



Raising Policy Ambitions to Reduce Coal- and Gas-Fired Power Generation

The transition away from fossil fuels is significant in the global effort to reach the climate targets set by the Paris Agreement

The ambition for the transition away from fossil fuels was confirmed in the First Global Stocktake decisions at COP28 in Dubai. While there is a scientific case and historical evidence for phasing out fossil fuel power plants, especially unabated coal power plants, the future of natural gas power generation is more uncertain. New research investigates the social, political, and institutional factors to identify the drivers for existing coal and gas phase-out, which can potentially inspire future policy designs.

Early results show that:

- **Current progress and policy ambitions are not on track** for reaching 1.5°C without overshoot, according to IPCC analyses.
- Earlier examples of coal phase-out were accomplished through fuel switching to natural gas, but there is evidence that **switching directly to renewable energy is also feasible.**
- More credible and fair **phase-out pathways in developing countries will require more ambitious actions** in developed countries, especially by reducing gas-powered electricity generation.
- **Economic policies, regulatory policies, and power market reform could enable faster phase-out.**

Expanding current scenarios

Although the scientific community is generally in consensus on the importance of reducing the use of fossil fuels, the specific path to get there depends on the scenario type. Different Integrated Assessment Models (IAMs) are used to understand these potential futures through modelling the interactions of climate, energy, and economies. IPCC Assessment Reports compare and summarise the scenarios generated by these models to assess policy insights.

IAMs present the best available science, but no model can fully represent the real world. Currently, they mostly focus on techno-economic considerations and have limited representation of social and political opportunities or roadblocks. There are, however, efforts to incorporate more realistic assumptions for more feasible outcomes.

There is an ongoing debate about a coal phase-out, which brings with it immense implications on a justice level. Current coal phase-out IAM pathways to reach Paris Agreement targets, moreover, have raised concerns, especially in the context of China and India. To consider a more feasible coal phase-out in developing countries, much more ambitious and significant decline in natural gas and oil would be required in developed countries to compensate.¹

As such, many lessons are still to be learned from historical coal phase-out. This report conducts empirical analysis on the factors linked to coal and gas power plant phase-out in the past, which could inspire more ambitious actions for the future.

Technology substitution

To phase-out higher-polluting coal while still utilising existing infrastructure, some coal power plants have been switched to operate with natural gas. This strategy is commonly adopted in the eastern United States, Europe, and eastern China (Figure 1).

Given the need to also reduce natural gas

power generation, such substitution strategies may result in stranded assets. Moreover, the underestimated climate impacts and geopolitical fuel trade uncertainties can lead to future challenges around natural gas.²

Empirical analysis shows that expanding renewable energy technologies such as solar and wind, coincides with historical coal and gas declines. For example, the rapid cost reduction of renewable energy has led to natural gas power plant shutdowns in the United States. Indeed, localised policy efforts to reach one of the targets agreed on by the First Global Stocktake – to triple the world’s renewable capacity by 2030 could provide additional incentives for a transition away from fossil fuels.

Societal considerations

The transition away from coal and gas is especially difficult for people and communities reliant on these resources for employment and economic growth.

Our empirical analysis shows that countries with a larger percentage of workforce employed in mining are less likely to phase out coal-fired power generation. Countries with natural gas production contributing to a larger portion of Gross Domestic Product (GDP) are less likely to reduce natural gas-fired power generation.

Policies aimed at more ambitious fossil fuel phase-out should incorporate compensatory packages for affected communities. Engaging with local stakeholders in this transition can also improve the political buy-in and justice implications.³

International cooperation and support are especially crucial for countries reliant on fossil fuel resources and lacking economic capacities.

Market reform

The difficulty in transitioning away from fossil fuels is closely intertwined with power market structure and design. Market reform across various mechanisms was found to be connected

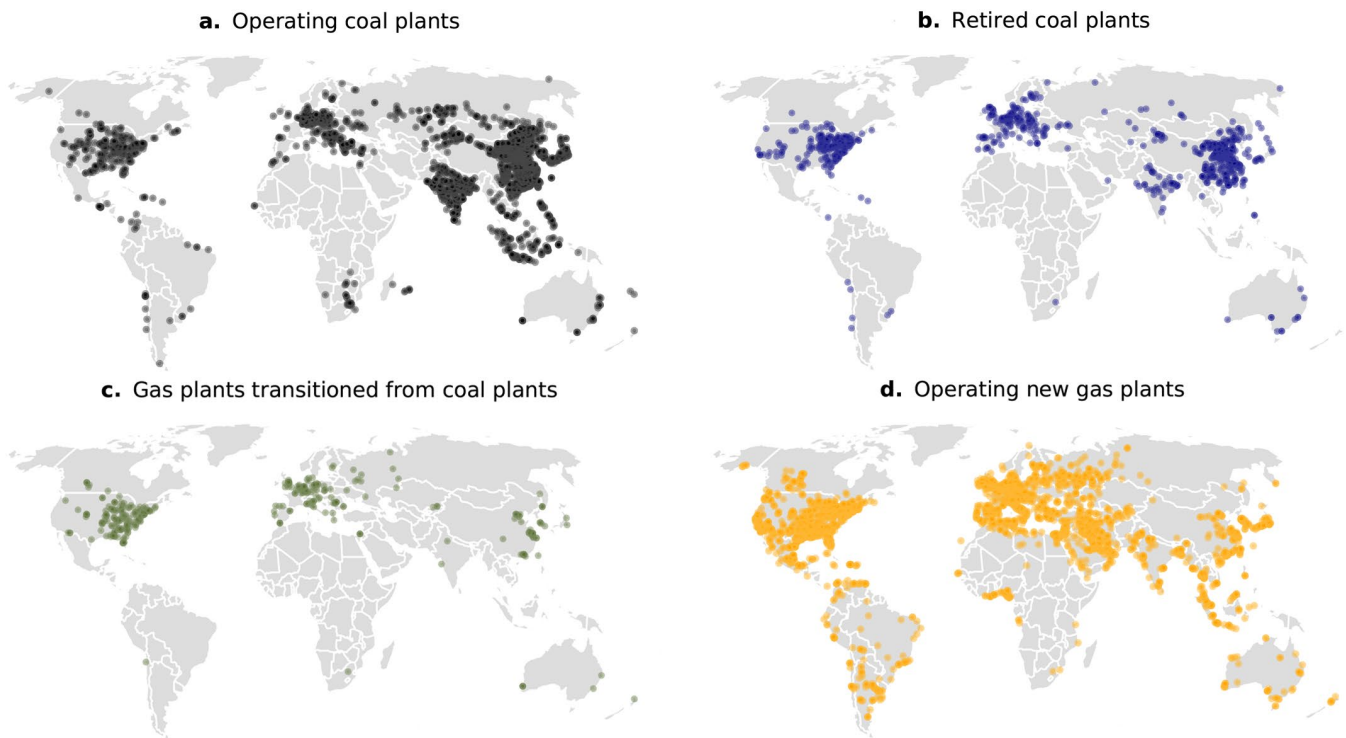


Figure 1: Operating, retired and transitioned coal power plants and operating natural gas power plants in 2022. Data source: Global Energy Monitor coal and natural gas plant data.

with a more ambitious coal and gas phase-out. Notable mechanisms include the choice of electricity supplier, privatisation, and the availability of wholesale markets.

Countries that currently have reformed power markets are also those with higher GDP, where a larger portion of the population that believe human activities are the main contributor for climate change. These countries are also more likely to enact climate policies in the energy supply sectors to address economic or regulatory barriers of fossil fuel phase-out. The combined effects of economic capacity, consumer willingness, and a liberalised market could facilitate and stimulate more ambitious actions.

Overcoming lock-in

Most countries with climate progress have experienced periods of fossil fuel reliance. For those only starting the transition now, there are many policy opportunities to overcome lock-in. Special attention should be paid to natural gas-reliant countries which appeared to be more stagnant in the transition.

IAM modellers are working towards incorporating such social, political, and institutional factors to develop more politically relevant scenarios. Policymakers can utilise existing evidence to enable the transition away from fossil fuel with more ambitious domestic policies and more equitable international cooperations.

References

1. Muttitt, G., Price, J., Pye, S. & Welsby, D. Socio-political feasibility of coal power phase-out and its role in mitigation pathways. *Nat. Clim. Chang.* 13, 140–147 (2023).
2. Kemfert, C., Präger, F., Braunger, I., Hoffart, F. M. & Brauers, H. The expansion of natural gas infrastructure puts energy transitions at risk. *Nat. Energy* 7, 582–587 (2022).
3. Bolet, D., Green, F. & González-Eguino, M. How to Get Coal Country to Vote for Climate Policy: The Effect of a Just Transition Agreement on Spanish Election Results. *Am. Polit. Sci. Rev.* 1–16 (2023) doi:10.1017/S0003055423001235.

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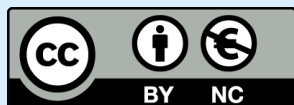
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More information about the ELEVATE project: www.elevate-climate.org

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**PBL Netherlands Environmental
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