Briefing

Highest possible ambition: science-aligned fossil fuel phase-out pathways

Neil Grant, Olivia Waterton, Dimitris Tsekeris, Claudio Forner

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Introduction

In the first global stock take of the Paris Agreement (GST-1) the world agreed to "transition away from fossil fuels in a just, orderly and equitable manner" (UNFCCC 2023). Achieving consensus on what transitioning away from fossil fuels (TAFF) means has been difficult. However, diplomatic and political momentum around TAFF has been growing, including via the Brazilian COP30 Presidency's global roadmap initiative (UNFCCC 2025) and the International Conference on Transitioning away from Fossil Fuels held at Santa Marta in April 2026 (Climate Analytics 2026c). Meanwhile, the US-Israel war on Iran and the ensuing energy crisis has only underlined the fundamental vulnerabilities of a global economy addicted to fossil fuels and emphasised the economic and security benefits of transitioning away from the fossil economy.

Central to any TAFF is a roadmap that sets out the course of action. While agreement is growing around the need to transition away, questions remain on how fast and how deep any transition should be at the global/national/sectoral level. The Santa Marta conference concluded with a commitment to collaborate on building national and regional TAFF roadmaps, which is a critical and welcome step.

National roadmaps should be anchored in clear principles to ensure credibility and effectiveness, including common but differentiated responsibilities and respective capabilities (CBDR-RC). They should go beyond merely setting out phase-out timelines and targets but also address the myriad non-technical factors that often inform and constrain ambition and cover a comprehensive set of planning elements including just transition frameworks, fossil fuel subsidy reform, economic diversification, participatory governance and more.

They also need to align with the latest science – which shows that while we are entering an era of overshooting the 1.5°C goal, pursuing highest possible mitigation ambition from now can still minimise the duration and magnitude of overshoot and get temperatures back significantly below 1.5°C before 2100. To do this, reaching net zero CO_2 by or before mid-century and reaching net zero GHG emissions soon after is critical.

In this brief, we present some timelines on what TAFF could look like at both the global and national level, building on the Highest Possible Ambition (HPA) scenario released last year by Climate Analytics and PIK (Climate Analytics and PIK 2025). Focusing on fossil fuel demand, we provide data on the fossil fuel transition for a selected set of 15 countries.

This information is not meant to replace the detailed country-driven process of developing TAFF roadmaps. It also only covers fossil fuel demand, with more data on fossil fuel production pathways planned for release in autumn 2026 by Climate Analytics. However, it provides one key line of evidence – what a transition aligned with highest possible ambition that minimises overshoot would look like. This can help inform and shape discussions around TAFF at the national level. Climate Analytics stands ready to support countries and organisations exploring what ambitious TAFF roadmaps look like as we move forwards from Santa Marta towards COP31 in Antalya and beyond.

The global fossil phaseout

The headline numbers

The climate crisis is a global issue – and we need global action to address it. This means that all countries need to transition away from fossil fuels.

Climate science is clear that to stop global warming we need to reach net zero CO_2 emissions at the global level, and to reverse warming back below 1.5°C we need to achieve and sustain global net-negative CO_2 emissions. With fossil fuel production and use responsible for 70% of global emissions in 2023 (Schumer *et al* 2025), TAFF is the most impactful lever at our disposal for reducing emissions at pace and scale.

Reaching global net zero or net-negative CO_2 emissions will require very deep reductions in fossil fuels. This is because any remaining fossil fuel consumption will have to have its emissions captured and stored with carbon capture and storage (CCS) or compensated for by carbon dioxide removal (CDR). However, the feasible potential for CCS/CDR deployment is severely limited by a wide range of geological, technological and institutional barriers (Deprez *et al* 2024, Grant *et al* 2022, Lane *et al* 2021, Zhang *et al* 2024, Gidden *et al* 2025). And in a world overshooting 1.5°C, much of the limited CO_2 storage potential will need to be prioritised for CDR to reduce temperatures back below 1.5°C and hedge against climate uncertainties (Grant *et al* 2021, 2022, Schleussner *et al* 2024). This leaves very little, if any room, for continued fossil fuel consumption compensated for by CCS/CDR.

In recent research, Climate Analytics, in collaboration with the Potsdam Institute for Climate Impact Research (PIK), released a new global scenario which explores how to minimise overshoot above 1.5°C, the Highest Possible Ambition scenario (HPA) (Climate Analytics and PIK 2025).

In this scenario:

- Fossil fuel production and use halves by 2035 and is phased out globally by 2070
- Global CO_2 emissions reach net zero around 2045, and global GHG emissions reach net zero around 2060
- Temperatures peak at 1.7°C and then fall to significantly below 1.5°C before 2100

Figure 1 shows the global transition away from fossil fuels in the HPA scenario. It also highlights the point at which each fossil fuel is effectively phased out.[1] In the HPA scenario, global fossil fuel production and use peaks in 2025, is reduced substantially by 2030, and falls to zero by 2070. Coal, gas and oil are effectively phased out by 2050, 2060 and 2070 respectively.

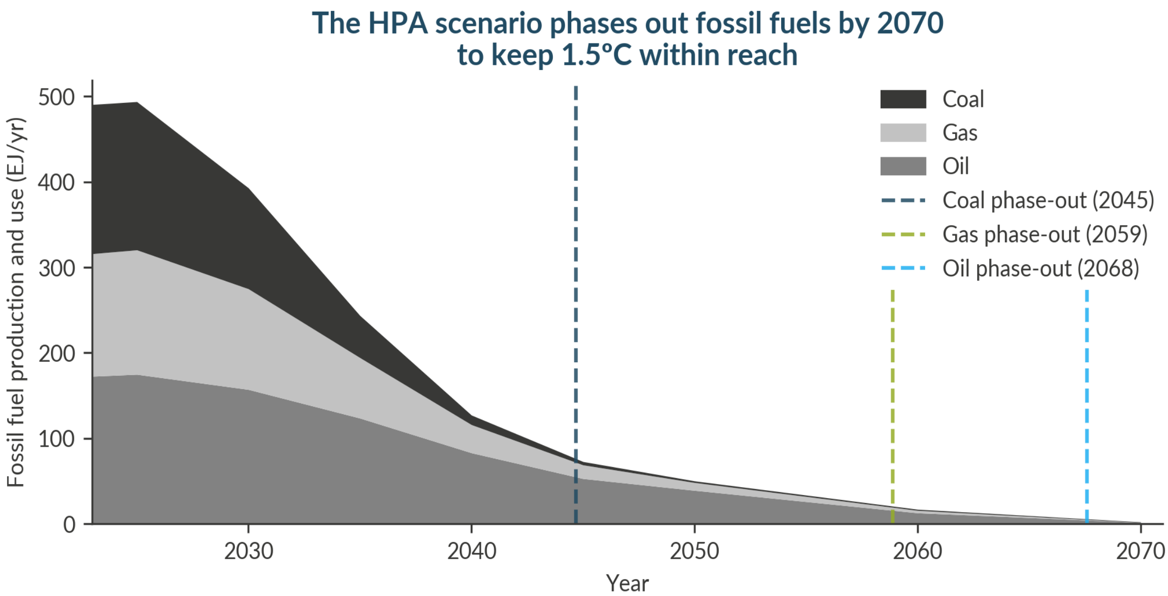

Figure 1: The global transition away from fossil fuels in the HPA

Table 1 shows the reductions per fuel relative to 2023 in the HPA scenario. All fossil fuels need to be rapidly reduced, not just coal. As fossil fuel production and use has continued to rise over the past years, these cuts will need to be even greater now and are concentrated in a shorter period of time. Cutting fossil fuels by 20% over 2026–2030 would require annual reductions from now of 4–5% per year in fossil fuel production and use.

Table 1: Global reductions in fossil fuel production and use in the HPA scenario, relative to 2023

	2030	2035	2050	2070
Coal	-32%	-72%	-99%	-100%
Gas	-18%	-51%	-94%	-100%
Oil	-9%	-28%	-77%	-99%
Total	-20%	-50%	-90%	-100%

[1]Many modelled energy transitions do not reach exactly zero fossil fuel demand due to structural factors in the modelling. As such, there are different approaches to defining a phaseout. Here we define an effective phaseout as when:

a) Fossil fuel demand has fallen at least 97.5% from baseline (2023) levels *or*
b) Fossil fuel demand is under 0.5 EJ / yr at the global level

CDR approaches are scaled up significantly in the HPA but remain broadly within literature-defined sustainability bounds. Engineered removals grow to reach over 5 $GtCO_2$/y by 2050, and cumulative removals from CDR exceed 500 $GtCO_2$ over the century, from a combination of BECCS, DACCS and afforestation/reforestation. There is also minimal deployment of CCS, as a limited geological CO_2 storage potential is prioritised for removals.

These dimensions are inextricably related. If the global TAFF is slower than modelled in the HPA scenario, then either CDR and CCS deployment needs to be scaled up much faster than envisaged, or global CO_2 emissions will be higher. This would mean that global temperatures peak even higher than 1.7°C and potentially do not fall back below 1.5°C by 2100. You cannot argue for a slower fossil phaseout than shown in the HPA without implicitly either relying more heavily on CCS/CDR or escalating the extent of global temperature overshoot – or both.

There is no need for new oil or gas fields

Previous analysis has found before that there is no need to open any new oil and gas fields, if fossil fuel demand falls in line with climate goals (Green *et al* 2024, IEA 2025a). The HPA scenario reiterates this message. Figure 2 compares future oil/gas demand to the production that is feasible from existing and already approved fields. For both oil and gas, existing capacity is more than sufficient to meet fossil fuel demand during a global TAFF.[2] This should be a starting point for any discussion on the dimensions of a TAFF in fossil fuel production – with more detail on this planned for release in autumn 2026 by Climate Analytics. In contrast to this, in the first four months of 2026, new oil and gas exploration licenses were provided to a cumulative production of 273 million barrels of oil and 2710 bcf of gas production, with almost 8 billion USD invested in exploration (Bois von Kursk and Posada 2026).

[2] This analysis does not account for the disruption in supply created by the US-Israel war on Iran. If this leads to long-term reductions in supply from the Middle East, there could be a need for some very short-term and limited expansions in oil and gas supply elsewhere to meet the shortfall. However, as demand for oil and gas fall rapidly in HPA, this would likely eliminate the need for any major new oil and gas developments elsewhere.

There is no need for new fossil fuel projects in the HPA scenario

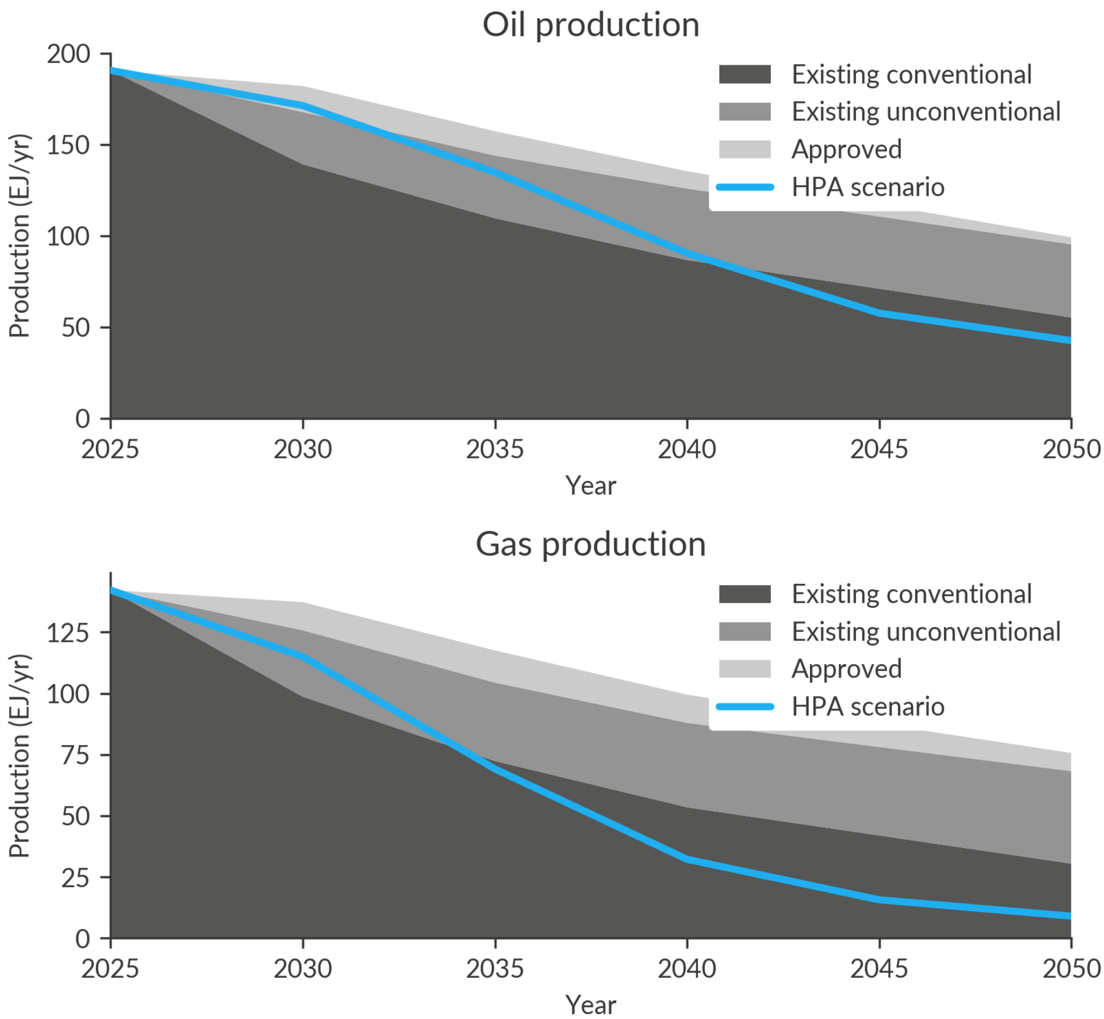

Figure 2: Future oil and gas demand in the HPA scenario, compared to production from existing and already approved oil and gas fields. Future production data is taken from (IEA 2025a), with HPA data harmonised to align with IEA production data in 2025.

Electrification delivers a fossil-free future

Not all fossil fuels exit the energy system at the same rate, and not all sectors decarbonise at the same rate. This is due to differences in the scale and availability of zero-carbon alternatives across different sectors. Figure 3 shows the global TAFF broken down by sector between the four main areas of fossil fuel consumption – buildings, transport, industry and power.

The power sector is the fastest area of transition in the HPA scenario. Oil is phased out in the 2030s, coal in the 2040s and gas by mid-century. The result is a clean power sector by 2050, with very significant reductions even by the 2030s. Rapid power sector decarbonisation is driven by a transition to wind, solar and batteries as the workhorse of the energy transition. The transition to clean electricity then unlocks the maximum emissions benefits of electrification of the end-use sectors, which proceeds in parallel in the HPA scenario.

Meanwhile the buildings and transport sector both reach real zero by 2060, and industry reaches real zero by 2070, but with substantial reductions even by the 2030s. In the case of transport and industry, this is driven by the need to scale zero-carbon alternatives in sectors such as aviation, shipping and chemicals (including feedstocks) where current fossil-free options are still nascent and often in demonstration phases. However, these sectors represent only around 15% of global fossil fuel demand currently (IEA 2025b) – for much of the remainder, solutions already exist at scale and are ready to be deployed now.

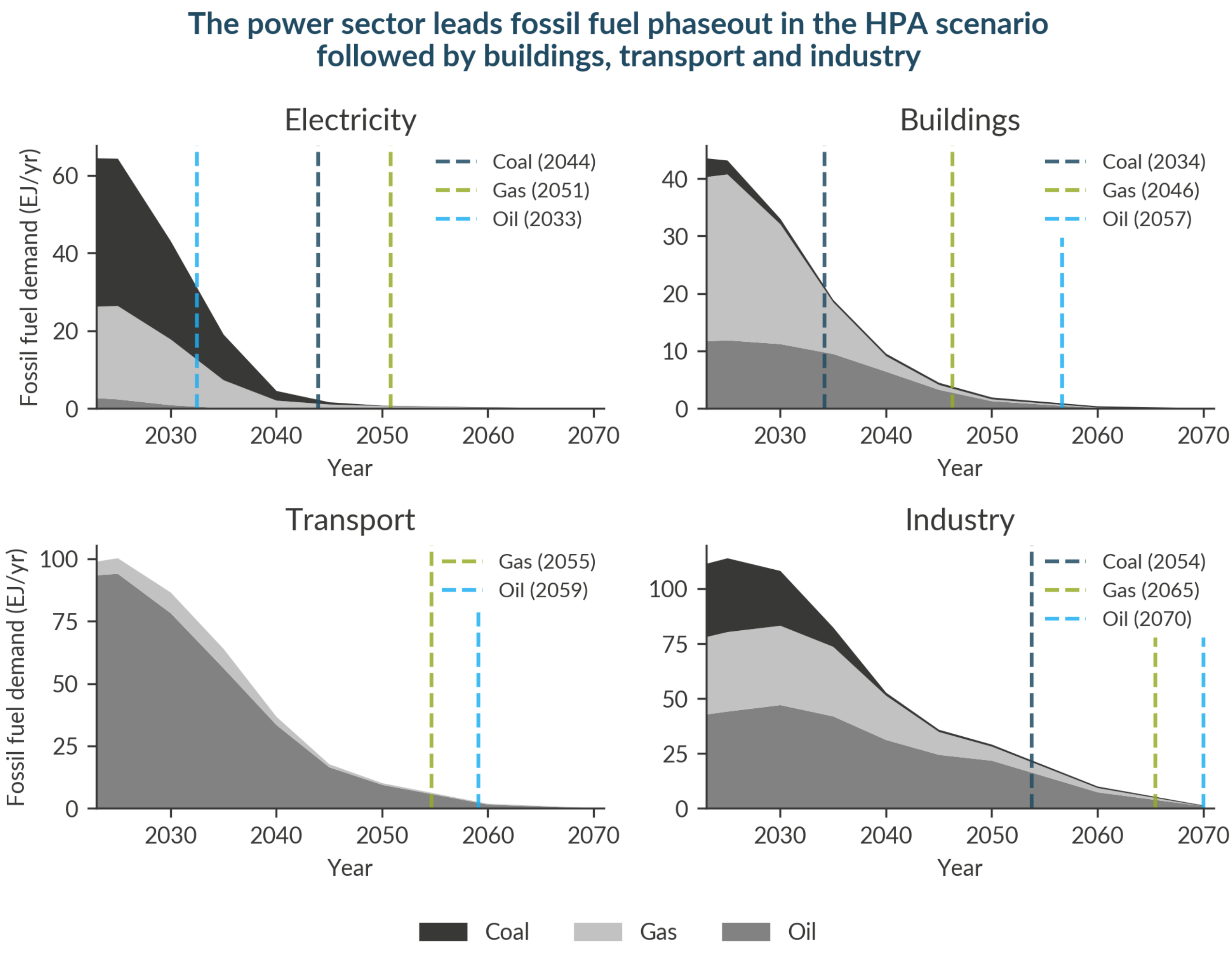

Figure 3: The sectoral transition away from fossil fuels in the HPA

Any transition away from fossil fuels is also a transition towards clean energy, which outcompetes and displaces fossil fuels in the energy mix, supported by ambitious climate policy. Renewable electricity emerges as the new cornerstone of the global energy system. Table 2 shows the electrification rates per sector in the HPA scenario.

Table 2: Global electrification rates in the HPA

	2023	2030	2035	2050	2070
Buildings	36%	44%	57%	83%	90%
Transport (including aviation and shipping)	2%	9%	22%	74%	82%
Industry	22%	28%	37%	50%	50%
Industry (excl. feedstocks)	25%	32%	42%	57%	58%
Total	21%	28%	39%	65%	70%

In the HPA scenario, global electrification reaches 70% by 2070, driving fossil fuels out of the system. The remaining energy demand is being provided by a mix of district heating in buildings, sustainable biomass use (distributed across all sectors), synthetic fuels (largely concentrated in aviation/shipping), and direct use of hydrogen (particularly in industry). Electrification rates are even higher in buildings/transport, and somewhat lower in industry, where the hydrogen and sustainable biomass play significant roles as well as synthetic feedstocks to displace fossil feedstock demand. These numbers should not be taken as an ambition ceiling on electrification – particularly in the case of industry where other modelling demonstrates the feasibility of achieving even deeper levels of electrification (Etter-Wenzel and Rosenow 2026). Pushing the electrification ceiling further can help reduce demand for biomass, hydrogen and synthetic fuels, all of which face significant challenges in scaling sustainably. This should be a key focus for future research on fossil-free energy systems.

National fossil fuel transitions

The global transition away from fossil fuels is driven by the need to reach net zero and then net-negative CO_2 emissions, combined with the limited availability of CDR.

However, translating any global transition down to the national level is a more complex process. This requires considering a broad range of principles, including equity, common but differentiated responsibilities and respective capacities (CBDR-RC), the requirement for the highest possible ambition entailed in the Paris Agreement, the differential technical potentials for renewables rollout across countries, and the socio-political and economic issues that can hamper a transition away from fossil fuels even when this is a cost-effective strategy.

We have downscaled the HPA scenario to the country level using a new downscaling algorithm (Sferra *et al* 2026).[3] This data is a snapshot of much broader data, covering all sectors and exploring fossil phaseout, clean electrification scale-up and whole-economy emissions pathways. It is accessible at the National Pathway Explorer (Climate Analytics 2026a).

The HPA scenario accounts for the different circumstances of individual countries and regions by applying differentiated carbon prices across regions, which converge to a global average in 2070. This ensures that advanced economies take the lead in the transition away from fossil fuels, as is justified by both a wide range of equity principles and their greater institutional and fiscal capacity to support a rapid transition. However, all regions need to accelerate a transition away from fossil fuels, driven by the very limited carbon budget allowable, even within a world that is temporarily overshooting 1.5°C. It is also important to highlight that this scenario was not explicitly designed to align with a given equity perspective, and international cooperation and support remain critical to achieving the transitions presented below.

Figure 4 presents the results for a series of 15 countries, using a similar definition of 'phaseout' as the global level.[4] Three broad categories of countries can be identified in Figure 4, in which the transition away from fossil fuels takes different shapes. However, in all cases, fossil fuels are phased out by 2070 at the latest, in line with the global transition.

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[3] This converts the scenario data, which is provided at the level of major "macro-regions" (e.g. Latin America), down to the country level. For more details, see Sferra *et al* 2026.
[4] At the national level, the use of an absolute threshold is harder, as each country has its own scale of primary energy supply. Therefore a fossil phaseout is defined as when:

a) Fossil fuel demand has fallen at least 97.5% from baseline (2023) levels *or*
b) Fossil fuels provide under 1% of primary energy supply

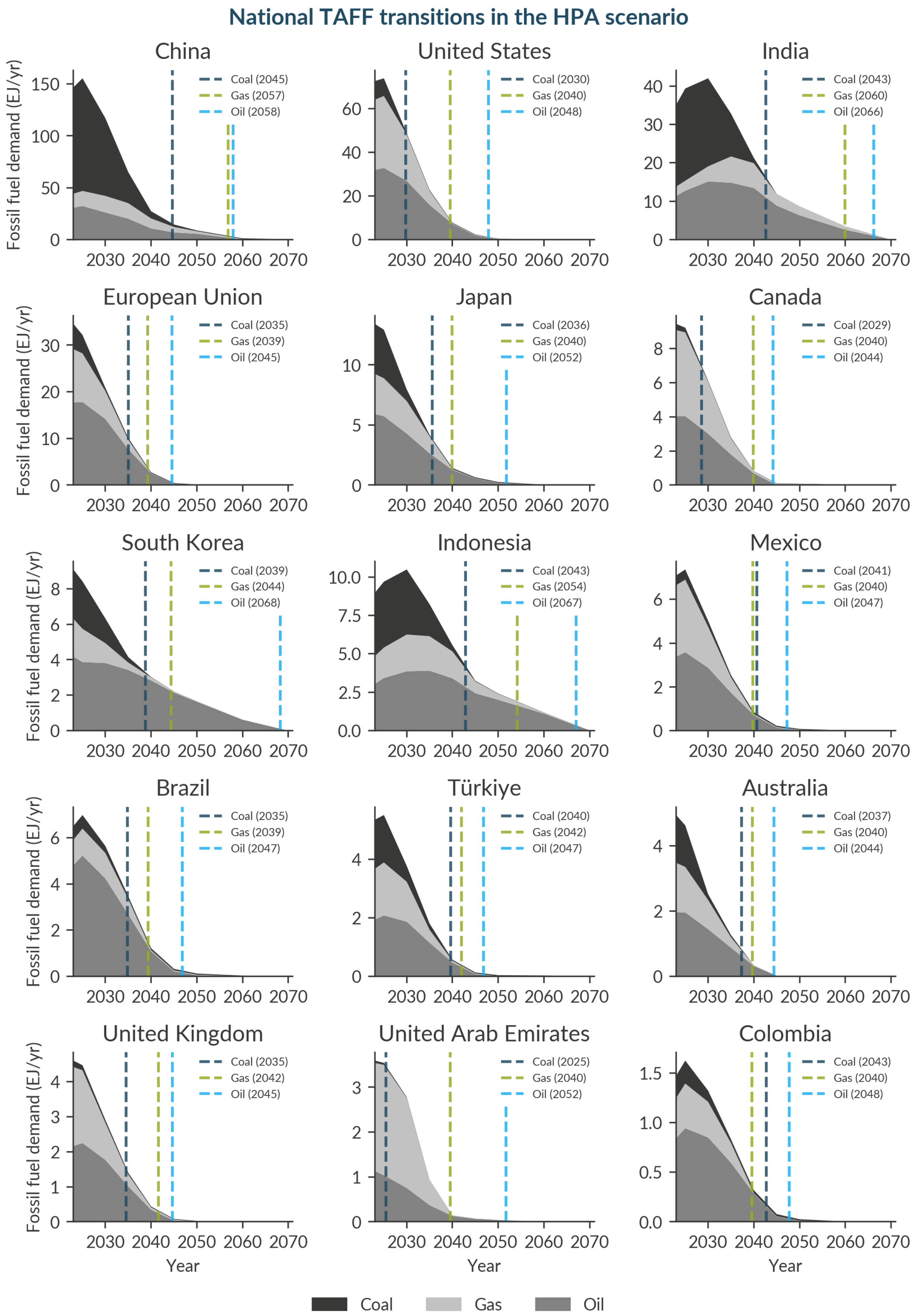

Figure 4: Country-level fossil fuel transitions in the HPA

Advanced economies, including the USA, EU27, Canada, Japan, Australia and the UK, lead the global transition aligned with the highest possible ambition and must make deep reductions in fossil fuel use immediately, cutting fossil fuel demand by 30–40% by 2030. This requires annual reductions of around 7–10% starting today. These countries also achieve a total fossil phaseout by 2050. Advanced economies can be the incubators of a real zero future where fossil fuel use is eliminated.

There is then a set of broadly upper middle-income countries including China, Brazil, Mexico, Türkiye and Colombia. In these countries fossil fuel consumption has begun to plateau in recent years, with China's consumption potentially peaking in 2024. These countries now move into a phase of clear and decisive decline in fossil fuel demand but see slower reductions in fossil fuel demand by 2030 than advanced economies. Fossil demand falls around 10–30%, requiring annual reductions of around 2-7% between now and 2030. By 2050, many middle-income countries have effectively phased out fossil fuels or will do so in the next few years.

Finally, there is a set of countries in which fossil fuel demand has been growing strongly in recent years, which here are represented by India and Indonesia. While the road to TAFF in these countries is still gathering momentum in the short term, the long-term outcome remains clear. In line with the global transition in the HPA, all fossil fuels must be phased out by 2070. In the near-term, fossil fuel demand continues to grow slightly as economic and population growth pushes energy demand up in sectors that are harder to quickly decarbonise, particularly transport and industry. This leads to some continued growth in oil and gas demand in India and Indonesia.

At the same time, the foundations for the energy transition are being laid – strong energy demand growth is being met primarily by clean electricity which meets 52/83% of energy demand growth between 2023-2030 in India/Indonesia. EV sales grow rapidly and as EV sales transform the overall vehicle stock, oil demand in transport peaks in 2030 in both countries. Meanwhile demand for gas is largely concentrated in industrial development, and as clean electrification gathers pace here, gas demand peaks in 2030 in Indonesia and 2035 in India.

These broad groupings help identify a possible way forwards for the TAFF in which advanced economies take the lead, followed by middle-income and lower-income countries, but in which fossil fuel demand peaks rapidly and declines to zero by 2070 in all countries. There are also specific variations between individual countries (for example, in the HPA scenario there is a slower phaseout of oil in Korea than in other advanced economies). More in-depth analysis per country will be provided on the National Pathway Explorer as profiles are released.

Table 3 shows the reductions in total fossil fuel demand across these countries in the downscaled HPA scenario. All data supporting this report is made freely accessible on Zenodo (Climate Analytics 2026b). As highlighted before, these should not be seen as TAFF roadmaps on their own. Rather, they should be seen as one critical line of evidence that can feed into any roadmap developed at the country level. This should be complemented by national-level modelling and scenario analysis, as well as policy, societal and economic assessments and action to translate TAFF into a clear roadmap and set of actions for that country. CA stands ready to work with countries who are interested in developing TAFF roadmaps and provide further evidence on what a transition aligned with highest possible ambition could entail.

Table 3: Country-level transitions away from fossil fuels in the HPA

		Change in fossil fuel demand relative to 2023			
	Fossil fuel demand in 2023 (EJ)	2030	2035	2050	2070
China	146.7	-20%	-56%	-94%	-100%
United States	72.6	-33%	-69%	-100%	-100%
India	35.1	+20%	-7%	-75%	-100%
EU27	34.6	-40%	-71%	-100%	-100%
Japan	13.4	-41%	-69%	-98%	-100%
Canada	9.4	-35%	-70%	-99%	-100%
South Korea	9.1	-30%	-54%	-82%	-100%
Indonesia	9.0	+17%	-8%	-73%	-100%
Mexico	7.0	-29%	-64%	-99%	-100%
Brazil	6.5	-13%	-47%	-98%	-100%
Türkiye	5.3	-29%	-66%	-99%	-100%
Australia	5.0	-49%	-74%	-100%	-100%
United Kingdom	4.6	-37%	-70%	-99%	-100%
UAE	3.6	-23%	-74%	-99%	-100%
Colombia	1.5	-10%	-44%	-98%	-100%

Actions needed by countries on the road to a fossil-free future

A roadmap helps set direction but is useless if you don't then take to the road. The aim of any roadmap should be to accelerate action and implementation, as well as setting a clear and ambitious direction.

As countries develop roadmaps as part of Santa Marta's three thematic workstreams on TAFF, they can also take action to address some of the key enablers and barriers of the transition. This can help ensure that these roadmaps catalyse implementation, rather than serving as a new talking shop for climate action.

This should include addressing some of the largest barriers to TAFF, including investor-state dispute settlement arrangements, misinformation and undue lobbying, limited access to low-cost transition finance, and the severe fiscal dependency on fossil fuel production in certain countries, which is often exacerbated by debt distress.

Key enablers of the transition would also include fossil-fuel subsidy reform, with direct subsidies for fossil fuel production and use still at around one trillion USD in 2024 (IISD and OECD 2026), introducing severe market distortions that hamper the clean energy transition. Developing and implementing just transition measures for affected workers and communities is also key, as is expanding cooperation across borders on TAFF. Here Santa Marta's third workstream on producer-consumer dialogue, which seeks to reshape trade systems and build alignment across groups, is of particular interest. Whether this results in new buyers' clubs, or bilateral partnerships across importers and exporters with specific energy transition objectives, or other forms of cooperation remains to be seen – but further collaboration to provide a measure of security and clarity in a fossil economy that has been shown to be structurally volatile is of significant value.

By taking these actions, as well as setting the direction of travel, countries can provide roadmaps that drive both ambition and implementation on the transition away from fossil fuels. These roadmaps can then be integrated into the next round of NDCs and LTSs, so that the TAFF process supports implementation of the Paris Agreement and the Global Stocktake, rather than distract from it.

Conclusions

This briefing provides an overview of what a transition away from fossil fuels in line with the highest possible ambition could entail. At the global level, coal, gas and oil need to exit the energy system by 2050, 2060 and 2070 respectively. There also need to be rapid reductions in the near–term: global fossil fuel demand falls 20% over 2023–2030 in the HPA scenario, requiring annual reductions of 4–5% per year. The global TAFF needs to begin immediately.

As the US-Israel war on Iran has highlighted, fossil fuels drive economic chaos as well as climate chaos. The fossil economy relies on an increasingly fragile global supply chain. Critical physical chokepoints like the Strait of Hormuz and the Suez Canal are highly vulnerable to conflict and natural disasters. Globalised fossil fuel markets then transmit price shocks across borders, and energy crises quickly turn into inflation, economic downturn, and food security crises, impacting the most vulnerable people and countries' budgets most severely. A transition away from fossil fuels is essential not only for the climate, but for secure and resilient economies, particular for the quarter of the global population who live in countries spending over 5% of their GDP on fossil fuel imports every year (Ember 2025).

Achieving a transition away from fossil fuels at the national level requires addressing multiple challenges. Thirty percent of the world's population live in countries highly dependent on fossil fuel exports for fiscal revenue and economic activity (Peszko *et al* 2020). Fiscal dependencies must be overcome to ensure that no country is left behind in the transition to a fossil-free energy system. Socio-political, institutional, infrastructural and economic challenges to the phaseout of fossil fuels need to be overcome.

This analysis is not meant to replace a more detailed, country-driven process of developing and implementing TAFF roadmaps – but is meant to support by providing one key line of evidence that can be considered during this process. All data is made freely available online, and more detail can be found on the National Pathway Explorer for selected countries (Climate Analytics 2026a).

However, despite the challenges, the prize is clear. The fossil economy is inefficient, fragile and continues to pour fuel on the fire of the climate crisis, pushing temperatures upwards and leading to an ever-escalating cascade of impacts and risks. Clean energy offers an alternative path – of efficient, secure and climate-compatible development and energy. As momentum builds around TAFF, turning words into action can help unlock these benefits and usher in a better world.

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