCUS: the global picture

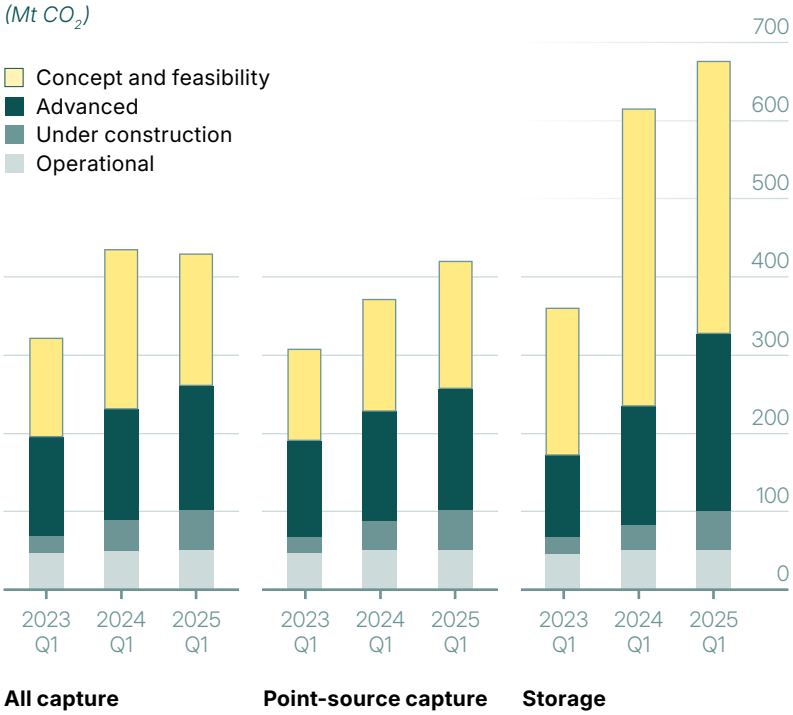
(Mt CO_2)



Source: "CCUS: Net Zero Emissions Guide", Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, International Energy Agency, 26 September 2023. https://www.iea.org/reports/ccus

Announced and operational carbon capture, utilisation, and storage capacity in 2030 across editions of the IEA CCUS Projects Database

(Mt CO_2)



Source: Mathilde Fajardy, Carl Greenfield, and Josephine Tweneboah Koduah, "CCUS projects around the world are reaching new milestones", International Energy Agency, 30 April 2025. https://www.iea.org/commentaries/ccus-projects-around-the-world-are-reaching-new-milestones

The IEA has tended to reduce, rather than increase, the amount of carbon it assumes can be captured per year by 2050 in its Net Zero Emissions scenario. The IEA's 2021 Net Zero by 2050 report assumed 7.6 Gt CO_2 would be captured by 2050.[41] Its update to the Net Zero scenario in the 2025 World Energy Outlook, meanwhile, forecast just 6.05 Gt CO_2 capture by 2050.[42]

In this context of limited build-out of operational capacity, relying on a sudden upsurge in CCUS as a silver bullet to solve the coal emissions problem is not a credible strategy for addressing climate change.

Rethinking retirement

Coal, then, is exceptionally hard to quit and hard to decarbonise at scale within a reasonable timeframe.

Despite ambitious emissions reduction strategies, countries in the developing world, and to an extent now also the rich world, continue to build coal power plants to keep up with surging demand for electricity. These new plants are not legacy assets nearing retirement but investments whose owners—often state-backed power companies—require returns to repay construction debt. At the same time, power purchase agreements (PPAs) can require governments to buy electricity from these plants for decades to come or face significant financial penalties.

Expecting developing countries to simply retire such assets at a time of growing demand for power is unrealistic. As Didi Apriadi, special staff to Indonesia's Minister of Investment, makes clear, this will not happen without capital transfers from wealthier states: "If the international community wants Indonesia to retire coal ahead of schedule, concessional capital must absorb the asset write-downs and fund the replacement baseload infrastructure."

Instead of waiting for such concessional capital to materialise, cost-effective ways must be found to deliver emissions reductions. These interventions should be able to attract private capital by offering financial returns.



One pathway to achieving this is by making use of the existing capital stock and licences that new coal plants represent—cooling towers, turbines, grid connections, and transformers, for example—in order to reduce the cost of generating clean electricity. Coal power plant sites would continue to anchor local economies and employment, but their emissions would be slashed. That sounds impossible, but it is not. It is called **repowering**.



2

The case for **repowering**

The idea of **repowering**—or maintaining a coal plant site and infrastructure but changing the energy source it runs on—accomplishes what seems impossible. By running existing infrastructure on a clean power source, the plant continues to play a crucial role in grid stabilisation and offers baseload and dispatchable power, while providing heat to local industry or homes. Crucially, it continues to generate returns for plant operators, increasing the chance of securing their buy-in.

Repowering represents a third way forward for coal plants, in between the two poles of retrofitting with CCUS or retirement with capacity replaced by renewables plus batteries. Reducing costs by reusing existing infrastructure increases the chance of projects attracting commercial capital, preventing a fourth scenario: that newly built coal plants continue to burn unabated coal for decades to come—the most damaging option.

Armed with the understanding of why repowering is an appealing choice compared with the alternatives, this chapter explains how repowering works.



A new heat source

The core idea behind repowering is simple but requires a basic understanding of how coal-fired power plants work. Basically, they consist of two separable components:

1. **The boiler**, which burns coal to produce heat
2. **The power block**, which converts heat into electricity via a steam cycle and feeds it into the grid

The power block includes most of the infrastructure of the plant: the steam turbines, generators, cooling systems, transmission connections, and, if one exists, the heating network that serves nearby homes or industry. The most direct version of repowering is replacing the coal boiler with a clean alternative heat source while retaining as much of the power block as possible.

Cheaper, faster, more secure, and local

While the concept of repowering is relatively simple, it delivers a wide range of benefits.

A coal plant site comes with assets that are expensive, time-consuming, and politically contentious to create: grid connections and transmission corridors, land already zoned and permitted for heavy industrial use, cooling water infrastructure, and a skilled local workforce. In many cases it also has an existing customer base for heat—factories, or residential districts already connected to the plant's thermal network.

Repowering preserves these assets, delivering emissions reductions without needing to build a power plant from scratch.

Cost savings

Reusing the power block of an existing coal plant delivers substantial savings. One study found that converting a coal power plant to nuclear, for example, can save up to 35% of the cost of greenfield nuclear power plant construction, if the coal plant's boiler can be replaced with a high-temperature gas-cooled reactor.[43]

"Repurposing existing coal infrastructure can materially reduce the cost and time of building clean energy. A coal plant's existing grid connection, transmission assets, land, and other infrastructure, which can take years and significant capital to develop from scratch, can instead be reused for renewable generation and storage," says Lawrence Ang, managing partner and co-founder of Reviva Transition Partners, an active equity investment platform seeking to transform and decarbonise operating coal assets.

Time savings

Even in developed markets, connecting new power capacity to the grid is one of the most significant bottlenecks in the energy transition.[44] Electricity generated at power plants must pass through a transformer to be stepped up in voltage for transmission through the grid to consumers. These transformers are giant pieces of equipment that rely on complex, labour-intensive manufacturing processes which are difficult to automate. The firms and specialised supply chains which dominate transformer manufacture have not been able to keep up with the surge in demand created by the AI boom, meaning that transformers which could once be ordered just months in advance now take years to be delivered.[45] That makes coal power plants that come with existing transformers on-site extremely attractive.

"People are increasingly seeing the benefits of reusing grid connections, land, and skills, rather than starting from scratch, particularly where the alternative is waiting years for a new grid connection," says Julia Skorupska, head of secretariat at the Powering Past Coal Alliance, a coalition of governments and businesses working to advance the transition away from unabated coal power generation.

> "Repurposing existing coal infrastructure can materially reduce the cost and time of building clean energy."
>
> **Lawrence Ang**
> Managing Partner and Co-Founder, Reviva Transition Partners

Energy security

Gas and oil prices have skyrocketed twice in the last five years after Russia's invasion of Ukraine in 2022 and the closure of the Strait of Hormuz in 2026. Countries that depend on fossil fuel imports to maintain power generation have repeatedly found themselves scrambling to secure cargoes—and paying significant premiums—prompting emergency measures to reduce consumption, including growth-destroying industry closures.[46,47]

As geopolitical tensions continue to rise across the world, governments are seeking to reduce fuel imports in order to bolster their energy security. Repowering coal plants to run on geothermal energy, solar power, or nuclear, the three principal clean energy pathways, reduces dependence on imported coal. Both solar and geothermal rely on naturally occurring, local assets. Nuclear power stations, meanwhile, run on 12-to-24-month fuel cycles, with fuel for the next cycle typically stored onsite,[48] reducing vulnerability to trade disruptions or commodity price spikes.





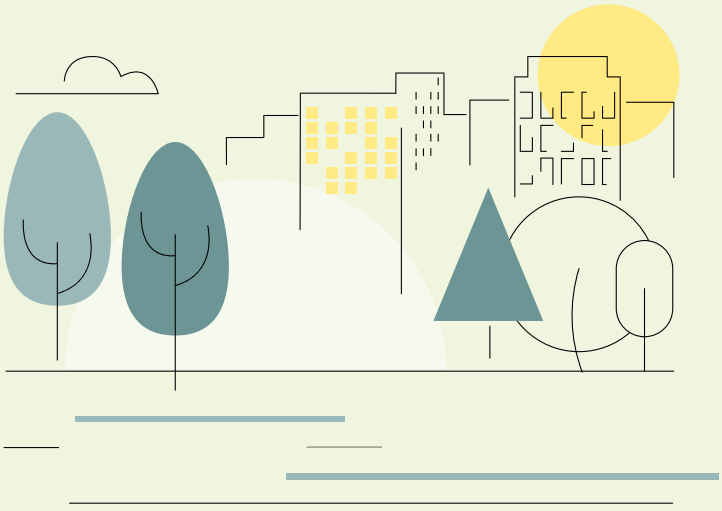
Community preservation

Coal plants are not just infrastructure; they are often the employment anchor of entire communities. A repowered plant keeps jobs, skills, and the tax base in place, offering opportunities for coal plant workers to retrain or upskill for work in the clean power sector. This avoids the long tail of social costs, from mass relocation to local economic depression, that have followed coal closures in the US Rust Belt, France's Meuse Valley, and the UK's former mining communities.[49]

Coal plants are not just infrastructure; they are often the employment anchor of entire communities.

Environmental benefits

Repowering can not only keep coal communities intact; it can also improve environmental conditions within those communities. While the carbon emissions associated with coal plants tend to be measured at a global level, the air pollution they create produces highly local impacts that affect the health and quality of life of nearby residents.[50] Spills of the ash produced when coal is burnt can also impact local waterways.[51] Meeting the electricity needs of the local community using clean power mitigates these impacts. Building clean power generation within the footprint of an existing coal plant, meanwhile, prevents unnecessary land development.



An emerging practice

Repowering is already gathering momentum across the world with coal plants in various stages of transition to other power sources. These projects often do not sit under the umbrella term “repowering”, and their developers may not recognise themselves as part of a wider community of practice. Together, however, they are creating a concentration of knowledge, experience, and investability evidence which forms the basis of a new discipline that can play a decisive role in the energy transition. This emerging discipline of repowering is what the rest of this report sets out to map and contribute to.



3

Routes to **repowering**



This chapter examines the pros and cons of **five different clean fuel pathways** to repowering the boiler of a coal plant:

1. Conventional nuclear reactors
2. Small modular nuclear reactors (SMRs)
3. Geothermal energy
4. Advanced geothermal systems (AGS)
5. Concentrated solar power (CSP)

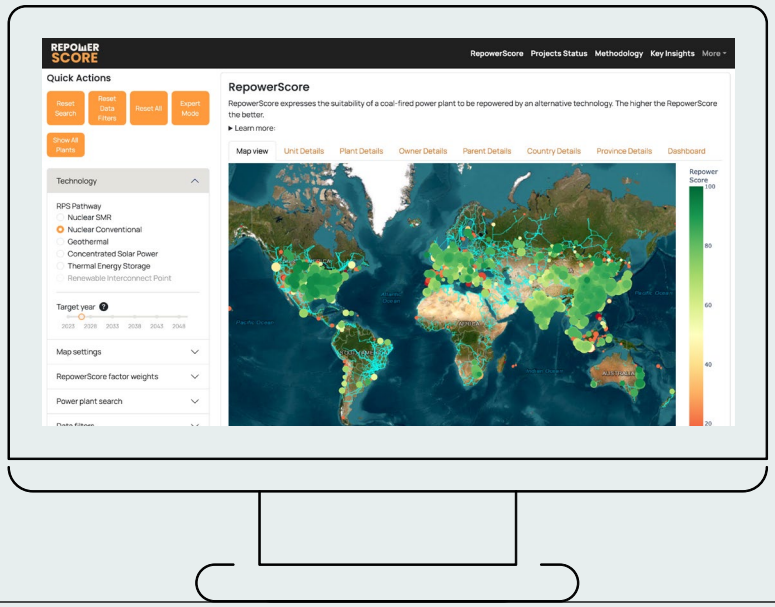
It also explains the transitional step of installing thermal energy storage (TES) at a coal power plant, which can significantly reduce coal consumption in the short term and pave the way for a later clean fuel repowering of the coal boiler.

The RepowerScore dashboard

The RepowerScore dashboard, available at RepowerScore.org, offers a rapid and intuitive way to understand the viability of repowering thousands of different coal plants across the world. It allows users to model cost savings relative to greenfield construction, while also integrating local demographic and labour data to ensure the repowering supports just transition goals.

The dashboard analyses technical, environmental, and socio-economic variables, including proximity to high-voltage grids, cooling water availability, and seismic suitability, to provide an immediate visual insight into each plant: green indicates high suitability for repowering, while red indicates significant challenges.

The dashboard allows coal plant operators, investors, policymakers, and academics to switch between different clean power pathways and TES, and to model how viability is likely to change over time as technologies improve. It is free to use, and operators can manually adjust the weightings of variables.



Conventional nuclear

Conventional nuclear power, including large pressurised water reactors like EDF's EPR2, KEPCO's APR-1400, and the Westinghouse AP1000, matches coal's typical operating profile relatively closely. It provides continuous, dispatchable baseload power and grid inertia from synchronous generation, while also generating heat that can be used by non-electricity consumers, for example district heating. The Haiyang nuclear plant in China, for example, supplies heat to a city of 400,000 people, alongside electricity generation.[52]

In terms of space requirements, nuclear reactors are relatively compact, meaning they can generally fit within the footprint of existing coal boilers. A nuclear power plant produces roughly 68 times lower carbon emissions than a coal power station—a median lifecycle figure of 12 g of CO_2 equivalent emissions per kWh of power generated for nuclear versus 820 gCO_2eq/kWh for coal (including upstream emissions)—with those emissions occurring during plant construction and uranium mining and enrichment, rather than day-to-day operation of the power plant.[53]

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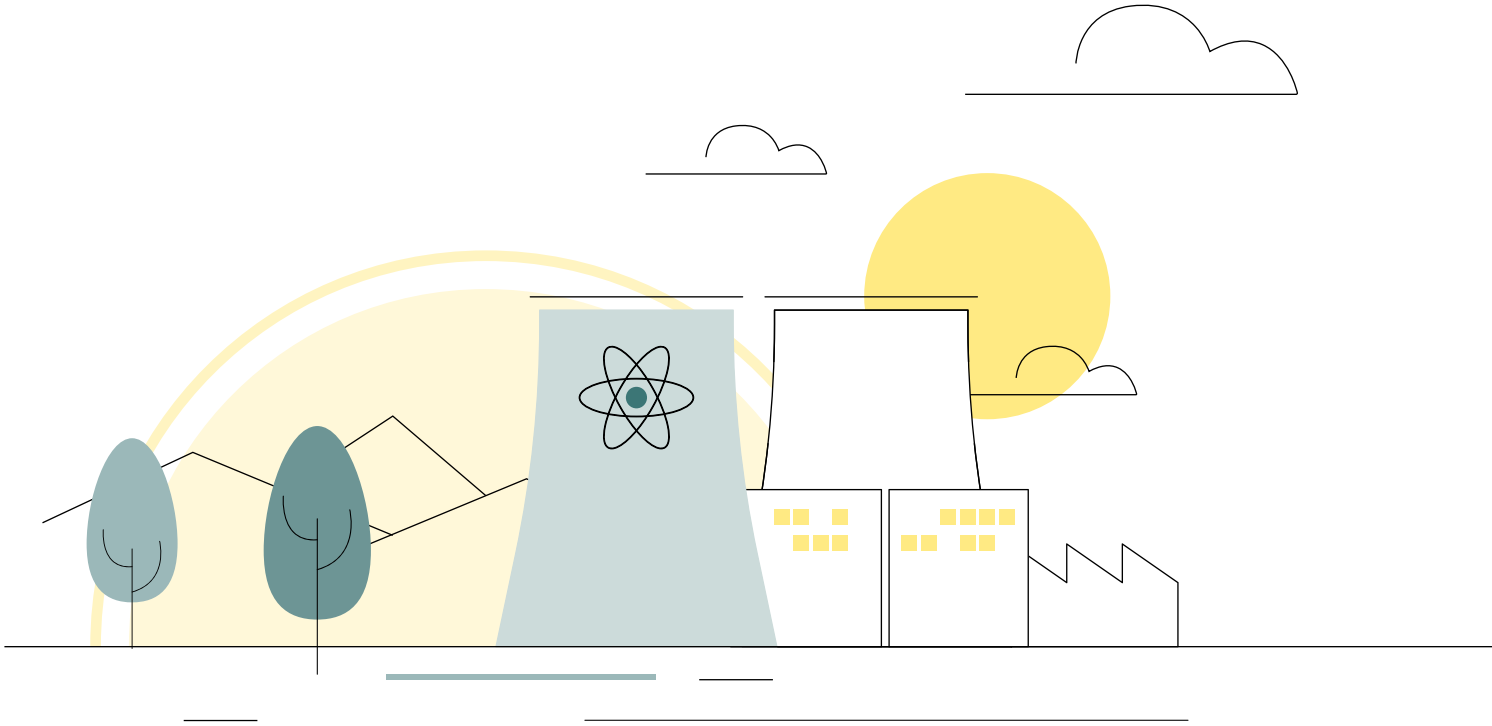
At the same time, **several limitations constrain conventional nuclear**:

Siting restrictions:
Many countries require conventional nuclear power plants to be located in sparsely populated areas because of safety concerns. US regulations, for example, define three concentric circles around nuclear power plants based on radiation doses in the event of an accident,[54] which effectively rule out conventional nuclear repowering of coal plants situated in urban areas. Geographic exclusion zones are being relaxed, however, for small modular reactors, as discussed below.

In China, inland nuclear power developments have been paused indefinitely since the Fukushima nuclear accident in Japan in 2011.[55] For now, that effectively rules nuclear out of the repowering conversation for the majority of Chinese coal power plants, which are concentrated in the country's interior. Whether China's 16th Five-Year Plan, which will run from 2031 to 2035, changes this is one of the most consequential open questions in the field.

Public acceptance:
Siting restrictions are often linked to public opposition to nuclear power because of safety fears. Germany, for example, abandoned nuclear power completely in the wake of the Fukushima disaster.[56]

Scale mismatch:
Conventional reactors generate more than 1,000 MW, which is two to three times the output of a single coal unit.[57,58] If a reactor was replacing a single coal unit, it would require substantial interconnections to other cities, provinces, or districts to absorb its full generation capacity and deliver a return on investment. Some coal plants contain multiple units, however, in which case conventional nuclear reactors do provide a similar sized replacement.



Long build times:
Construction can run for 10–15 years and often involves significant delays, meaning substantial time can pass before the power and/or heat source is replaced and emissions reductions are delivered. Project lead times are expected to fall, however, as nuclear power plant developers like Westinghouse in the US, EDF in France, and South Korea's KEPCO begin to work on multiple orders simultaneously and make construction a more repeatable process. Examples like the new-build of four units at the Barakah power plant in the United Arab Emirates (UAE) by KEPCO are encouraging.[59] Governments are also seeking to unblock nuclear build-outs. In the UK, for example, the Fingleton Review called for regulations around nuclear power to be radically simplified, while the UAE adopted both US and South Korean regulations to kickstart construction of the Barakah plant.[60,61]

Complex supply chains:
Project build times are complicated by bottlenecks within supply chains. Relatively few companies and global plants are capable of building the giant metal parts required for nuclear reactors. Even less specialised equipment like pumps and valves must meet stringent nuclear safety standards, shrinking the pool of potential suppliers.[62] That can lead to long wait times for components.

Capital requirements:
Conventional reactors are expensive to build, with budgets running into several tens of billions of dollars in the US and Europe, and frequently subject to overruns. The Vogtle 3 and 4 project in the US, for example, came in at over $30 billion, against an original estimate of $14 billion.[63] Hinkley Point C in the UK has risen from an original estimate of £18 billion to £35 billion and counting.[64] Again, larger order books may improve the predictability of capital costs as companies gain more experience.

Sensitivity to the cost of capital:
While nuclear power stations are relatively inexpensive to run, they are costly to build, and projects take many years to complete. That means significant capital must be borrowed upfront to fund not only construction but also interest payments in the years before power generation begins and revenue is generated to repay debt.[65]

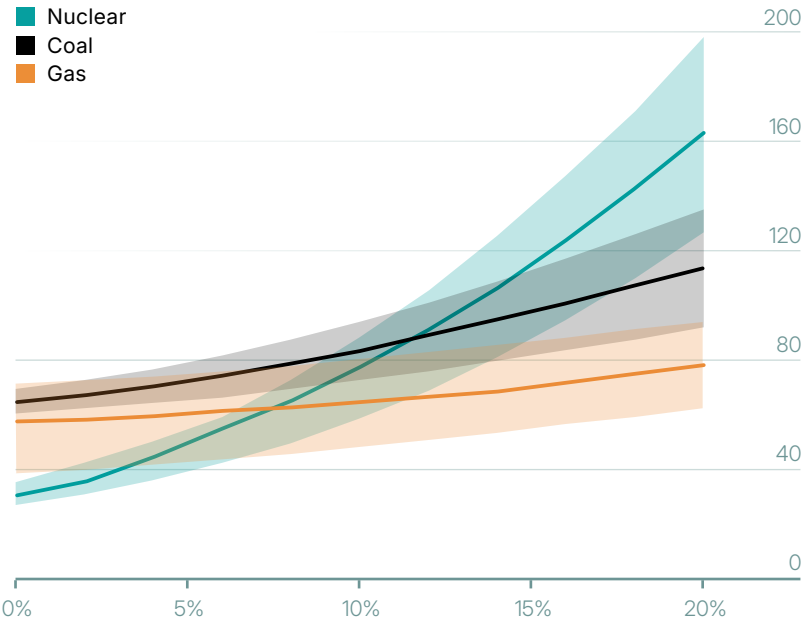
Nuclear power projects are therefore unusually sensitive to the cost of capital borrowed to fund a project. In fact, an Organisation for Economic Co-operation and Development (OECD) report from 2024 found that financing can represent two-thirds of the total cost of nuclear electricity when the cost of capital reaches 9%, but less than one-third if the project's cost of capital is only 3%.[66]

By contrast, coal plants are far less sensitive to the cost of capital. They are cheaper and faster to build than nuclear plants, and a large part of the project cost—fuel purchases—is only incurred after the plant is operational and generating revenue.[67,68] They therefore require less debt.

High borrowing costs can, in fact, erode nuclear's cost advantage against coal altogether. The same 2024 OECD report estimated that at a cost of capital of 10%, the cost of nuclear power rises above coal power, even with the assumption of a carbon price of $30 per tonne of emissions.[69]

That makes access to concessional capital, which lowers the overall cost of capital, particularly important for nuclear power projects. For nuclear new build projects, the consultancy EY puts the weighted average cost of capital (WACC)—the average interest rate a developer pays when all of its borrowing is taken into account—at between 5% and 15%.[70] China appears to be at the bottom end of this range, thanks to relatively cheap finance. Its nuclear industry WACC is around 5–6%, according to one Chinese study, with state-owned companies that dominate the nuclear sector able to borrow at preferential interest rates: the average cost of debt at China National Nuclear Corporation (CNNC), for example, is between 3% and 4%.[71,72] Governments in other countries are also acting to reduce financing costs for nuclear power projects, with the US Department of Energy, for example, providing $17.5 billion in low-interest loans to finance the purchase of nuclear reactor components.[73]

The competitiveness of baseload power generation technologies as a function of the cost of capital (discount rate)
(Levelised cost of energy (LCOE), USD/MWh)



Source: "Projected Costs of Generating Electricity 2020", International Energy Agency, 9 December 2020. www.iea.org/reports/projected-costs-of-generating-electricity-2020

Limited dispatchability:
Conventional nuclear plants are built to operate at continuous capacity and have limited flexibility to ramp output up and down in response to demand.

Access to water:
Nuclear plants require access to cooling water, although this is also a requirement for coal plants, so such infrastructure should already be in place.

Heat mismatch:
Conventional nuclear reactors produce steam at approximately 300–320°C at the turbine inlet, significantly below the 540–620°C temperatures that coal boilers generate.[74,75] This means they cannot serve industries that require very high-temperature heat, for example hydrogen, steel, or petrochemicals production, without additional processes and equipment, for example steam compression to upgrade temperature and pressure.

Despite these limitations, RepowerScore shows that nuclear can already potentially repower many plants across the world.

Nuclear small modular reactors (SMRs)

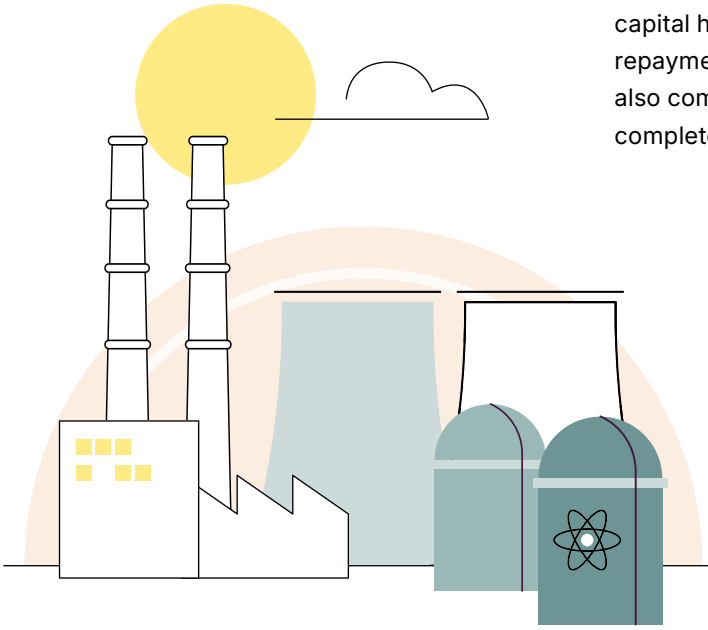
Small modular reactors (SMRs), generally defined as reactors with capacity of less than 300 MW,[76] can address any scale mismatch between coal plants and conventional nuclear reactors. A single SMR can be sized to match a single coal unit, simplifying grid integration.

Factory-built modular components promise faster construction and lower upfront costs than bespoke large reactor builds. And certain SMR designs, such as high-temperature gas-cooled reactors (HTRs), can generate heat at far higher temperatures than conventional nuclear. China's HTR-PM at Shidao Bay in Shandong province—the world's first modular high-temperature gas-cooled reactor plant to enter commercial operation[77]—runs at a helium coolant outlet temperature of 750°C,[78] compared with a ceiling of roughly 330°C in a conventional light-water reactor.[79] Since 2024, it has also supplied district heat from high-temperature steam drawn off its power cycle.[80] That makes HTRs better able to replicate the industrial heat applications of coal combustion than conventional nuclear.

SMRs are considered safer than conventional reactors because they have smaller reactor cores. They therefore use less fuel and can rely on passive safety features such as gravity to keep them cool during an accident.[81,82] Governments are therefore open to companies locating SMRs closer to population centres, where conventional reactors have been excluded. In the US, for example, the Nuclear Regulatory Commission (NRC) has created a performance-based framework for SMR siting, rather than applying the same prescriptive rules that conventional reactors follow.[83] A regulation proposed by the UK government would allow SMRs to be developed near population centres.[84] That would open up many more existing coal power plants to nuclear repowering.

Some SMR designs also use air-cooling, significantly reducing the need for access to water, a major obstacle to inland siting of nuclear reactors in China.[85] SMR designs are also being refined to increase dispatchability of electricity.[86]

For now, SMRs attract a higher cost of capital than conventional nuclear power projects, because the technology remains relatively young.[87] However, they are less sensitive to changes in the cost of capital than conventional nuclear projects because lower build costs and shorter construction timeframes mean less capital has to be borrowed upfront, and debt repayment starts sooner.[88,89] Capital costs could also come down as first-of-a-kind projects are completed, proving commercial viability.

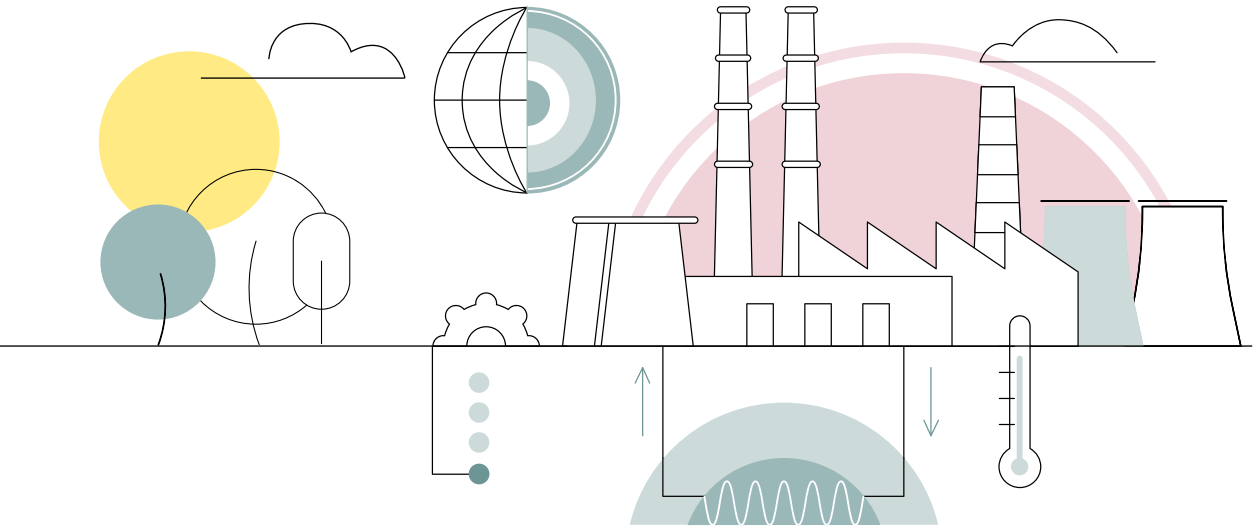


As with conventional nuclear, RepowerScore data show the wide swath of coal plants around the world that SMRs could eventually repower.

Geothermal

Geothermal replicates many aspects of a coal power plant. Heat in the earth's crust produces steam that drives conventional turbines. It is dispatchable, baseload, and inertia-providing, with no fuel cost or fuel waste. It also produces heat, albeit at a much lower temperature than coal power plants, making it more suitable for district heating systems than for industrial consumers.[90]

The constraint is geology. High-temperature resources close to the earth's surface are mostly concentrated in volcanically active regions like Indonesia, Kenya, Iceland, New Zealand, and parts of the western US. However, as RepowerScore shows, a significant chunk of China's coal plants can also potentially be repowered with geothermal.



Advanced geothermal systems (AGS)

Advanced geothermal systems (AGS) is an umbrella term for several technologies that access higher temperature rocks deeper beneath the surface than conventional geothermal technology. While conventional geothermal relies on existing reservoirs in volcanic rock, both enhanced geothermal systems (EGS) and superhot rock (SHR) fracture rocks deeper underground to create man-made reservoirs. Closed-loop geothermal systems (CLGS), meanwhile, pass water through a closed piping system, still allowing for deeper subsurface drilling but without fracturing rock to create a reservoir.[91] These technologies can potentially address the two main shortcomings of conventional geothermal as a replacement for coal: low-temperature heat output and limited geographic potential.

First, because EGS drills far deeper beneath the earth's surface, it is possible to find high-temperature rock even in regions that do not have volcanic activity. Fervo Energy in the western US has demonstrated the approach at small commercial scale,[92] and Repower's own site assessments have identified EGS as a viable repowering pathway for coal plants in Southeast Asia. Second, the higher temperatures found deeper beneath the earth's surface mean it is possible to generate higher temperature heat outputs and potentially serve industrial customers.[93] Drilling costs rise with depth, however,[94] making capital requirements highly site-specific.[95]

Concentrated solar power (CSP)

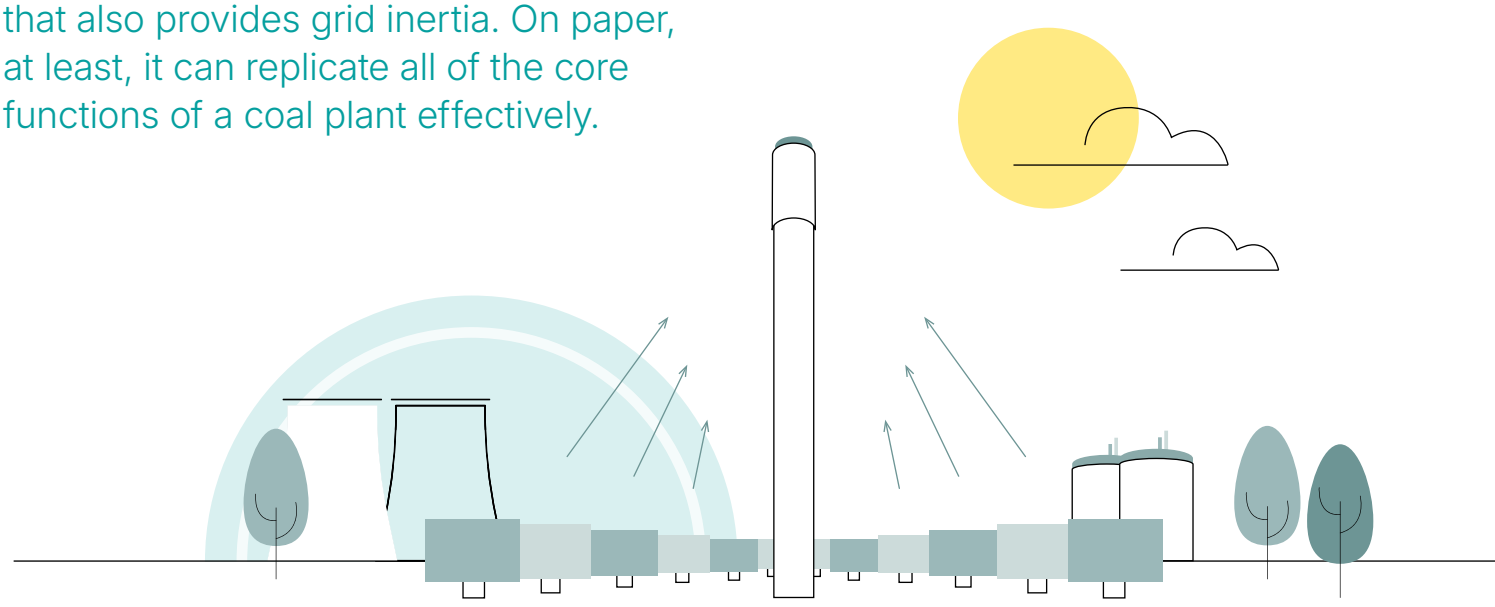
Wind and conventional solar PV are not suitable replacements for coal boilers because they convert sunlight or wind directly into electricity, without producing heat for homes or industry or driving turbines to produce inertia. CSP, by contrast, uses mirror arrays to focus sunlight onto a heat transfer fluid that generates steam to drive a turbine. The heat generated can also be stored in molten salt tanks and released later, as heat for homes or industry, or to generate electricity when the sun is not shining. That makes CSP with thermal storage a source of baseload and dispatchable power that also provides grid inertia. On paper, at least, it can replicate all of the core functions of a coal plant effectively.

At $0.092/kWh on an LCOE basis, CSP generation is now four times cheaper than it was in 2010, according to the International Renewable Energy Agency (IRENA). CSP costs have fallen faster than every renewable power source except conventional solar PV over the period and are now just 25% higher than coal for continuous baseload generation.[96]

In China's Qinghai province, the daylong 0.47 RMB/kWh tariff agreed for a recently commissioned CSP plant is lower than the 0.5 RMB/kWh the local government pays for electricity from the grid at night.[97]

CSP requires intense direct sunlight, currently limiting viable deployment to desert and semi-arid regions. That includes parts of China and India, the two biggest users of coal power. China already has four of the world's 50 largest CSP plants by capacity, with all of those facilities in Qinghai or neighbouring Gansu province, which borders the Gobi Desert. India has three of the top 50 plants, spread across the country from arid Rajasthan in the northwest to South India. The US, Spain, South Africa, and Gulf Cooperation Council countries are other areas of significant deployment.[98] However, CSP also requires a much larger physical footprint than coal power plants, in order to accommodate the vast arrays of mirrors.[99]

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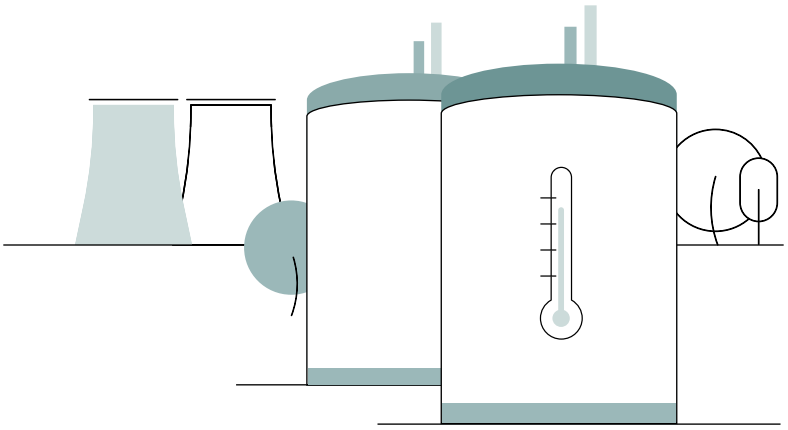


Thermal energy storage (TES): an intermediary step

A TES system uses a material like molten salt to store some of the heat produced during power generation for later release.[100] The stored heat can be fed back into the power block to generate electricity. For a baseload power provider like a coal or nuclear power plant, a TES system raises capacity because heat in the TES can be used to supplement power generation during peak demand.[101] For a CSP facility, installing a TES during construction increases capital costs by around 12–17%, but this means power can be generated from stored heat even when the sun is not shining.[102,103] That allows a CSP facility to better replicate the baseload function of a coal plant.

Alternatively, the heat in the TES can be provided directly to consumers, like a district heating network or industrial facility, helping power stations play a cogeneration role and serve heat customers as well as electricity consumers. China's State Power Investment Company (SPIC), for example, already supplies zero-carbon district heating to the city of Haiyang by extracting steam directly from its nuclear plant.[104] A thermal store generalises that model: because it can be charged from any heat source, a power plant can burn coal to meet demand for heat today, but switch to a clean source later. That makes installation of TES an intermediate step towards repowering—making coal plants "repower ready".

Installing TES at a coal plant makes a subsequent clean energy repowering easier in other ways too. Coal plant steam turbines are precision-engineered for specific temperatures and pressures, but replacement heat sources—whether nuclear, geothermal, or CSP—rarely match these exactly.[105] The TES system can act as a buffer, absorbing heat from the clean source and releasing it into the power block at the temperature and pressure the existing turbines require, protecting expensive equipment.[106]



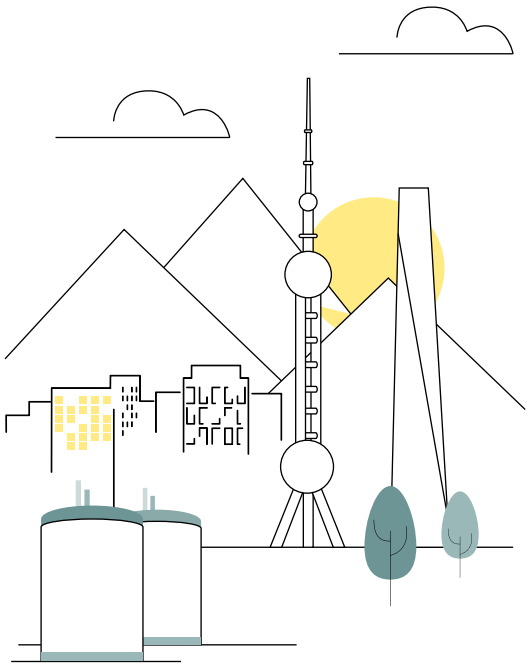
A staged process

TES can be part of a staged repowering. In the first step, TES is added to an existing coal plant, improving flexibility and efficiency of the coal unit. Replacing the coal boiler with a clean heat source is then planned and financed as a second step. CHN Energy's molten salt installation at the Suzhou power plant in Anhui, which entered commercial service in August 2025, is the clearest proof of concept for the first stage: 1,000 MWh of heat storage is charged with steam the power block does not need at times when variable renewable wind and photovoltaic solar generation is high.[107]

The value of that first step is clearest in China, where wind and solar now supply 22% of power and coal is being formally reassigned from a baseload supplier to cover a dual role: a backup provider when renewable generation cannot meet demand, and a grid regulator that ramps output up and down to match demand.[108,109] To play this regulating role, new Chinese coal units are now required to be able to run at as low as 20% or 30% of capacity, with a retrofit programme to add this flexibility set to be largely completed by 2027.[110] Operating a boiler at just 20% capacity is inefficient, however, requiring significantly more coal to be burned per kilowatt-hour of electricity produced, and the use of oil or gas to keep combustion stable, while it also increases wear and tear.[111]

TES provides this dispatchability by another route. Rather than throttling the coal boiler up and down to meet changes in demand, steam that the generator does not need when renewable generation is high is diverted into the store, allowing the plant to reduce the amount of electricity it sends to the grid and raise it again within minutes by using the heat in the store. By allowing the coal plant to operate at low capacity and adjust output to meet demand, the Suzhou TES is expected to make room for 128 GWh of renewable generation a year and avoid around 85,000 tonnes of CO_2.[112] The logic is not specific to China: it applies wherever a coal or gas fleet is required to make room for variable renewables.

TES is particularly valuable at coal plants that supply heat to customers. Chinese cogeneration units historically had to run at 75% capacity to meet heat demand from customers, even if demand for power from the plant was low, but TES breaks the coupling between heat provision and power generation.[113] At Suzhou, full heat output can be maintained for five consecutive hours with the unit at 30% of power generating capacity, while the plant's heating capacity rose by 73%.[114]



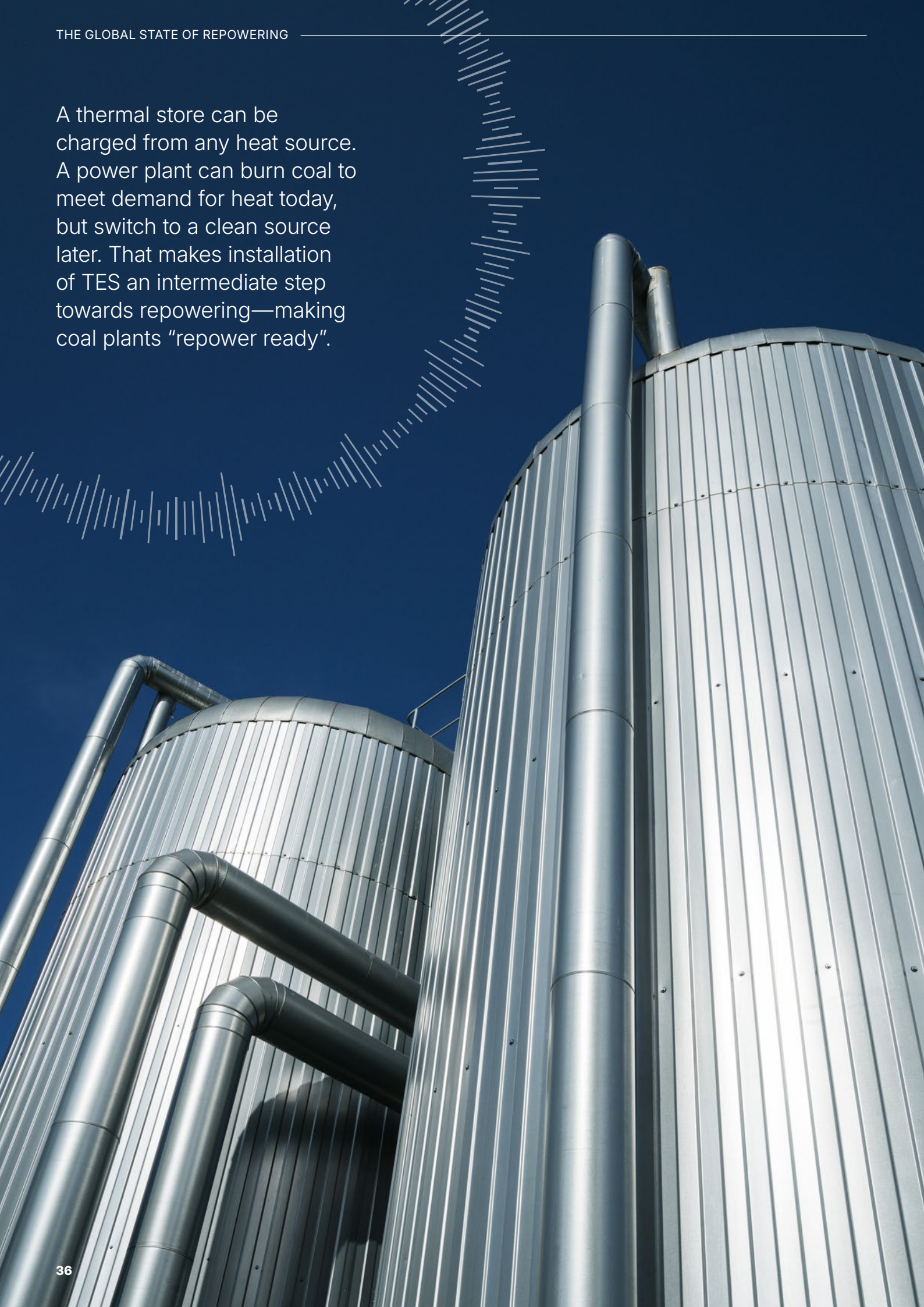
An "adaptor plug" for heat

Seen this way, adding a TES is not only an efficiency measure but an investment that keeps the site's assets—the steam turbine, generator, grid connection, heat network, and skilled workforce—in service. Once the TES and its steam interface exist, the plant is largely indifferent to the origin of its heat, thus turning the TES system into a kind of "adaptor plug" that makes the second step of clean energy repowering practical. Clean energy sources can be added without rebuilding the power block—saving money and shortening build times. Indeed, research presented in 2026 by the China Nuclear Energy Association found that reusing the conventional island of a coal plant reduces the investment cost of a nuclear project by between 18% and 21%, and that around 10% of 149 assessed Chinese coal sites could host large reactors, while 42% could host SMRs.[115]

Two conditions determine whether the emissions benefit of TES is realised, and both are matters of policy and project design rather than properties of the technology. First, although adding a thermal store to a coal plant increases efficiency by capturing unused heat, it will not necessarily result in reduced coal consumption. If there is sufficient demand for power, a plant operator can use the thermal store to increase electricity output, rather than reducing fuel use. In China at least, however, incentives increasingly favour the latter: renewables are cheap, and from 2026, capacity payments cover at least half of a coal plant's fixed costs, up from 30% in the 2024–2025 period, shifting income away from electricity supplied and towards availability.[116]

The second condition is that the clean repowering actually follows. Since TES improves the coal plant's economics, it could in principle extend the lifetime of the coal boiler, increasing emissions. To avoid this, TES projects should be structured in a way that ensures the second stage of clean repowering does take place. Guarantees could include, for example, a fixed date for converting the boiler, pre-screening to determine which clean power source will be added, or caps on coal consumption in the interim period up to clean repowering. Without those commitments, a standalone TES proposal may violate the investment mandates of renewables investors.

A thermal store can be charged from any heat source. A power plant can burn coal to meet demand for heat today, but switch to a clean source later. That makes installation of TES an intermediate step towards repowering—making coal plants “repower ready”.



Clean fuel repowering pathways compared

	Coal power plants (baseline)	Conventional nuclear	Nuclear small modular reactor (SMR)	Conventional geothermal	Advanced geothermal systems (AGS)	Concentrated solar power (CSP) with thermal energy storage (TES)
Typical output	**300–1,000 MW** (Average unit size in China ~342 MW)[117]	**1,000 MW+**	**50–300 MW per unit**, although single sites can hold multiple units, increasing capacity	**5–100 MW per individual plant**, although single sites can hold multiple plants, increasing capacity up to 900 MW[118]	**Capacity potentially much higher than with conventional geothermal.** Fervo Energy's Cape Station development, for example, has received permitting approval to expand up to 2 GW[119]	**50–500 MW**[120]
Land footprint per MW	**Low to moderate**	**Low**—very high energy density	**Low**	**High**	**High**	**High:** mirror arrays require large area
Max heat temperature	**~540–620°C** (supercritical/ ultra-supercritical boiler)	**~300–320°C** (Pressurised water reactor outlet)	**Varies by design**; HTR-PM ~750°C at reactor outlet	**~50–300°C**[121]	**Up to 500°C**[122]	**~400–560°C** (molten salt systems)[123]
Typical build time	**3–6 years**	**10–15 years**	**5–10 years** (projected; unconfirmed at commercial scale)	**3–7 years** (hydrothermal)	**Potentially shorter than conventional geothermal, because there is no need to explore for appropriate reservoirs**	**3–6 years**
Technology readiness level	**TRL 9** —fully commercial, mature for over a century	**TRL 9** —fully commercial	**TRL 6–8** (West); TRL ~8 (China HTR-PM)	**TRL 9** (hydrothermal)	**TRL 5–7** (EGS)	**TRL 8–9** (with molten salt storage for TES)
Baseload	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes** —with sufficient TES storage

	Coal power plants (baseline)	Conventional nuclear	Nuclear small modular reactor (SMR)	Conventional geothermal	Advanced geothermal systems (AGS)	Concentrated solar power (CSP) with thermal energy storage (TES)
Dispatchability	Moderate —can ramp/ cycle, but slower and less efficient than gas power plants	**Limited** —designed for constant output	**Limited** —same as conventional nuclear	**Yes** —steam flow can be modulated	**Yes** —steam flow can be modulated	**Yes** —storage enables dispatch independent of sunlight
Grid inertia	**Yes** —synchronous generator	**Yes** —synchronous generator	**Yes** —synchronous generator	**Yes** —synchronous generator	**Yes** —synchronous generator	**Yes** —synchronous generator
Heat co-generation	**Yes** —widely used for district heating and industrial steam	**Yes** —district heating and industrial steam, though at lower temperatures than coal	**Yes** —HTR-PM particularly suited to high-temperature industrial heat	**Yes**, but low-temperature resources suited to district heating	**Yes**, including for some high-temperature industrial uses	**Yes** —produces high-temperature heat
Geographic constraints	**Low** —siting flexible; requires coal supply access (rail/port/mine-mouth) and cooling water	**Currently can't be located in areas of high population density,** earthquake zones, or in inland locations in China; requires cooling water	**Same as conventional nuclear**	**High-temperature resources** geographically concentrated	**Deep drilling** makes technology viable beyond volcanic areas	**Requires high direct solar irradiance**; currently limited to desert/semi-arid regions, although that includes parts of India and China, the two largest users of coal power
Energy security risk	Low for countries that are self-sufficient in coal, but moderate to high for coal importers depending on coal availability and price	Low: long fuel cycles, with replacement fuel kept onsite	Low: same as conventional nuclear	None— domestic resource	None— domestic resource	None—solar resource

Alternative pathways

There are many other pathways to repowering coal plants, which are not explored in depth in this report for reasons explained below, including lack of emissions savings, inability to replicate key features of a coal plant, technology immaturity, or lack of scalability.

Nuclear fusion

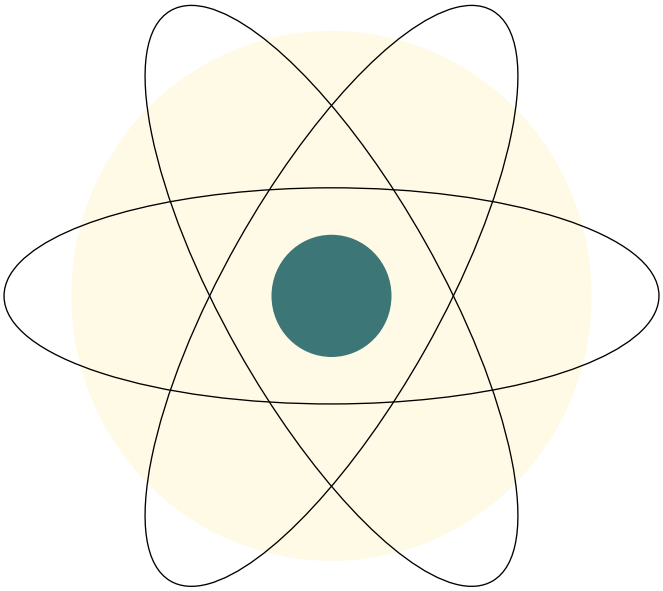
Nuclear fusion—where light atoms are fused together at high temperature to form a heavier one while releasing energy—has been pursued by advocates of clean power for decades. It offers theoretically limitless energy. Fusion's fuels, for example deuterium and tritium, are naturally abundant or easily produced. And it produces no carbon emissions or long-lived radioactive waste.[124]

From a repowering perspective, fusion can also potentially replicate the main features of a coal plant. Many proposed fusion plant designs use the heat generated during reactions to drive a conventional steam turbine, providing baseload power and grid inertia.[125] In principle, heat could also be provided to industrial customers, while pairing fusion plants with batteries or storage; controlling the speed of the fusion reaction could make power dispatchable.

The infrastructure coal plants already have is also precisely what fusion developers need. A 2026 framework for siting fusion power plants produced by the University of Michigan found that proximity to substations and transportation infrastructure are two of the four most important factors in fusion plant location. Both are characteristics that coal plants possess by definition. The same report found that the retirement timeline for the US coal fleet aligns closely with the anticipated commercialisation window for fusion energy, with 68 GW of coal plant capacity planned for retirement or conversion between 2025 and 2030 and 35 fusion companies aiming to operate pilot plants between 2030 and 2035.[126]

Fusion developers have drawn this connection to coal plants themselves. The UK government is building a Spherical Tokamak for Energy Production (STEP) prototype fusion plant at a retired coal plant in West Burton, targeting first operations by 2040.[127] In the United States, Type One Energy is developing a fusion plant at the retired Bull Run coal power station in Tennessee.[128,129]

The only reason we do not examine fusion in depth as a repowering pathway in this report is that it is not yet a deployable technology. No commercial fusion plant yet has produced electricity for the grid.[130,131] Progress, however, is real and accelerating. Private investment in fusion reached $10 billion globally by 2025, with companies signalling specific timelines for power production and signing power purchase agreements with companies including Google.[132] Microsoft has signed a contract to purchase power from fusion developer Helion Energy, which will see penalties imposed if Helion is unable to provide electricity in 2028.[133]



Natural gas

One repowering pathway that has already been shown to be commercially viable and repeatable is the conversion of coal power plants to natural gas.[134] However, while burning natural gas does deliver some emissions reductions compared with coal, it locks in the use of a fuel that still contributes to global warming.

Batteries and utility-scale photovoltaic solar or wind

The combination of batteries with PV solar panels or wind farms offers the potential to provide clean baseload and dispatchable power from existing coal plant sites. However, PV solar and wind convert sunlight or wind directly into electricity, without producing heat for homes or industry, or driving turbines to produce inertia. They therefore do not replicate key aspects of a coal plant.

Synchronous condensers

Coal plants could be used to house synchronous condensers, large rotating machines that spin in order to regulate voltage and stabilise power grids. That can solve the shortfall in inertia that is created when renewable power sources like PV solar and wind replace coal power stations.[135] However, synchronous condensers do not themselves generate electricity or replace the heat production lost when coal is replaced by PV solar or wind.

Hydrogen

Burning hydrogen instead of coal potentially provides clean power in a way that replicates every aspect of a coal plant. Yet producing hydrogen in the first place is an energy-intensive process which generally involves fossil fuels. Low-emissions hydrogen, produced from fossil fuels but with the use of CCUS, or by using renewable electricity to separate hydrogen from water through electrolysis, accounts for just 1% of global hydrogen production.[136] Diverting this limited amount of available low-emissions hydrogen to power stations would prevent the decarbonisation of other activities where there are fewer alternatives to hydrogen, such as refining.[137]

Biomass

Burning biomass—renewable organic material that comes from plants and animals, such as wood pellets, agricultural crops, or waste—can also replicate many aspects of a coal plant. Biomass is considered largely carbon neutral in the long run, in the sense that as long as new trees and crops are planted, they will absorb the carbon emitted when burning biomass.[138] Given the urgency of limiting the level of CO_2 in the atmosphere, however, biomass has been critiqued for not contributing enough to carbon neutrality in the short to medium term.[139]

The amount of sustainably grown biomass, defined as biomass which does not produce significant emissions during growth or cause land use changes that prevent food production or undermine biodiversity, is unlikely to meet power sector demand, according to a 2021 report from the Energy Transitions Commission.[140] The IEA also notes constraints on expanding the supply.[141] The traded market for biomass is also shallow, with Drax, which operates a biomass power station in the UK, controlling about 12% of the market on its own.[142]

4

Repowering in action

The projects in this chapter come from a scan of the global coal fleet conducted for Repower by the Carbon Trust in 2026. Candidates were identified through partner interviews and desk research, matched where possible to a unit in the Global Coal Plant Tracker,[143] and tested against the three conditions set out in the report appendix: substitution of the coal-fired heat source, delivering at least a 90% lifecycle emissions reduction; carry-over of at least one qualifying asset from the existing generating plant; and continuity of the original site.

The emissions test is set deliberately high. The European Union's threshold for low-carbon fuels is a 70% reduction against the unabated alternative.[144] Full alignment with a 1.5°C pathway would require closer to 99.5%, since Paris-aligned power sector intensity falls below 5 gCO_2/kWh by 2040 while coal generation sits closer to 1,000 gCO_2e/kWh.[145,146] Ninety percent is therefore not a climate endpoint but a floor: high enough to exclude coal-to-gas conversion and low-blend co-firing, which change a plant's fuel without substantially changing its climate impact, and low enough to admit technologies capable of deep reductions in the near term.

The other two conditions are looser by design. Infrastructure reuse requires one qualifying asset from the five main areas of a coal plant rather than a fixed share of capital value, because what can feasibly be retained varies with plant condition and pathway. Site continuity requires co-location and the carry-over of a site-linked resource but sets no cap on land take. Power densities differ too widely for a uniform limit to be even-handed: advanced nuclear can deliver comparable output on roughly three-quarters less land than coal, while concentrated solar power or geothermal may need an order of magnitude more.[147,148,149,150] A land ceiling would have ranked pathways by footprint rather than by outcome.

Repower plant dataset: dashboard results

Technology pathways	Nuclear—conventional	Nuclear—advanced	Nuclear—fusion	Biomass	Thermal energy storage	Hydrogen	CSP	Geothermal	N/A
Repowering	2	2	1	0	0	0	0	0	0
Repowering (subject to data verification)	0	0	0	0	1	0	0	0	0
Partial substitution	0	0	0	9	0	1	0	0	0
Repower ready	0	0	0	0	8	0	0	0	0
Co-location	0	1	0	0	1	0	0	0	2

Development status	Operational	Under construction	In development	Under consideration
Repowering	0	0	1	4
Repowering (subject to data verification)	0	0	0	1
Partial substitution	8	0	0	2
Repower ready	7	1	0	0
Co-location	3	1	0	0

Note: Bełchatów and Konin are alternative sites for a single plant and appear as two entries.

Applied strictly and consistently, that test admits four projects for which repowering data has been verified, and it produces qualifiers the reader should carry into the table below. Where the owner or developer states that the generating plant has been demolished, as at Cottam, Doicești, and West Burton A, infrastructure reuse is recorded as not met and the project is classified as site repurpose; none of the three is therefore covered in the table above, but they are described below because they show how much of a coal site's value survives demolition. Bełchatów and Konin entered the list only in June 2026, when Poland's updated nuclear programme named them as the leading candidates for the country's second large reactor plant; they are alternative sites for one plant, counted once here, and both are early enough that infrastructure reuse and site continuity remain open questions. Five completed biomass conversions have displaced coal entirely but publish no lifecycle figures for post-conversion operation. Because published figures for sustainable biomass sit at or just short of the threshold,[151,152] they are recorded as partial substitution unless plant-level evidence shows otherwise.

Uncertainty of that kind is not a defect in the projects. It reflects how little of the relevant evidence asset owners currently publish, and it is among the most useful things the sector could change. It is also why projects that fall short of the definition are recorded alongside those that meet it. Partial substitution shows that boiler-side conversion at utility scale is established engineering. Co-location shows developers capturing the commercial value of a coal site without preserving the link between heat and power generation. And the repower-ready group, tallied separately, has already partially decoupled heat production from generation.

One of the four qualifying projects, meanwhile, is a fusion prototype at Bull Run in Tennessee, US, and fusion's commercial prospects remain uncertain. The test does not assess such prospects: it asks whether a project substitutes the coal heat source, carries over a qualifying asset, and stays on the original site, not whether the technology behind it is proven at scale. Bull Run is recorded as in development and will not generate power for some years.

Coal-to-nuclear and fusion projects in development on coal sites

Bull Run, Tennessee, United States

Owner:	Project:	Assessment against the three conditions	Classification:
Tennessee Valley Authority **Pathway:** Fusion (from bituminous coal) **Status:** In development	Type One Energy is building its Infinity One fusion prototype, with the Tennessee Valley Authority, in a repurposed section of the former single-unit coal plant; the partners are also planning Infinity Two, a 350 MW fusion pilot plant.	**Heat source substitution: met.** Fusion satisfies both substitution and the emissions reduction threshold. **Infrastructure reuse: met.** Some plant infrastructure, including the cooling towers, has been demolished, but the prototype is being built in a repurposed section of the turbine hall, which indicates a degree of reuse. **Site continuity: met.** The site is being reused.	**Repowering**

Cottam Power Station, Nottinghamshire, United Kingdom

Owner:	Project:	Assessment against the three conditions	Classification:
EDF **Pathway:** Advanced nuclear (from bituminous coal) **Status:** In development	Joint venture between EDF UK and Holtec to develop four SMR-300 units on the former site, supplying an onsite data centre as well as the grid. Demolition is under way.	**Heat source substitution: met.** Coal to nuclear SMR, which has zero point-source emissions. **Infrastructure reuse: not met.** The cooling towers were demolished in 2025 and site clearance is under way; the proposal cites only the grid connection, which counts towards site continuity. **Site continuity: met.** The SMR project is planned for the site of the former power station.	**Site repurpose (outside the hierarchy)**

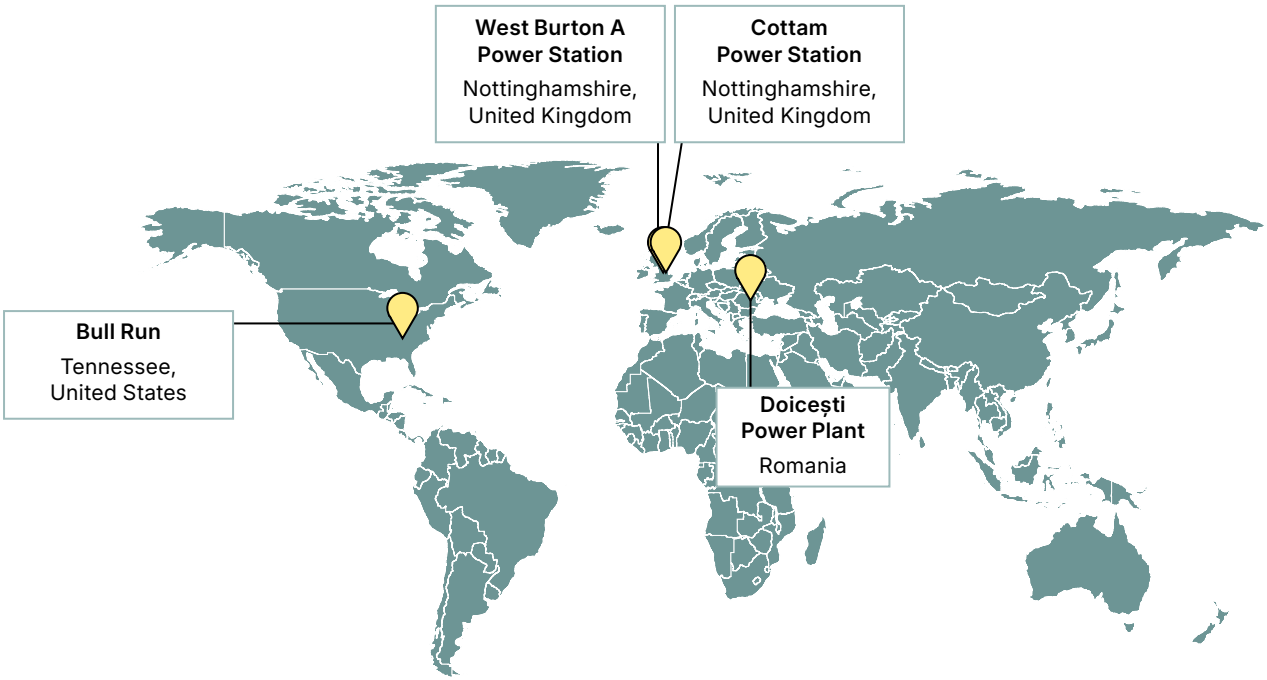
Doicești Power Plant, Romania

Owner:	Project:	Assessment against the three conditions	Classification:
RoPower Nuclear (Nuclearelectrica and Nova Power & Gas) **Pathway:** Advanced nuclear (from lignite) **Status:** In development	Six 77 MW SMRs to be built on the former coal site. Final investment decision taken in February 2026. Joint venture between state-owned Nuclearelectrica and Nova Power & Gas.	**Heat source substitution: met.** Repowered from coal to nuclear, with zero point-source emissions. **Infrastructure reuse: not met.** The developer describes Doicești as a fully remediated coal site that has undergone demolition, including above-ground and underground structures. **Site continuity: met.** Nuclear generation takes place on the site of the former coal plant.	**Site repurpose (outside the hierarchy)**

West Burton A Power Station, Nottinghamshire, United Kingdom

Owner:	Project:	Assessment against the three conditions	Classification:
UK Atomic Energy Authority, via UK Fusion Energy (first phase of site acquisition completed March 2026) **Pathway:** Fusion (from bituminous coal) **Status:** In development	Selected as the site for the STEP fusion pilot. Partners have been appointed and development is under way. The former coal station is being returned to a ground-level brownfield site.	**Heat source substitution: met.** Transition from coal to emissions-free nuclear fusion. **Infrastructure reuse: not met.** The developer states the site is being cleared to ground level; the boiler house was demolished in January 2026. **Site continuity: met.** The fusion project is taking place on the site of the former power station.	**Site repurpose (outside the hierarchy)**

Source: Repower plant dataset, October 2026. Full project detail, condition-level justifications, and sources are available at RepowerScore.org.





Repower ready:
thermal energy storage in China

Eight coal plants have installed thermal energy storage between the furnace and the steam cycle. All eight are in China, seven are operating, and one is under construction. In each case, molten salt is charged from the existing coal boiler and discharged to the steam cycle on demand, which decouples heat production from electricity generation and allows the unit to shift output away from periods of low demand.

None of these projects substitutes the heat source, so none meets the repowering definition. What they have done is partially decouple the coal furnace from the power block. The next step is to change what charges the store. That is why the group is recorded as repower ready rather than excluded, and why it is the most immediately actionable asset population in this report.

Two of the eight show the scale now being reached. CHN Energy's Longshan plant in Hebei province began operating in April 2025, using multi-steam extraction to meet peak load demand and supply grid services, and adding 100 MW of peak shaving capacity to one of the plant's 600 MW units.[153] CHN Energy's Suzhou plant in Anhui province brought 1,000 MWh of molten salt storage into operation in 2025, using a three-way steam extraction and two-tank cycling scheme that provides up to five hours of time-shifted output.[154] Suzhou is an urban cogeneration facility supplying heat as well as electricity,[155] which makes it a particularly direct test of the heat substitution argument at the centre of the repowering case.

Repower-ready projects: thermal energy storage at operating coal plants

Suzhou Power Plant, Anhui province, China

Owner:	Storage configuration:	Assessment against the three conditions
CHN Energy **Status:** Operational (2025)	1,000 MWh of molten salt storage developed by the CHN Energy Research Institute. Three-way steam extraction and a two-tank cycling scheme provide up to five hours of time-shifted storage and peak shaving.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits.

Longshan Power Plant, Hebei province, China

Owner:	Storage configuration:	Assessment against the three conditions
CHN Energy **Status:** Operational (April 2025)	Multi-steam extraction regulates and meets peak load demand and supplies grid services. Peak shaving capacity has increased by 100 MW. The storage is connected to one of the plant's 600 MW units.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits.

Guoxin Jingjiang Power Station, Jiangsu province, China

Owner:	Storage configuration:	Assessment against the three conditions
Jiangsu Guoxin Jingjiang Power Generation **Status:** Operational (2022)	Demonstration project combining molten salt storage with existing coal generation to provide peak shaving capability.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** The storage appears to add onto existing coal infrastructure. **Site continuity: met.** The site is reused, including grid connections, land, and permits. Sources are limited; further validation is suggested.

Huaneng Weijiamao/Zhunger Weijiamao Power Station, Inner Mongolia, China

Owner:	Storage configuration:	Assessment against the three conditions
North Weijiamao Coal Power **Status:** Operational (2023)	Molten salt project providing peak shaving capability, raising the rated load for peak shaving from 60% to 75%. Delivered in partnership with the Xi'an Thermal Engineering Institute.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits. Further verification of the match between project and plant is suggested.

Jingzhou Power Plant, Hubei province, China

Owner:	Storage configuration:	Assessment against the three conditions
CHN Energy **Status:** Operational	100 MW/200 MWh molten salt storage system added to increase grid services and peak shaving capability.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits.

Huaneng Haimen Power Plant, Guangdong province, China

Owner:	Storage configuration:	Assessment against the three conditions
Huaneng Shantou Haimen Power Generation **Status:** Operational	Reported as the first molten salt storage project integrated onto an existing thermal power plant in southern China, and the first Chinese integration onto a million-kilowatt unit. Further technical detail is limited.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits.

Huaneng Dezhou Power Station, Shandong province, China

Owner:	Storage configuration:	Assessment against the three conditions
Huaneng Dezhou **Status:** Operational (2024)	Total heat storage capacity of 180,000 kWh. The system operates in either direct steam mode or peak shaving mode, at 50,000 kW for four hours.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: met.** Integrated with the existing coal-fired unit's steam-cycle systems. **Site continuity: met.** The site is reused, including grid connections, land, and permits.

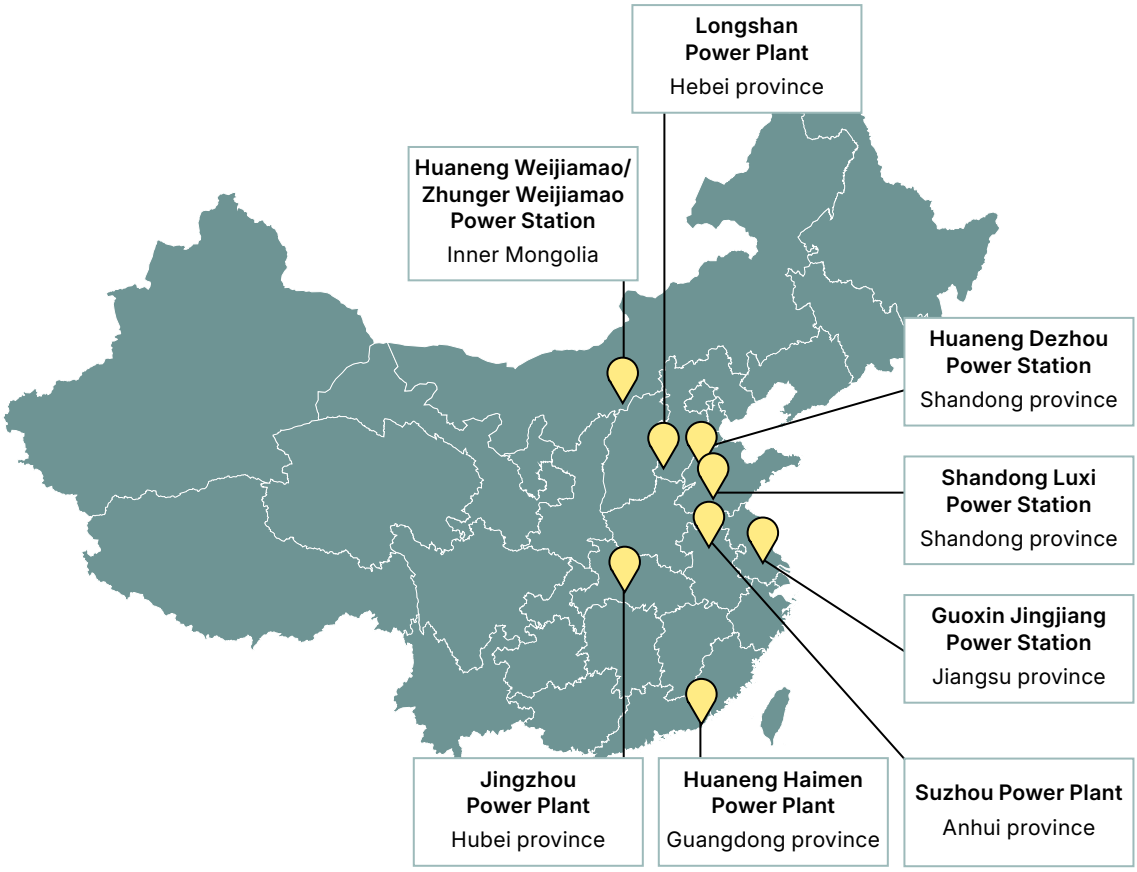
Shandong Luxi Power Station, Shandong province, China

Owner:	Storage configuration:	Assessment against the three conditions
Shandong Luxi Power Generation **Status:** Under construction	Molten salt retrofit intended to improve the flexibility of the thermal units. Further detail has not been published.	**Heat source substitution: not met.** The storage is charged from the existing coal source. **Infrastructure reuse: uncertain.** The project has the potential to meet the condition but little evidence supports it. **Site continuity: uncertain.** The same applies. Further verification is suggested.

Source: Repower plant dataset, October 2026. Full project detail, condition-level justifications, and sources are available at RepowerScore.org.

These lists show that repowering is moving from concept to reality. In the past two years, multiple projects have crossed the threshold from feasibility study into construction, permitting, or formal proposal, sometimes backed only by private capital. A growing number of coal plants in China, in particular, have also installed TES, which can pave the way for later repowering.

Together, these projects create the beginnings of a pipeline of investable projects, which is crucial to attracting capital (see Chapter 5). The remainder of this chapter zooms into some of the projects listed in the tables above, and others. Unless otherwise specified in a footnote, all data and underlying sources are found on RepowerScore.org, in the project status section.



CHINA

Coal to conventional nuclear at Haiyang, Shandong province

Haiyang is a good example of replacing coal-fired heat with nuclear heat. The plant's two AP1000 reactors, which entered operation in 2018 and 2019, supply electricity to the grid, while steam extracted from them has heated the surrounding city since 2021,[156,157] a clear demonstration that coal-fired heat obligations can be met from a low-carbon source.

Although the nuclear plant was built on a new site, its heat feeds the city's existing heating system: the heat exchangers are at the plant, but many of the dispatch centres that distribute the hot water were once part of the coal-fired heating system, one of them in a room that formerly held a 40-tonne coal-fired boiler.[158] In all, the plant has replaced 12 local coal-fired boilers,[159,160] making this a good example of wholesale replacement of coal-fired heat with nuclear, even if it is not repowering as strictly defined.

Image credit: WPTO, CC BY-SA 4.0, via Wikimedia Commons

UNITED STATES

Co-location of the TerraPower Natrium reactor beside the Naughton coal plant at Kemmerer, Wyoming

GENERATING CAPACITY:
500 MW
(at peak, including molten salt TES)

STATUS:
Under construction

TIMELINE:
2030[161]

Site continuity

The project reuses the existing transmission infrastructure and grid connection of the Naughton coal corridor.[168]

Cost savings

Specific cost savings have not been detailed for this project.

In April 2026, TerraPower formally broke ground on the Natrium nuclear power plant at Kemmerer, Wyoming.[162] The site was chosen for its proximity to the adjacent Naughton coal plant, allowing the nuclear plant to make use of existing grid connections and infrastructure.[163]

TerraPower's 345 MW SMR reactor is being paired with a molten salt thermal storage system, which will allow it to boost power output to 500 MW to meet peak demand by generating additional electricity from stored heat.[164] That makes it genuinely dispatchable in a way conventional nuclear power stations are not.[165]

To be clear, this project is classified as co-location, rather than repowering. The reactor is being built on a new site adjacent to the Naughton coal plant, the coal heat source is not substituted, and no generating asset carries over. It is included here because it demonstrates how much of a coal site's commercial value—grid connection, water rights, and workforce—can be captured even when the generating plant itself is not reused.[166,167]

Time savings

The NRC completed its safety review of the Kemmerer construction permit application ahead of schedule and 11% under budget in December 2025, reflecting the benefits of an established site with existing regulatory history.[169] The project is expected to be operational by 2030,[170] significantly faster than a comparable greenfield nuclear project would be on an unpermitted site.[171]

Commercial and private capital

The project is supported by a cost-sharing agreement with the US Department of Energy's Advanced Reactor Demonstration Program (ARDP), which is contributing up to $2 billion that must be matched dollar-for-dollar by private capital.[172,173] TerraPower has already raised $1.4 billion from investors including Bill Gates, South Korea's HD Hyundai, and NVIDIA's venture arm.[174] This hybrid of public and private finance, rather than purely commercial funding, reflects the first-of-a-kind technology of the Natrium design.





POLAND

A national commitment to coal-to-nuclear repowering

Poland is the European Union's single largest producer of coal, and low-quality lignite underpins power generation in the country.[175] Nevertheless, the Polish government has made a commitment that is, to date, unique among major coal-dependent nations: it has named post-coal sites as the preferred locations for its second large nuclear plant.[176]

In June 2026 the Ministry of Energy published an update to the Polish Nuclear Power Programme, naming Bełchatów and Konin as the preferred sites for the country's second large reactor plant, with Kozienice and Połaniec as further options. All four are coal sites. A competitive dialogue on technology and contractor selection is under way, with a partner expected to be chosen in 2027, construction from around 2032, and the first unit commissioned around 2040.[177]

POLAND

Coal to conventional nuclear: Bełchatów and Konin, Poland

GENERATING CAPACITY:
6–9 GW
across the programme,[178]
technology not yet selected

STATUS:
Under consideration;
preferred sites named
June 2026

TIMELINE:
Partner and technology selection 2027;
first unit around 2040[179]

Bełchatów is the largest lignite-fired power station in Europe and the single largest point source of carbon dioxide in the European Union.[180] Its units are due to retire as the local lignite resource depletes.[181] Konin, roughly 135 km to the north-west,[182] is a former lignite station decommissioned between 2020 and 2022.[183] The two are alternative sites for a single plant, with the site due to be confirmed in 2028,[184] and are counted once in this report. The Konin candidate site is at Pątnów, now controlled by PGE. Both sites offer transmission infrastructure and a skilled workforce that the second plant would otherwise have to build from scratch.[185,186]

Both projects satisfy the heat source substitution condition, because large reactors would replace coal generation outright. Infrastructure reuse and site continuity are both recorded as uncertain: the programme is at too early a stage for the extent of reuse to be known, and Łukasz Bartela of the Silesian University of Technology in Poland, who led the DEsire project, expects the reactors to be sited near rather than on the existing power blocks: this avoids site-related constraints, reflects the limited savings from reusing plant infrastructure, and lets the coal units keep running while the nuclear plant is built. PGE's preferred site at Bełchatów is Chmielowiec, near Szczerców, with Biały Ług, beside the existing plant, as a reserve.[187] If that is how the projects proceed, they would be reclassified as co-location rather than repowering. This is the single most consequential open question in the European pipeline.

The programme supersedes the earlier commercial project at Pątnów, which planned two APR1400 reactors under a joint venture between PGE and ZE PAK. Korea Hydro & Nuclear Power withdrew in August 2025, and that October, PGE agreed to buy out ZE PAK's stake.[188,189] The project is recorded in our dataset as frozen, with no indication of whether or when it will resume, and is excluded from the register, although the site itself remains a candidate under the national programme.

Infrastructure reuse

Uncertain. Transmission infrastructure and workforce are expected to carry over; reuse of generating plant is not yet determined.[190]

Commercial and private capital

The government has said it expects the technology partner to take an equity stake, with a majority remaining in Polish hands.[191]

Cost savings

The DEsire programme pre-feasibility studies of nuclear repowering at other Polish coal power plants—Kozienice, Dolna Odra, and Opole—found the potential for significant capital savings compared to greenfield nuclear power projects. Redevelopments of Dolna Odra and Kozienice, which reuse the coal plant site but not its power block, would yield savings of 1.76% and 1.36%, respectively. Replacing the coal boiler of Opole's 905 MW unit 6 with six Kairos Power KP-FHR reactors, while reusing the unit's turbine-generator, turbine hall, and cooling tower, would save 31.75% compared with a greenfield nuclear project.[192,193,194]

UNITED KINGDOM

Coal to SMR nuclear at Holtec reactors, in partnership with EDF, at retired Cottam coal power plant, Nottinghamshire

GENERATING CAPACITY:
1.3 GW

STATUS:
Formal proposal submitted to UK government, June 2026

TIMELINE:
To be confirmed

In June 2026, Holtec International and EDF Energy submitted a joint proposal to the UK government to deploy up to four of Holtec's SMRs at the former Cottam coal-fired power station in Nottinghamshire. The site stopped generating electricity in 2019 after 50 years of operation but retains significant grid infrastructure.[195] The proposal, made under the UK's Advanced Nuclear Framework, envisages approximately 1.3 GW of clean generation capacity from the new site, with Holtec providing technology and EDF leading operations. The companies describe it as a demonstration of "how former coal sites, with existing grid infrastructure, can be repurposed to support the next generation of nuclear energy while revitalising the local economy and transforming the region."[196] To be clear, this project is classified as site repurpose rather than repowering: the generating plant is being demolished, but the site's grid connection carries over.[197]

Site continuity

The proposal reuses Cottam's existing grid connection infrastructure.

Time savings

Cottam's existing grid connection may shorten the route to generation compared to a greenfield nuclear site,[198,199] but a specific time saving has not been calculated.

Cost savings

No project-specific cost saving figure has been published, but the value of reusing Cottam's grid connection in a UK context, where new power generation projects are currently waiting many years for a grid connection, is significant.[200]

Commercial and private capital

The proposal is structured as a private investment, with Holtec and EDF contributing equity to a joint venture. No concessional finance has been announced for the project, which the companies have characterised as market-led, although the UK government has said projects accepted into its Advanced Nuclear Framework may qualify for revenue support and risk sharing.[201,202]



ROMANIA

Coal to SMR nuclear at Doicești, Romania

Doicești is the most advanced coal-to-SMR project in Europe. Six 77 MW small modular reactors are to be built on a former lignite site, with a final investment decision taken in February 2026 by a joint venture between the state nuclear company Nuclearelectrica and Nova Power & Gas. It is the only coal-to-SMR project in Europe to have taken a final investment decision, although the government has said it will fund only the first module, with the remaining five to follow once the first is proven.[203]

The developer describes the site as fully remediated after demolition of above-ground and underground structures,[204] so infrastructure reuse is recorded as not met and the project is classified as site repurpose. The site, its grid connection, and its consents carry over.



UK & US

Fusion: West Burton A (UK) and Bull Run (US)

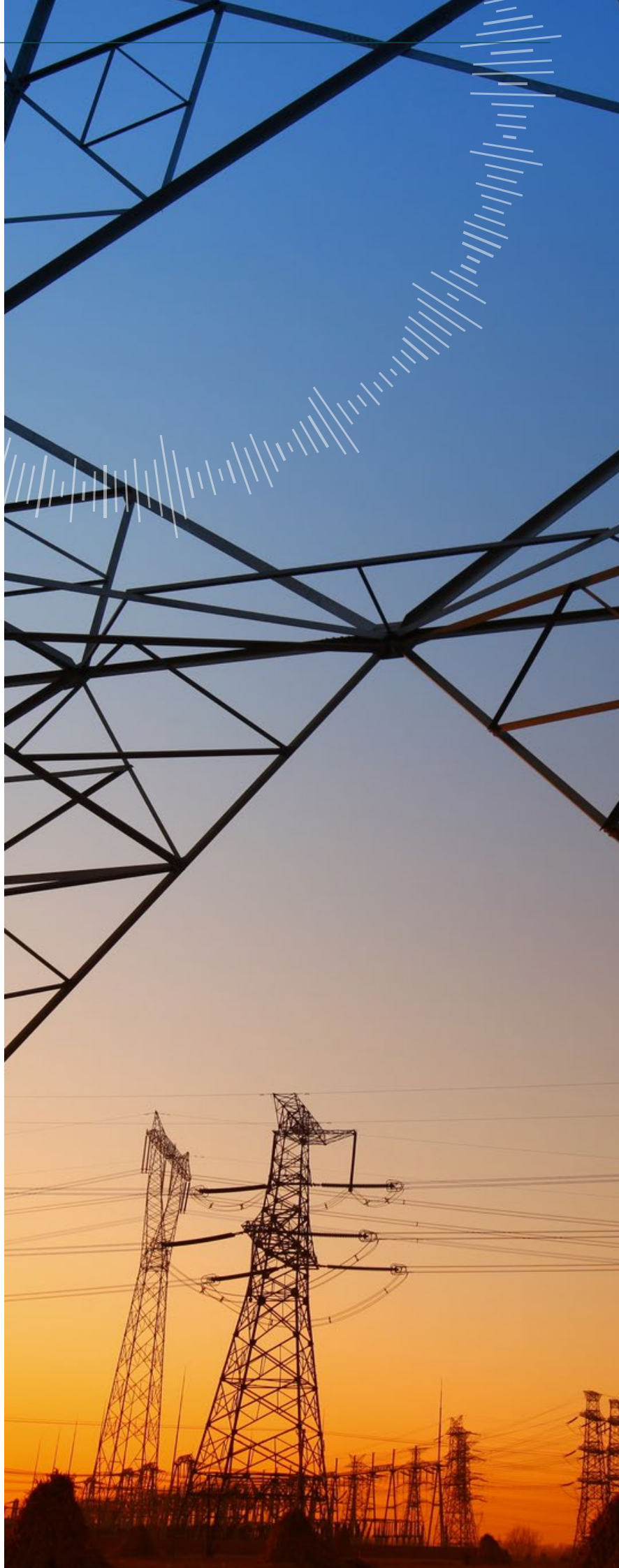
One fusion prototype meets the repowering definition, and a second is planned on a cleared coal site. The UK Atomic Energy Authority has selected West Burton A in Nottinghamshire for the STEP fusion pilot, with partners appointed and development under way; the former coal station is being returned to a ground-level brownfield site, so West Burton A is classified as site repurpose. At Bull Run in Tennessee, the Tennessee Valley Authority and Type One Energy are building the Infinity One prototype in a repurposed section of a former single-unit coal plant's turbine hall, and are planning a 350 MW fusion pilot plant, Infinity Two. Bull Run is the only repowering project in the dataset whose infrastructure reuse is recorded as met rather than uncertain. Neither will generate power for some years, and fusion remains a pre-commercial technology (see chapter 3). Bull Run is included because it satisfies all three conditions on the evidence available, and both are discussed because the siting logic that led two separate fusion programmes to leverage retired coal plants is the same logic that underpins this report.

A growing, global pipeline

Taken together, these projects show a pipeline that is genuinely global but narrow. Four projects meet the full definition: one in development in the United States, and three under consideration in Poland, India, and the United States. One more is held pending verification, and three nuclear and fusion projects are in development on coal sites in Europe that have been, or are being, cleared. China has, in addition, completed seven thermal energy storage retrofits at operating coal plants, with an eighth under construction. Combined with China's position in SMR development, that storage fleet is the most plausible route to repowering at scale anywhere in the world.

Most governments offer some form of support for new power generation projects, from price guarantees to outright subsidies, and low-carbon projects are no exception. Doicești has taken its investment decision, Cottam is proposed as a privately financed joint venture, and private capital has been committed to the co-located Natrium plant at Kemmerer, which suggests the concept is commercially viable within existing incentive programmes. Poland's earlier commercial vehicle at Pątnów, by contrast, may not survive the withdrawal of its technology partner.

Finally, the projects demonstrate the potential for time saving. TerraPower's project in Wyoming aims to significantly shrink the decade-plus time horizon for nuclear power projects,[205,206] while the Cottam plant's existing infrastructure should provide a way around the lengthy queues for connections to the UK grid.[207]



5

Towards **repowering** at scale

The case studies and project list from the previous chapter show that repowering is a viable route to reducing emissions from coal-fired power stations and that it can attract private, profit-seeking capital. Yet for repowering to meaningfully contribute to emissions reductions, as a complement to greenfield clean power generation, it needs to become a standardised and repeatable practice. Each stakeholder group in the energy transition community—financiers, asset operators, researchers, and policy specialists—can play a role in establishing such a practice.

This section considers how the global energy transition community can accelerate repowering, providing practical guidance for each major stakeholder group.

Focus on individual power plants

While the case for repowering rests on universal principles—the reuse of infrastructure to reduce costs—it must take place at the individual power plant level. That means persuading asset owners, operators, and external investors to back a profitable pathway to transitioning a specific piece of infrastructure to clean power. To achieve this, repowering advocates must:

1

Identify and prioritise coal plants approaching major maintenance or retrofit cycles.

That is where capital commitments are made and decisions taken about retirement or life extension. It is the key moment in a plant lifecycle when repowering pathways can be proposed.

2

Fund feasibility studies at candidate plants.

Each power plant, local grid, and customer set is unique. Detailed studies must be carried out to assess the technological and economic viability of different repowering pathways at that particular asset. These analyses should also identify similarities between plants, preparing the ground with a toolkit of options that many repowering candidates can draw from. Such feasibility studies are a rare place where grants should be considered: catalytic funders can finance studies to build a site-specific case for commercially viable repowering.

3 Use technology screening to shape feasibility studies.

Detailed feasibility studies to explore specific repowering pathways are costly and time-consuming. Repower's experience in Vietnam, where a philanthropic grant from HSBC supported Repower's exploration of the viability of coal plant repowering, introduced an initial technology screening step. This eliminated unsuitable technology pathways at a fraction of the cost of full feasibility studies, ensuring only viable technologies were researched in depth.

4 Engage with asset owners as partners.

Utilities and other plant owners have an interest in securing a plant's long-term future. Repowering can deliver that and even substantially extend lifetimes. That creates alignment and the potential for repowering advocates to work in partnership with asset operators.

Asset owner cooperation is crucial in proving the viability of repowering. In Vietnam, for example, Repower found plant operators, or their affiliates within a state-owned power network, already held much of the information required to determine the risk of different technology pathways.

5 Treat concessional finance as a last resort.

Concessional finance may be needed to fund pilot projects to prove the feasibility of repowering pathways, but it cannot be taken for granted. For repowering to gather pace, it must be a commercial practice capable of attracting capital in its own right. Existing projects have shown that early retirement or repowering can be achieved on purely commercial terms where there is a clear incentive for an asset owner to reduce emissions because of environmental, social, and governance commitments or a high or rising carbon price that incentivises a move away from coal.

6 Identify a specific financial gap before seeking to bridge it.

If concessional finance is required to provide a reasonable rate of return for private investors, the exact amount of capital needed should be defined. Private investors willing to commit to the project on condition of external finance should also be lined up in advance.

Work with investors

Predictability and a high certainty of returns attract capital. Greenfield wind and solar projects are able to provide this because the technology is proven and construction costs have become predictable through decades of project repetition. Add in power purchase agreements that guarantee minimum levels of revenue, and these become bankable projects.

With repowering in its early stages of global rollout, costs, in particular, are less clear. But that does not mean predictability cannot be achieved relatively soon.

"Repowering projects are often more bespoke than greenfield developments," notes Bartela. "However, this is not an argument against repowering; it is an argument in favour of standardising the project development process."



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>
> **Łukasz Bartela**
> Silesian University of Technology

1 Build a playbook for repowering projects.

Repowering should be split into multiple stages: technology pre-screening, feasibility study, boiler shutdown, boiler removal, and clean power replacement, for example. Each of these modular activities can then be considered independently with costs becoming clearer over time. As Bartela emphasises: "Capital does not require projects to be identical. Capital requires projects to be comparable, with a clearly defined and well-understood risk profile."

Parts of this playbook already exist. The methodology developed by Repower in Vietnam for technology screening, for example, produced a reusable table for scoring every potential technology pathway against coal on carbon intensity, particulate emissions, technology readiness, and supply-chain maturity. This can be reused globally.

2 Guarantee revenue.

Pre-signed offtake agreements help power plant projects to raise capital by offering investors visibility of future revenue. In jurisdictions where renewable power plants are given freedom to strike offtake agreements directly with industrial consumers—as Vietnam has recently permitted, for example[208]—repowering initiatives should be able to do the same. This can provide revenue guarantees from a creditworthy customer, rather than relying on future sales into a power grid.

3 Bring repowering into green investment mandates.

Repowering projects—particularly TES-only projects that do not immediately reduce coal use—risk falling outside green investment frameworks, cutting them off from a large pool of capital that can only invest in green-labelled assets. The EU Taxonomy—among the most influential frameworks for defining what qualifies as a sustainable activity—excludes coal-fired power generation, even if the investment is designed to enable a repowering or shorten the lifespan of a plant.[209] A targeted advocacy push, working through energy governance bodies like IRENA and the IEA and financial governance institutions like the International Capital Market Association, which publishes the Green Bond Principles, should work to make transition finance taxonomies explicitly recognise clean repowering.

4 Develop a project pipeline.

One of the factors that made wind and solar bankable as asset classes was the emergence of a visible, comparable project pipeline.[210] Confident that more investment opportunities would materialise, asset managers built specialist teams, developed pricing expertise, and were able to spread risk across a portfolio of similar projects rather than treating each one as unique. Repowering currently has no equivalent. A credible, investor-facing registry of clean repowering projects at defined stages of development with standardised data on technology pathway, capacity, timeline, and financing status would help legitimise repowering as an asset class, reduce investor due diligence costs, and create the conditions for the kind of portfolio financing that has proved transformative in other clean energy sectors.

Win the public argument

Power grids, utilities, and transmission networks are crucial pieces of public infrastructure, sources of jobs, and major drivers of economies. Gaining approval for power sector projects, therefore, involves much more than simply securing finance for a return-generating asset. Governments, for example, tend to be intimately involved in planning as well as funding power stations, through PPAs or the design of contracts for difference. Public opposition, meanwhile, can determine whether a power plant is built in a specific locality or what technology is acceptable there. For repowering to gain momentum, its advocates need to engage both governments and local populations.

1 Raise awareness of repowering within policymaking circles.

Governments tend to think of power markets in aggregate and over long time horizons, forecasting demand in terms of decades, modelling how it can be met by different generation sources and what the environmental impact will be. As long as repowering is confined to discrete projects at power stations nearing their end of life, it will simply not feature in that wider discussion. To see repowering as a potential lever in the overall energy transition, policymakers need to understand it as a method that can be generalised across their entire fleet of coal-fired assets to deliver meaningful emissions reductions—as well as other benefits—in a short timeframe. That requires academics, policy experts, and researchers building the argument through publications, speaking, and advocacy, as much as it does asset operators running the economics on individual plants. Poland's turn to repowering, for example, came only after an academic case was constructed over several years and eventually caught the attention of policymakers (see box on page 61).

2 Invest in early, transparent community engagement.

Public opposition has shaped power projects across the world for decades, from wind farms to fossil fuel plants and even transmission infrastructure like pylons.[211] Even among populations concerned about climate change, there can be opposition to the construction of power generation and grid assets in their own backyard.[212,213] Repowering advocates should push for community engagement programmes to begin at the feasibility stage, not once planning permission is sought. That community engagement should be aimed at understanding local priorities and concerns and sharing the benefits of power capacity development, for example, through cheaper bills for local residents, rather than simply educating populations about the benefits of nuclear or other clean power sources.[214,215]

3 Let science, rather than fear, guide public debate on nuclear.

Nuclear power is an emotive subject and accidents have cast a long shadow over the industry in some countries, with Germany, for example, abandoning nuclear power completely.[216] However, designs for reactors have since incorporated additional safety measures, including gravity-based cooling, while SMRs carry an enhanced safety profile compared with conventional large reactors.[217,218] The latest science should be at the centre of any debate about nuclear expansion.

4 Emphasise the energy security aspects of repowering.

Soaring natural gas prices after Russia's invasion of Ukraine were crucial in persuading the Polish public to back nuclear repowering of coal plants (see box). The US-Israel war on Iran and subsequent closure of the Strait of Hormuz has only added to energy security concerns. Repowering should be cast as a way to reduce energy import dependence through the reuse of existing infrastructure.

Lessons from Poland's embrace of coal-to-nuclear

Poland has been synonymous with coal for decades.[219] Even today, 17 mines employ 75,000 people across the country—the largest single producer of coal in the European Union and a significant exporter.[220,221] Coal-fired generation provided nearly all of Poland's electricity at the start of the century and still accounts for the majority of power supply today.[222] Yet in November 2023, Poland committed to building nuclear power at one of its existing coal power stations, as part of a gradual phase-out of coal from the power mix (see chapter 4).[223]

Poland's transition from a deeply ingrained cultural commitment to coal to repowering offers lessons for other countries.

The groundwork: grant funding raises awareness

Poland's government embraced emissions reduction policies as long ago as the 1990s, but its focus was, for a long time, on building greenfield wind, solar, and hydropower plants, whose combined contribution to power generation increased from just 3% in 2010 to 25% in 2024.[224,225] Repowering existing coal power stations—and maintaining jobs in mining communities as a result—was not on the agenda until academic advocates within the country began to bring attention to it as a way to accelerate the energy transition.

The DEsire programme was set up in 2022 to build an academic case for repowering with funding from external donors, including the Repower Initiative. As awareness within research circles grew, this funding was used to conduct site-specific feasibility studies, which considered how repowering would impact employment retention, grid stabilisation, and power costs at any given site.

Only when this research began to permeate into state and energy industry circles did the government take up repowering, providing funding to DEsire to identify the best candidates for repowering.

Shifting public opinion

Poland's example shows the importance of securing public backing for energy transitions. While the case for repowering was growing within academic and government circles, popular opinion remained opposed to nuclear power, in particular, throughout the 2010s.

It was only Russia's invasion of Ukraine in February 2022, soaring gas prices, and a sharp spike in public concern about reliance on energy imports from Russia that led to a change.[226] Public support for building nuclear power stations in Poland shifted from 39% in May 2021 to 75% in November 2022, and the government approved in principle the country's first nuclear power station soon after.[227,228]



Push for incentives

Repowering can only take place within a policy environment that creates effective incentives to transition away from coal and encourages alternative clean power sources. Three interventions would make the biggest difference.



1 Put a robust price on carbon.

The fundamental economics of repowering are strengthened by any policy that raises the cost of continued coal use. Carbon pricing—whether through an emissions trading scheme or a carbon tax—creates a direct financial incentive for plant operators to consider transitioning away from coal. Repowering advocates should add their voice to calls for robust, sensible, predictable carbon pricing in markets across the world.

2 Embed repowering in national energy planning.

Repowering will not happen at scale if it remains a project-by-project exercise pursued by individual asset owners. It needs to become part of how governments plan their energy systems. Poland has already explicitly embraced repowering as a concept, encouraging asset owners, financiers, and technology developers to seek suitable sites for experimentation. Repowering advocates across the world should encourage governments in their own countries to do the same.

3 Incentivise the consideration of repowering opportunities when redesigning grids.

As data centres are built, power demand increases, and renewable capacity is expanded, grids in many countries will have to be expanded. Governments must incentivise the reuse of existing grid infrastructure represented by coal power plants. Programmes that reward companies only for building new capacity would discourage this.

6 Conclusion

Clean repowering of coal plants is not a universal solution. It depends on site-specific conditions and policy environments that vary enormously across the countries where it matters most. Not every clean heat source is available in every geography. And the financing structures needed to make it a repeatable, scalable practice are still being developed.

What this report has shown, however, is that repowering has real potential. The first projects are moving forward. Private capital is interested. Governments are taking notice. And the underlying logic—that reusing a coal plant's infrastructure to generate clean power is faster and cheaper than building from scratch—is sound. What is more, the projects described in this report are the potential beginnings of something transformative: clean power servicing existing coal communities and the industries that depend on them.

Taken together, repowering suggests that the global coal fleet is not a problem to be managed, but an opportunity to be seized. The opportunity is huge: thousands of gigawatts of generation capacity, thousands of grid connections, already built and waiting, and thousands of communities with the skills to support large-scale energy production. All of it is currently powered by a fuel that is harming the climate. It need not be this way.

A coal plant that is simply closed takes its grid connection, infrastructure, and workforce with it. A coal plant that is repowered preserves all three, while reducing emissions. That choice, made plant-by-plant across thousands of sites, is one of the most important yet least discussed in the global energy transition.

The task now is to move from proof of concept to practice. That means standardisation, policy support, and a pipeline of projects visible enough to attract the institutional capital that transforms a niche investment into a mainstream asset class. None of this is simple. But it is achievable, and the cost of not achieving it, measured in locked-in emissions from the global coal fleet, is high.

That makes this moment consequential. The decisions being made now about coal plant infrastructure will determine outcomes for decades. A coal plant that is simply closed takes its grid connection, infrastructure, and workforce with it. A coal plant that is repowered preserves all three, while reducing emissions. That choice, made plant-by-plant across thousands of sites, is one of the most important yet least discussed in the global energy transition.

Appendix

This appendix summarises the framework used to identify and classify the coal plant transition projects presented in chapter 4. It was developed for Repower by the Carbon Trust and applied in a global scan of the coal fleet completed in 2026. The full methodology, the complete technology pathway assessment, and the project-by-project dataset are available for download at RepowerScore.org.

1. Working definition

Repowering is a decarbonisation event in which the coal-fired heat source serving an identifiable existing coal power plant is replaced by a low-carbon heat source at the same site, reusing as much of the existing plant, infrastructure, and workforce as is economically practicable.

The definition derives from Qvist et al. (2021), which distinguishes three forms of retrofit decarbonisation: carbon capture, fuel conversion, and heat source replacement. Repowering as defined here spans the second and third. Carbon capture falls outside it because the coal-fired heat source is retained. A project must satisfy all three conditions below. Each is assessed independently and recorded as met, not met, or uncertain, with supporting evidence.

Table A1: The three-pillar definition of repowering

Condition	Requirement	Rationale	Indicator
Heat source substitution	The coal-fired heat source itself must be substituted by a lower-carbon heat source.	The central purpose of repowering. Without substitution of the heat source, an intervention delivers no material emissions benefit.	Lifecycle greenhouse gas emissions intensity reduced by at least 90% relative to the original coal plant.
Infrastructure reuse	At least one substantive asset from the existing generation unit carries over into the repowered configuration.	Assets carried over reduce capital expenditure that a greenfield project would incur in full. This is what makes repowering an economic solution and not only an environmental one.	Evidenced carry-over of at least one qualifying asset from the five core areas of the coal plant (see section 2).
Site continuity	The repowering event must be located at the same site as the existing coal plant.	Without co-location, the project cannot be linked to the coal plant, and both could in principle operate at once. Remaining on site also carries over permits and grid connections.	Evidenced co-location together with the use of at least one identifiable site-linked resource: land, permits, or grid connection.

2. Where the thresholds come from

Heat source substitution: a 90% lifecycle emissions reduction.
The threshold sits between two reference points. The European Union's definition of low-carbon fuels requires a 70% reduction against the unabated alternative. At the other end, Climate Action Tracker's Paris-aligned benchmarks require power sector intensity below 5 gCO_2/kWh by 2040; against a median coal lifecycle intensity of around 1,000 gCO_2e/kWh,[229] that would demand roughly 99.5%. A 90% threshold is therefore not a full Paris-aligned endpoint, but a high minimum bar that screens out marginal fuel switching without excluding technologies capable of delivering material near-term reductions. Assessment is on a lifecycle basis, so emissions embedded in fuel production and supply count alongside emissions at the stack.

Infrastructure reuse: at least one qualifying asset.
Coal plant infrastructure is grouped into five areas: heat generation (boiler, furnace, superheaters, flue gas treatment); power generation (turbine and generator); fuel preparation and handling; the steam-water cycle (piping, condensers, feedwater); and the cooling system. At least one asset from these areas must carry over. This is the minimum evidence needed to distinguish repowering from site repurposing, where land, access, or grid rights may be reused but the generating plant does not. No fixed proportion of capital value is required, because feasible reuse varies with plant condition and pathway.

Site continuity: no numerical land-take threshold.
The methodology tests site continuity through co-location and the carry-over of a site-linked resource and deliberately does not impose a land-take cap. Power densities vary too widely for a uniform limit to treat technologies or sites even-handedly. Nuclear can deliver comparable capacity on roughly 75% less land than coal, whereas replacing a 500 MW coal plant with concentrated solar power could require a land take up to 10 times larger. Where nuclear repowering is constrained, the binding factors are usually cooling water, seismic conditions, population density, and safety requirements, rather than land.

3. What is not repowering

Several interventions are commonly described as repowering without meeting the definition. Some sit within the hierarchy in section 5 of this appendix, having achieved one or two conditions; others sit outside it entirely, because the coal heat source is retained or the generating plant is demolished.

Table A2: Site decarbonisation interventions that do not constitute repowering

Intervention	What happens on site	Condition not met	Position
Fuel switch below threshold	The furnace combusts a different fuel, wholly or in part: gas, hydrogen, ammonia, or low-blend biomass.	Heat source substitution: displacement occurs, but the lifecycle reduction falls short of 90%.	Partial substitution
Thermal storage charged from coal	A storage medium is inserted between the furnace and the steam cycle, but coal remains the charging heat source.	Heat source substitution: no displacement, and round-trip losses may raise intensity above the pre-retrofit level.	Repower ready
Asset co-location	A new asset, commonly battery storage, shares the site and grid connection but is not integrated into the steam cycle.	Heat source substitution and infrastructure reuse: the coal unit continues unencumbered.	Co-location
Decarbonisation retrofit	Post-combustion capture is fitted; the boiler burns coal and emissions are removed downstream.	Heat source substitution: the coal energy input is not displaced.	Outside the hierarchy
Efficiency or life-extension retrofit	Boiler, turbine, or controls are upgraded to improve heat rate, ramp rate, or minimum load; coal remains the input.	Heat source substitution: coal consumption may fall marginally but the input is not displaced.	Outside the hierarchy
Site repurpose	The plant is decommissioned and demolished, and a low-carbon plant is built on the existing land.	Infrastructure reuse: no part of the generating plant carries over.	Outside the hierarchy

4. Assessment of technology pathways

Each candidate technology was assessed against the three conditions before any individual project was considered. Pathways carrying one or more red ratings are excluded from further assessment, since they cannot satisfy the definition under any deployment scenario. The full assessment, with the reasoning behind each rating, is published as a supplement to the methodology at RepowerScore.org.

Table A3: Red-amber-green assessment of technology pathways against the three conditions

Technology pathway	Heat source	Reuse	Site	Outcome
Nuclear—high-temperature SMR or advanced reactor, including fusion	Strong	Strong	Good	Qualifies. Steam conditions most closely resemble coal-fired plant, giving the strongest potential for steam-cycle and turbine reuse.
Nuclear—low-temperature SMR or conventional reactor	Strong	Good	Good	Qualifies. Lower steam conditions may limit turbine reuse without modification; generator, condenser, and cooling equipment reuse well.
Geothermal—enhanced	Strong	Strong	Conditional	Conditional. Contingent on a suitable subsurface resource and adjacent land.
Geothermal—conventional	Strong	Strong	Conditional	Conditional. Contingent on a resource beneath or near the site; land take can be substantial.
Concentrated solar power	Strong	Strong	Conditional	Conditional. Well matched to the existing steam cycle, but the solar field requires far more land than the boiler island.
Biomass co-firing and conversion	Conditional	Strong	Strong	Conditional. Sustainable torrefied pellets give roughly 95–145 gCO_2e/kWh, so the threshold needs near-complete conversion and a low-emissions supply chain. Against a median coal plant this sits at or just short of the threshold, so conversions are recorded as partial substitution unless plant-level lifecycle evidence shows otherwise.
Hydrogen co-firing	Conditional	Strong	Good	Conditional. Green hydrogen reaches 5–40 gCO_2e/kWh; blue (87–558) and grey (350–1,200) cannot. Needs green supply at very high blend ratios.
Ammonia co-firing	Conditional	Strong	Strong	Conditional, under narrow conditions only. Green ammonia is reported at roughly 95–215 gCO_2e/kWh, so near-complete conversion on a green route could clear the threshold against the upper bound for coal. Low-blend co-firing cannot.
Thermal energy storage	Conditional	Strong	Strong	Repower ready. Storage generates no heat, so it qualifies only when paired with a low-carbon charging source.
Natural gas—co-firing or gas turbine	No	Strong	Strong	Excluded. Lifecycle intensity of roughly 320–500 gCO_2e/kWh is above the threshold, whether co-fired, converted, or replaced with combined cycle gas turbine or open cycle gas turbine.
Utility-scale solar PV	No	No	Conditional	Excluded. No heat source is used, so none can be substituted, and no meaningful reuse of the power block is possible.
Onshore wind	No	No	Conditional	Excluded. As for solar PV: no thermal generation process and no carry-over of generation assets.
Battery energy storage	No	No	Strong	Excluded. Batteries generate no primary electricity and, beyond the grid connection, reuse no generation infrastructure.

Ratings: Strong—inherently well suited to meeting the indicator. Good—well suited, with minor technology-specific challenges. Conditional—the condition is met only where the technology is deployed in a particular manner. No—fundamental misalignment; the indicator cannot be met under any deployment scenario.

5. The repower hierarchy

Recording only projects that meet the definition would give an incomplete picture of transition activity across the coal fleet. Projects are therefore placed on a graded hierarchy showing how far each has progressed and what remains to be done. Band A meets the definition; band B does not, but records where the gap lies. Counts refer to this edition.

Table A4: The repower hierarchy

Band	Classification	Conditions met and remaining gap	Projects	Meets definition
A	Repowering	All three conditions met, so no gap to the definition. Asset owners can still go further, for example by adding thermal energy storage for flexibility and balancing.	5	Yes
B	Partial substitution	Infrastructure reuse and site continuity met. Heat source substitution is under way but below the 90% threshold, or not shown to meet it; a change in blend ratio or fuel pathway could close the gap.	10	No
B	Repower ready	Infrastructure reuse and site continuity met. The furnace is partially decoupled from the steam cycle, usually by inserted thermal storage, but heat source substitution has not begun.	8	No
B	Co-location	Site continuity met only. A new asset shares the site without breaking the link between heat generation and the steam cycle. Furthest from qualifying.	4	No

The dataset applies one further working category, "repowering (subject to data verification)", to one project that appears to satisfy the definition but for which published evidence is incomplete: Angamos, where no lifecycle emissions data yet exists. This is held separately from band A, pending verification. The five band A entries cover four projects, since Bełchatów and Konin are alternative sites for one plant; only Bull Run is classified as in development, with the remainder still in the concept stage.

6. Classification process

Identification and classification follow a stage-gate process, with the stages taken in sequence rather than simultaneously. Stage 4 keeps the register current as projects progress and as the definition evolves.

Table A5: Stage-gate process

Stage	Gate	Activity
1	Repowering identification	Candidate projects are sourced through partner interviews and desk-based research, and each coal unit is matched to a Global Coal Plant Tracker unit identifier for consistency.
2	Repowering classification	Projects are tested against the three conditions. Those falling short are assigned a position on the hierarchy, indicating what remains to be done to meet the definition.
3	Source material evaluation	Source material is assessed to assign a confirmation tier reflecting the likelihood that the project will be delivered as described.
4	Retrospective project review	Projects already on the project status tool of RepowerScore.org are extracted and reassessed against the definition, then reclassified, re-tiered, or omitted where they no longer align.

Table A6: Confirmation tiers

Tier	Evidence base	Treatment
Tier 1—confirmed	Firm commitments in primary sources directly linked to the organisations responsible for delivery: company announcements, government statements, transmission system operator, or utility disclosures.	Highest confidence. Held in the active register.
Tier 2—credible	Evidence of intent without firm commitment to proceed: feasibility studies, corporate roadmaps, strategic planning documents, credible media reporting.	Held in the active register, subject to continued inspection.
Tier 3—excluded	Secondary sources alone, with no corroboration from organisations directly associated with the project.	Documented in the review but excluded from the active register.

Each condition is separately recorded as met, not met, or uncertain. "Uncertain" indicates an evidence gap rather than a negative finding, and arises in two recurring situations: where a plant has substituted its heat source but publishes no lifecycle emissions figures against which the threshold can be tested; and where a project is at an early stage and the scope of demolition and retained equipment has not been disclosed. Where the owner or developer states that the generating plant has been demolished, infrastructure reuse is recorded as not met.

7. Scope of the 2026 scan

The scan assessed every candidate identified through partner interviews and desk research, together with a retrospective reassessment of all 29 projects held in Repower's previous project status tool. Records that did not qualify are retained rather than discarded, so the basis for each exclusion is auditable.

Table A7: Records assessed in this edition

Outcome	Records	Basis
Classified on the hierarchy	28	Twenty-four entries in the priority register—repowering, repowering subject to data verification, partial substitution, and repower ready—plus four co-location projects recorded separately.
Assessed and excluded	24	Technology out of scope (13), site repurpose (3), plant since retired (3), no development plans (2), project frozen (1), scale too small to assess (1).
Identification errors	3	Entries carried in the previous project status tool found not to correspond to a coal power plant.
Total records	55	All are published at RepowerScore.org with their condition-level assessments and sources.

8. Further work and limitations

This framework establishes whether an intervention is a repowering event and how strong the evidence for it is. It does not yet rank how good an example it is: that would require project-level evidence on system value, cost against a greenfield equivalent, and workforce outcomes, which are not consistently available for the projects identified to date. The criteria below indicate the direction of that work, with provisional units.

Those criteria would cover the emissions reduction achieved above the 90% minimum; how far reuse goes beyond the single qualifying asset; the levelised cost against a greenfield equivalent; the years between coal retirement and repowered operation, where a gap of 15 years or more indicates a new project rather than a continuation; the ancillary services the new capacity provides; and the retention and reskilling of the workforce.

Some material objections to particular pathways fall outside the three conditions and would be captured by criteria of this kind rather than by the definition. Ammonia co-firing is the clearest case: the cost of producing and combusting ammonia for power, the opportunity cost of diverting scarce green ammonia from hard-to-abate uses such as fertiliser and plastics feedstock, and the local air quality consequences of combustion are all material to whether a project should proceed. None is an emissions, infrastructure-reuse, or site-continuity question, so none affects the classification.

A further limitation applies to the heat source substitution indicator. The emissions intensities that determine whether a pathway meets the threshold come from published lifecycle assessments, and the field has not converged on a single method for calculating them. Studies differ in where the system boundary is drawn, whether emissions are reported per unit of fuel energy or of electricity, what plant efficiency is assumed, and whether upstream transport and non-CO_2 combustion emissions are counted, so results for the same fuel can differ materially between sources.

Finally, the framework tests whether a project is a repowering event. It does not assess whether repowering is the best use of a site, nor whether the chosen technology suits that grid. The scan draws on English- and Chinese-language sources. Matching to Global Coal Plant Tracker unit identifiers is not always exact where a repowering affects some but not all units at a site. Classifications describe a point in time; the register at RepowerScore.org is the current version.

9. Sources (see the full methodology at RepowerScore.org for complete endnotes)

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