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Santa Marta Action Repertoire (SMART)

Additional information on the 12 Action Insights

Further details and background information from the Santa Marta Academic Dialogue to the First International Conference on Transitioning Away from Fossil Fuels, Santa Marta, Colombia

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About this document

This volume compiles the working documents of the twelve Action Insight groups of the Santa Marta Academic Dialogue. They provide further details and background information on the 12 Action Insights presented in the *Santa Marta Action Repertoire (SMART) Summary* (doi.org/10.5281/zenodo.19797562).

The documents reflect the current state of work of the individual groups. They differ in structure, depth and degree of completion, and some sections are not yet complete – for example, the literature list of Action Insight 6. They should therefore be read as living working documents, not as a final or peer-reviewed report, and do not necessarily represent the views of every contributor.

Apart from the layout and the correction of obvious typographical errors, the texts are reproduced as submitted by the Action Insight groups.

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Santa Marta Action Repertoire (SMART) Additional information

Further details and background information on the 12 Action Insights

Dear Excellencies, dear colleagues,

Attached we are pleased to share the additional information of the Santa Marta Academic Dialogue, prepared as the final outcome of the scientific workstream contributing to the First International Conference on Transitioning Away from Fossil Fuels in Santa Marta, Colombia.

This report brings together the work of a diverse scientific community over the past months. Contributors came from different research fields, disciplines, regions and methodological traditions. This diversity is one of the strengths of the process, but it also means that the individual statements vary in scope, emphasis, style, and level of maturity. Not every statement should therefore be understood as being endorsed in full by every contributing academic. Rather than presenting a closed consensus document, the additional information should be read as an evidence-informed, collaborative, and living text — a basis for further dialogue, refinement, and cooperation.

The additional information offers scientific statements, actionable insights, and recommendations intended to support a just, orderly, and equitable transition away from fossil fuels. It is designed to contribute to the Santa Marta process while also serving as a practical resource for governments, subnational institutions, NGOs, civil society actors, and communities engaged in shaping and implementing climate action.

In line with the values of the different stakeholders, the report aims to strengthen science-policy diplomacy by making knowledge accessible, actionable, and useful across different levels of governance. It recognises that the transition away from fossil fuels cannot be delivered by national governments alone, but requires cooperation between international processes, national administrations, regional and local governments, academia, civil society, and affected communities.

We hope this report supports dialogue, helps identify useful next steps, and strengthens the connection between science, policy, institutions, and society in and beyond Santa Marta.

The coordination team

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Action Insight 1: **Develop holistic government plans to transition away from fossil fuels and dismantle legal, financial, and political barriers resulting from fossil fuel lock-in and entrenchment. Roadmaps including milestones for the Transition Away from Fossil Fuels (TAFF) are best anchored in science and justice, with national planning and international coordination.**

Further Details:

The current state:

Many economies in the global south still heavily reliant on raw material exports and struggling to develop local manufacturing bases. Further, Labour rights and retraining are addressed reactively during fossil fuel phase-out processes, leaving workers exposed to sudden job loss, income insecurity, and limited consultation. Training initiatives are fragmented, poorly coordinated, and often introduced only after closures occur. They frequently fail to recognize workers' existing skills or align with territorial economic opportunities and labour market needs. Weak coordination between education systems, labour institutions, and transition policies prevents retraining programs from translating into stable employment. As a result, displaced workers experience prolonged unemployment or are pushed into precarious work, reinforcing perceptions that energy transitions threaten livelihoods rather than create opportunities (Cardoso et al.,2026).

Outcome of actionable insight implementation:

The Transition away opens opportunities for green industries, renewable-based manufacturing, and critical mineral processing, but also imposes the risk of exclusion from global value chains shaped elsewhere. Labour transitions away from fossil fuels therefore should be proactively planned and embedded within comprehensive just transition strategies that integrate social protection, labour guarantees, and economic diversification. Workers participate meaningfully in decision-making through social dialogue mechanisms involving governments, trade unions, and employers.

Labour retraining and Technical and Vocational Education and Training (TVET) systems become core pillars of transition planning. Training pathways are developed early, co-produced with workers and local institutions, and aligned with territorial development strategies and emerging labour market opportunities in renewable energy and other sustainable sectors. Retraining programs recognize prior learning, build transferable skills, and lead to certified qualifications linked to decent, stable employment. Through coordinated lifelong learning systems, workers are supported to transition into well-paid jobs that sustain local economies and strengthen the social legitimacy of decarbonization.

The historical allocation of the carbon budget has been highly inequitable. A just transition provides an opportunity to organize equitable technology transfers and internal redistribution, ensuring that economic gains contribute to the fulfillment of basic needs for all.

Details and Background Information:

Despite being central to the concept of a just transition, labour protection and retraining remain among the weakest components of fossil fuel phase-out strategies. In practice, labour transitions are often treated as reactive responses to industrial decline rather than as integral elements of energy transition planning. The literature shows that closures of fossil fuel industries frequently occur abruptly, driven by corporate strategies responding to market pressures, declining demand, or climate regulations, with limited advance consultation with workers or communities (Snell, 2018; Snell et al., 2015). This initiates a causal chain in which workers face sudden unemployment and income insecurity while governments implement short-term mitigation measures rather than long-term transition strategies.

A key locking mechanism is skills specialization. Workers in fossil fuel industries often possess highly specific technical and experience-based skills developed over decades within a single sector. Without anticipatory retraining systems and recognition of prior learning, these skills are difficult to transfer to

emerging low-carbon industries (García-García et al., 2020; Snell et al., 2015). This creates a reinforcing feedback loop: limited re-employment opportunities increase worker insecurity, which generates resistance to climate and energy policies perceived as threatening livelihoods (Olson-Hazboun, 2018). Such resistance can weaken political support for ambitious transition policies, reinforcing reactive governance and delaying structural reforms.

Labour retraining programs often fail to break this cycle because they are introduced too late and implemented in fragmented ways. Weak coordination between labour ministries, education systems, and energy transition policies results in isolated training initiatives that are poorly aligned with local labour markets. As a result, retraining frequently does not translate into stable employment, reinforcing skepticism toward the promise of "green jobs" (Cha et al., 2020; Levy et al., 2023).

In many regions of the Global South and Latin America, these dynamics are intensified by structural dependence on extractive economies and labour markets characterized by informality and inequality (Rivera-Albarracín, 2020). Limited economic diversification means that newly trained workers may still face a lack of viable employment opportunities locally. This creates another feedback loop in which the absence of alternative livelihoods reinforces territorial dependence on fossil fuel industries, delaying both economic diversification and meaningful retraining efforts (Gudynas, 2019; Svampa, 2022).

Finally, weak social dialogue further constrains effective labour transitions. When workers and trade unions are excluded from transition planning, training programs risk being poorly designed and lacking legitimacy (Stevis & Felli, 2015; ILO, 2015). Without anticipatory planning, coordinated TVET systems, and worker-centered governance, labour transitions remain trapped in cycles of insecurity, resistance, and delayed transformation—preventing the realization of equitable and socially sustainable energy transitions.

Key intervention points and opportunities

For a socially legitimate and economically just energy transition, proactive, worker-centred planning is required. This planning must be anchored in coordinated TVET systems, social dialogue and international equity, in order to ensure that decarbonisation drives inclusive and fair development, rather than becoming a source of displacement and inequality. 1) Strengthening social dialogue and worker participation. Trade unions, employers, and workers must be actively involved in decision-making processes through institutionalized mechanisms of social dialogue to build legitimacy, reduce resistance, and ensure programs that meet actual needs. Economic diversification in the Global South and equitable technology transfer. 2) Strengthening TVET as a central pillar of labour transition by developing flexible and relevant training programs for workers transitioning away from the fossil fuel sector including long term finance programs. This involves aligning educational offerings with emerging sectors, while promoting lifelong reskilling processes. The strategy should include partnerships between educational institutions, local governments, businesses, and communities to design labour profiles aligned with territorial economic diversification. It must ensure access to technical training, certification of competencies, and labour mobility towards green and sustainable jobs.

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Action Insight 2: **Proactively protect livelihoods and workers through early retraining, skills development, and community and regional redevelopment based on dialogue, ensuring the economic benefits and costs of the transition are distributed fairly.**

Further details:

Merely adopting policies to encourage renewables and alternative energy will not lead to policy with the speed commensurate with addressing the climate change problem (Heras and Gupta 2023). This implies that governments may need to understand and unlock the various structural fossil fuel lock-ins their country faces in order to be able to take a strong domestic position, which can enable a strong international negotiation position abroad (see 3.1, 3.2 and 3.3; Gupta 2026, in press). However, a growing body of research suggests that some of the adopted decarbonization policies are triggering public protests, electoral backlash, and even violent unrest when they raise energy costs, redistribute power, undermine livelihoods, and challenge cultural norms, such as petro-masculinity (Natalini et al. 2020; Gilmore and Buhaug 2021; Le Billon 2026; Letourneau et al. 2023; von Uexkull et al. 2024; Jarzyk 2025). To prevent such outcomes, the management of the political economy of transitioning from fossil fuels must simultaneously address shifts in state power and geopolitical positioning, structural barriers within energy systems, securitization, misinformation, malinformation, disinformation, and the dynamics of public opinion, and the imperatives of climate system justice (Gupta et al. 2025; Le Billon et al. 2025).

This section covers four interconnected messages: (a) the need for roadmaps to transition away from fossil fuels; (b) the need to coordinate economic, fiscal, infrastructural, and legal strategies to break the fiscal and legal lock-ins while enabling a just and stable energy transition; (c) the need to address discursive, political, consumer and professional lock-in; and (d) addressing international challenges.

2-I) Roadmaps for the Transition Away from Fossil Fuels (TAFF) — at global and national levels— must be anchored in science and justice, integrating comprehensive national planning with international coordination to shift from fossil fuel dependence to resilient, equitable, and clean energy systems.

The transition away from fossil fuel has started with first movers, climate clubs and success stories:

First movers: The 80+ countries that supported TAFF at COP30 and the 24 countries that signed the Belem Declaration on the Transition Away from Fossil Fuels are the first movers. Moreover, at least 46 countries already have decarbonization plans for the power sector, and at least nine other countries have plans in place to reduce fossil fuel supply to varying degrees, with subnational leaders—such as California and Quebec— also moving ahead. Those could also be early movers putting forward national and provincial TAFF roadmaps.

Climate clubs: Clubs such as Powering Past Coal Alliance (PPCA), Beyond Oil and Gas Alliance (BOGA), the Clean Energy Transition Partnership (CETP), and the Coalition on Phasing Out Fossil Fuel Incentives Including Subsidies (COFFIS) are promoting collective action.

Success examples: Some national processes that can provide useful lessons for the implementation and design of national roadmaps are: JETPs (South Africa, Indonesia, Vietnam, Senegal), Colombia's Just Energy Transition Roadmap.

2-I.1) System Outcome

The current state:

The global economy is characterized by deep global dependence on fossil fuels, which drives geopolitical instability, economic volatility and volatility of fossil fuel markets. Despite record clean energy deployment (IEA, 2025), existing national production plans for 2030 remain more than double the levels consistent with a 1.5°C pathway (Stockholm Environment Institute et al., 2025). This misalignment risks massive "carbon lock-in", stranded assets (Bos and Gupta 2019), and a dangerous mismatch between energy supply and demand (Green and Denniss 2018).

However, political appetite for structured cooperation to overcome this misalignment is evident (Le Billon and Kristoffersen 2020; Picciariello et al. 2026). Over 80 countries endorsed the call for a global roadmap on transitioning away from fossil fuels at the 30th United Nations Climate Change Conference (COP 30) (Belem Declaration on the Transition Away from Fossil Fuels, 2025), and 2026 presents multiple diplomatic and technical processes that can help translate commitment into delivery, including the First International Conference on the Just Transition Away From Fossil Fuels and the Brazilian COP 30 Presidency's initiative to develop a global roadmap on fossil fuel transition.

Outcome of actionable insight implementation:

The desired state is a transition from fragmented, science-misaligned plans for fossil fuel production and use, and market-driven transitions, to coherent, whole-economy TAFF roadmaps that are just, orderly, and science-based, overcoming systemic geopolitical and economic friction.

Such roadmaps, promoted by the first movers, should explore how the "carbon lock-ins" will be addressed. These include production and consumption pathways; fossil fuel subsidy reform (Insight 6); just transition and economic diversification; decommissioning and cleanup; the debt lock-in and identify funds for the just transition for fossil labour. In particular, they should state how they will shift the existing concentration of investment, skills and political influence in the fossil fuel sector to enable economic diversification away from fossil fuels (Peszko, et. al., 2020). Moreover, roadmaps should also explain how they will deal with economic volatility and international finance. As long as countries rely on volatile fossil fuel markets, their fiscal stability is too fragile to commit to the high upfront costs of a clean energy transition (Muttitt, 2025). This is further complicated by the "finance-ambition gap", where insufficient concessional finance and access to capital prevent emerging economies from doing the investments required for the transitions without increasing the debt levels. In addition, dominance in low-carbon technologies, notably by China, remains a source of concern among many industrialized countries, with mixed effects including fears of being outcompeted, slowdown in EV imports, and fast-tracking of energy transition minerals projects (Deberdt et al. 2025; Le Billon 2026).

Roadmaps should analyse how producer and consumer countries should coordinate with each other. A lack of such structured coordination between producer and consumer countries (Newell, 2026) increases risks for "first movers". When countries attempt to transition from fossil fuels in isolation, they face increased political and economic risk if others do not follow, leading to potential market displacement rather than global emissions reduction (Rodríguez-Pose & Bartalucci 2024) (Insight 9).

Roadmaps should be anchored in clear principles that ensure credibility such as alignment with the best available science, fairness (e.g. Climate System Justice - ensuring epistemic and recognition justice (Insight 11); interspecies, intergenerational and intragenerational justice; procedural and substantive (distributive/ restorative/corrective) justice (Insight 1?) (Gupta et al. 2025), application of the common but differentiated responsibilities and respective capabilities principle, national ownership, international coordination, and a human rights-based development approach (Picciariello et. al. 2026).

Roadmaps should connect and operationalize existing plans, such as sectoral decarbonization strategies, nationally determined contribution implementation plans, long-term low-emission development

strategies, just transition frameworks, and supply-side policies.

They should integrate multiple elements, including energy access. Such plans need to be developed with; strong participatory governance; clear timelines and monitoring, reporting, and verification systems; and cross-ministerial as well as international coordination between producing and consuming countries.

2-I.2) Details and Background information

Geo-political instability, including trade and military wars, undermine the planning security needed for medium to long-term investment into transitions (Kuzina & Steiner, 2026). For example, the challenges in the Strait of Hormuz have led some actors to revert to coal for their energy needs, while better-financed actors are moving towards renewables (IMF, 2026). Clear, coordinated international political and legally binding goals are necessary to provide credibility and direction for the just transition, shaping narratives and expectations across markets, governments, and society.

Weak international coordination between producer and consumer countries is causing carbon leakage and price volatility (Grugni et al., 2026). Moreover, limited multilateral cooperation is leading to other unwanted consequences of moving ahead with the transition (e.g. investor-state disputes (Insight 12) or sovereign credit downgrades, debt exacerbation). Additionally, there is a lack of effective governance to manage critical mineral, technology, and infrastructure supply chains that are required for the energy transition, while avoiding new dependencies and social or environmental harms (Mangani et al. 2025; Le Billon 2026).

Overly complex institutional structures can slow down the decision-making agility needed for urgent climate action. To be effective, roadmaps need to have a whole-of-government (and society) approach via cross-ministerial coordination, to ensure internal policy coherence and long-term clarity that focus also on unlocking the different fossil-fuel lock-ins/ path-dependencies.

In developing such roadmaps, attention must be paid to justice issues, since in the past political feasibility has implied that economically efficient measures were adopted at the cost of equitable and effective measures (Rempel & Gupta 2022) (see also Insight 5). Thus, just transition measures are needed to manage the transition (Newell, et. al., 2024) and should follow the principles of (a) transformational, recognition, epistemic and data justice (Insight 11); (b) interspecies, intergenerational and intragenerational justice; substantive (distributive, corrective, transitional and restorative justice; Insight 2?) and procedural (access to information, decision-making, civic space and courts) justice (Gupta et al. 2025) that are essential to support workers, communities, and regions that currently depend on fossil fuel industries during the transition (International Labour Organization, 2015). Flawed engagement with civil society and labor unions can lead to social backlash and a lack of local ownership and, hence, co-creation of the roadmaps is essential.

2-II Coordinate economic, fiscal, infrastructural, and legal strategies to break the related lock-ins while enabling a just and stable energy transition

2-II.1 System Outcome

The current state:

Currently, the continuing profitability of the fossil fuel sector keeps investors interested, resulting in a profitability lock-in. Profitability results from, inter alia, the growing demand for fossil fuels by developing economies, the rapidly-growing defense and AI sectors, the high subsidies given to this sector, the lack of legally binding fossil fuel targets, and narratives such as ‘net-zero’ and ‘overshoot’ that enable continued investments (Gupta 2026, in press).

Investors and borrowers then become locked into large, long-term capital investment in the fossil fuel market, as prematurely shutting down such investment is very expensive for the borrower. Moreover, divestment of shares by shareholders creates new vested interests and engagement by shareholders is difficult since fossil fuel companies have limited alternative options (McDonnell and Gupta 2024). Additionally, these large, long-term capital investments have locked our economy into an infrastructural lock-in, as pipelines, transport, etc. have become wound up in these long-term contracts, which are difficult to get out of. Currently, the fear of stranding these assets through a transition is what keeps us locked in.

The profitability, investment and infrastructural lock-ins contribute to a fiscal lock-in as both the revenues from the fossil fuel sector contribute heavily to the public treasury (rents in producing countries and taxes in consuming countries) and national GDP through the energy and material inputs fossil fuels provide. Moreover, many developing countries are locked into a debt crisis and extracting fossil fuel for export becomes a critical way to address the debt crises (Woolfenden & Debt Justice 2023).

Outcome of actionable insight implementation:

This requires, first, demand side management (Insight 8) to reduce fossil fuel demand and hence profitability; this will enable investors to shift away from fossil fuel. This includes retrofitting buildings, energy efficiency and lifestyle changes (Creutzig et al. 2024), and rules regarding what kinds of energy can be used by the AI sector if not the military sector (Renda et al. 2026).

Second, finance ministries should note that even though the 2025 advice of the International Court of Justice is not binding, it articulates that under international law, states continuing to use fossil fuel may be held liable for internationally wrongful acts (Peel 2026). This implies that ministries should collectively make a plan to transition from fossil fuel and send clear signals to society.

Third, transitioning away from fossil fuels confronts structural barriers embedded in energy systems and political institutions. Subsidies, infrastructure lock-in, and entrenched industrial interests often sustain fossil fuel dependence despite climate commitments (Matallah et al. 2023; Mahdavi et al. 2025). Reforming, e.g. subsidies is difficult as they function as economic instruments, as well as tools of redistribution, political stability and social contract. Removing subsidies unleash social unrest, “fuel riots” and subsidy reform crises (McCulloch et al. 2022; Belgioioso and Newman 2025). Effective transition strategies, therefore, require gradual sequencing, credible compensation mechanisms, and institutional reforms capable of overcoming system inertia (Gasim et al. 2025). Moreover, since renewable energy subsidies go mostly to those who can afford solar panels and electric vehicles, this leaves the less privileged out of the energy transition. Additionally, preventing assets like wells, pipelines, and refineries from becoming stranded is vital, as this is what currently still makes ministries reluctant to transition (Bos & Gupta 2019). Having a deep understanding of the contextual infrastructural dependence on fossil fuel is needed in order to reduce this dependence. This rethinking of various elements, such as retrofitting of existing buildings to the latest standards (Sharma et al. 2022) or revamping of the transport system towards more shared transport (Gupta, Chen & Rammelt 2024), should be done with this more contextual understanding, weighing options like greater electricity use, decentralized systems and grid expansion. Existing fossil fuel infrastructure needs to be repurposed as far as possible, recycled and dismantled to make space for the new infrastructure that is needed.

Fourth, the risk of poor investment should be shared by lenders and borrowers since both can be expected to know about the urgency to transition away from fossil fuel, states should individually and collectively demand risk sharing to reduce the burden on borrowers. Moreover, shareholders that continue to demand profits from fossil fuel producing and using companies should also be held accountable to stakeholders who suffer from climate impacts (WEF 2025). Means of changing the investment regime locally and globally need to be developed (see Insights 9 and 12).

Fifth, the double fiscal dependence on fossil fuel through rents and taxes as well as energy and material inputs needs to be changed. It requires a progressive redevelopment of how taxes are allocated in society to ensure that resources continue to be generated; the latter requires the promotion of alternative energy, a better grid and demand side management (Insight 8). This should be done through consultations, collaborative design, effective communication, and adequate grievance-mechanisms to reduce conflicts, delays, and policy failures.

2-II.2 Details and Background information

The mismanagement of transitioning away from fossil fuel politics, through poor policy design, communication, and implementation results in grievances, counterproductive conflicts, and policy rollback (Belgioioso and Newman 2025). Thus, a central mechanism of the profitability lock-in, the investments & divestment lock-in and the fiscal/economic lock-in lies in sunk investments in fossil assets—wells, pipelines, refineries, power plants, vehicles, and buildings designed around oil and gas (Moreau et al. 2026) as well as the contracts protected by contract and investment law. Such contracts cannot be easily cancelled.

Because these infrastructural and legal assets require long operating lives to recover costs, firms and allied actors lobby for supportive policies and resist strict climate regulation (Newell and Phillips 2016). Combined with concerns about jobs and tax revenues in fossil-dependent regions, this pressure contributes to weak or inconsistent climate policy, sustaining expectations of continued fossil demand (Newell and Phillips 2016; Brulle 2021; IEA 2025). The fiscal/economic lock-in reveals how both the state depends heavily on taxes and rents from the fossil fuel sector and on the fossil fuel itself in powering industry (SEI et al. 2023). Moreover, fossil fuel is heavily subsidized directly and indirectly by governments: this reinforces consumer dependency on fossil fuel all contributing to profitability of fossil fuel and investors will continue financing new projects, extending the system's lifetime and increasing the political and financial costs of rapid transitioning away from fossil fuels (Pichler et al. 2025).

2-III) Address discursive, political, consumer and professional lock-ins

2-III.1) System Outcome

The current state:

Many governments are locked-into the narrative that the economy must increase GDP and this implies encouraging profits at all costs in all sectors (discursive lock-in). This macro (GDP) and micro (profits) goal is the leading cause of the externalization of environmental and social impacts to current and future generations here and elsewhere in the world (Acheampong & Opoku 2023). This feeds into the 'resource nationalism' (Xu et al., 2023) and 'right to development' argument of countries and has led to the idea of 'full permanent sovereignty over natural resources' in the 2030 Agenda (2015). Other narratives, such as 'net zero' and 'overshoot', serve also to enable continued fossil fuel use (Gupta 2026, in press).

Such narratives flourish, not only because of the role of the fossil fuel companies (Gentile and Gupta 2025), but also because of supportive politicians who receive campaign finance from fossil fuel companies or because they have financial investments directly or indirectly in fossil fuel.

Given that climate change requires broad professional commitment, many professions from companies, universities, public bodies, and banks explain that even though climate change requires certain actions from them, their official mandate does not leave them with much space for such action (Gupta 2021-2026).

Consumers (and voters) are locked into fossil fuel use in different ways – the rich through their fossil fuel based lifestyles (Boucher 2016) even as they invest in solar panels and e-cars, the poor because they use fossil fuel to cook their food or bring their produce to the markets. Influenced heavily by misinformation, malinformation and disinformation (WEF 2025), consumers are beginning to question the science of

climate change.

Outcome of actionable insight implementation:

First, critically, economic ministries must realize that not only critical scholars are calling for inclusive development (where social, ecological and relational inclusiveness redefines what development is (Rammelt et al., 2022)), degrowth (Kallis et al., 2018) and post-growth (Hickel et al., 2021) theories of development, but that such visions are also promoted by the Secretary General of the United Nations and are currently also being discussed within UN circles. This is because environmental destruction and the destabilization of the planetary processes is likely to affect the supply chains of global trade and drastically reduce economic growth. It is important for developing countries to reconcile their right to development with leaving fossil fuels underground (Heras et al. 2025).

States need to ensure transparency of climate finance for election campaigns.Such financing from fossil fuel companies needs to be scrutinized. In general, independence from big donors is essential for a functioning democracy, as well as for leaving fossil fuel underground.

Professional ethics need to be revisited to require professionals to make science-based policy, irrespective of their mandates. Additionally, professionals should be aided in efforts to disseminate scientific information to the wider public about the urgency and benefits of phasing out of fossil fuels, for example, by helping professionals launch a platform to communicate with the public (Insight 4).

Moreover, governments should actively create policy to question the generation and amplification of incorrect information; those who produce and distribute such information should be held accountable.

In other words, ensuring a sustainable society requires revisiting what development is and how it can be achieved. Countries that lead in such thinking may also be able to shape global economics in the future.

2-III.2) Details and Background information

Connected societal narratives of ‘overshoot', net zero energy security and potential loss of competitiveness, resource nationalism/pride, the ‘right to development’, ‘energy poverty’, ‘national survival’, and the implied sacrifice or threats to lifestyles if fossil fuel are dominant narratives, hampering the phaseout of fossil fuel. Such lock-ins are nurtured by fossil industries denial and delay tactics which include (Gentile and Gupta 2025). *Additional information provided in the work stream Links.*

2.IV) Address international challenges

There has been a 22-year delay in adopting the 2°C target in the Paris Agreement and a subsequent delay in adopting the 1.5°C target. But while the 1.5°C target can be seen as a ‘safe boundary’, the Earth Commission has argued that 1°C is the just boundary since it reduces irreversible harm to tens of millions of people (Rockstrom et al. 2023; Gupta, Jesse et al. 2025) and further that politics has led to the delay in target adoption (Gupta et al. 2025). This implies that countries should adopt ambitious targets which means at least meeting 1.5°C without overshoot. All this implies that transitioning away from fossil fuels is an urgent priority. At the same time, the delay has implied the continued development of fossil fuel enterprises as well as increased impacts. Addressing this requires strong collaboration between states, appropriate technology use, and financial cooperation.

System Outcome

The current state:

The parties in climate change negotiations and Conferences of the Parties are reluctant to talk about transitioning away from fossil fuels. The delay in adopting legally binding targets has repercussions through economies worldwide, resulting in most states not explaining how exactly they will transition away from fossil fuels production and use in their NDCs. Many talk about the domestic renewable energy targets and policies, but few discuss how they will deal with the fossil fuel lock-ins, as discussed in this document.

International cooperation on climate change is at an all time low with some countries withdrawing from the Paris Agreement and with declining finance (Insight 10). Despite promises of $300 Bn to $1.3 Tn annually by 2035 (Bhattacharya, 2025), global aid is declining rapidly with the US closing down its International Aid agency in July 2025 and many other countries reducing their climate finance accordingly. Promises to fund the energy transition in some developing countries have also faced several challenges (Karg and Gupta 2024). In the ultimate analysis, phasing out fossil fuel flows needs to be undertaken in a just manner.

Outcome of actionable insight implementation:

The inability of the climate change negotiations to come to strong conclusions on fossil fuel can be countered by the results of the Colombia Conference which should be able to deliver actionable insights to COP 31 thereby pressurizing other countries to also join in this forward thinking coalition (Insight 5). The Colombia Conference is, implicitly, recognizing the obligations of states in accordance with the advice of the international courts and we argue that it should call on states to demonstrate due diligence in their climate policies.

In addition to fostering and encouraging international cooperation on TAFF, TAFF should call for a revitalization of international grants and the mobilization of resources and actors to accelerate the transition away from fossil fuels (Insight 10).

Furthermore, finance ministers need to collectively address the international debt crises. Many developing country governments have paid the capital borrowed many times over, their high cost of capital is paralyzing their ability to take action (Diwan & Harnoys-Vannier, 2025). Cancelling such debt and redirecting the resources to enable the energy transformation is one way in which this lock-in can be addressed and the transformation encouraged. This is an essential global justice issue and can raise resources for the energy transition.

2.IV.2) Details and Background information

Transitioning away from fossil fuels is widely recognized as a necessary condition for limiting global warming, yet its political management remains fraught with risks of conflict and backlash (Egli et al. 2022; Patterson et al. 2026). Given the advisory opinions of the International Court of Justice (2025), the Inter-American Court of Human Rights (2025) and the International Tribunal on the Law of the Sea (2024), national governments should refrain from violating human rights and encourage proper environment impact assessments of projects producing and using fossil fuel as well as adopt serious policies to transitioning away from fossil fuels. In the absence thereof, states can be seen as committing internationally wrongful acts (Villasante et al. 2026). This should be reflected in the NDCs to demonstrate that these countries are adopting ‘stringent due diligence’ in their climate policies.

This implies that even if the Climate Convention regime does not explicitly require a transition from fossil fuels, countries cannot rely on this, as future courts are likely to interpret international law in the same way.

Debt of developing countries is also a reason for investing in fossil fuel, since indebted states often hope that fossil fuel exports can generate the resources to pay back the debt (Woolfenden & Debt Justice 2023). Moreover, there is a lack of scaled-up, predictable international financial support, which is essential to help developing countries - with 78% of the remaining fossil fuels - manage the social, economic, and fiscal impacts of transitioning away from fossil fuels. National delivery in developing countries depends on access to dedicated, predictable, and reliable financial support from international sources. Non-debt-creating public finance is particularly critical for non-bankable projects such as dismantling fossil infrastructure or financing the just transition of labour, as is scaling blended finance strategies that leverage concessional loans and grants to unlock private investment for the more bankable projects.

3. Key intervention points and opportunities Co-create roadmaps and milestones for the Transition Away from Fossil Fuels (TAFF) anchored in science and justice, integrating national planning with international coordination and clearly communicate these to society (Insight 4). Scientific anchoring is critical to ensure that the roadmaps are effective. Anchoring in justice is needed to take the whole society in the energy transition at national level; and to ensure the effectiveness of a transition at global level noting that 78% of the remaining fossil fuel is in the developing world and the latter is also most vulnerable to its impacts while having contributed least to the problem. Integration in planning is needed to ensure that fossil fuel transition strategies are not overtaken by other plans. International coordination reduces the risks for first movers and mobilizes others. Communicating to society is needed to mobilize broad social support. All this is required to demonstrate stringent due diligence as required by international courts. Such roadmaps should unlock the fossil fuel lock-ins slowing down the transformation, confronting structural barriers embedded in current energy systems, political and social institutions. For example, they should be based on collecting and evaluating data relevant to: how countries could replace state revenues from the fossil fuel sector; support the adaptation of strategies to national circumstances; and develop a comparable system for embedding explicit transition strategies in NDCs. There is a need for transparency on campaign finance for elections and independence from big donors. Reform standards and regulations require all professionals to take science-based climate action, including managing their emissions, regardless of their formal mandates. This increased sense of commitment can unlock the discursive lock-in, reducing the demand and profitability of fossil fuels, making it less interesting for investors. Furthermore, outlining a clear and just roadmap for the transition away from fossil fuels will ensure energy security and prevent price spikes and social backlash.

First-mover alliances should be leveraged in order to reduce first-mover risks, supporting implementation, and send clear political signals on how they are already progressing TAFF – particularly on fossil fuel supply reduction, capitalizing on countries already declining their production. Convenings in 2026 should also be used to sustain leadership, with the Santa Marta conference and the Brazilian presidential roadmap for COP31 being key moments to maintain political momentum and to connect relevant initiatives to each other.

Roadmaps and alliances should identify lessons learnt and clear gaps in knowledge in order to promote deeper collaboration with the scientific community and civil society to engage all of society in this transition. This could be done through, for example, campaigns or platforms facilitating information dissemination to broader society. A the same time, strategies to dismantle the mechanisms of producing and amplifying fake news should be discouraged and maybe even made punishable as this confuses consumers and voters.

Roadmaps should also include an international dimension that addresses international issues such as enhancing negotiation rules within the UNFCCC framework, investment, development and climate cooperation funds, and debt. This should address problematic investment rules such as the Investor State Dispute Settlement (see Insight 12), promote non-debt-creating financial resources and the need for

transparency and predictability of such finance, address international debt and see if this can raise funds for climate action; and ensure collaboration between fossil producing and consuming countries. Examples could include the international generation of financial resources through a progressive redevelopment of taxes (e.g. the UN Framework Convention on International Tax Cooperation. Moreover, TAFF processes should support coordinated fossil fuel subsidy reform.

The Conference on Transitioning away from Fossil Fuels should foster a common roadmap framework that can connect existing plans and strategies across countries in a flexible manner adapted to national circumstances and suggest how these can be implemented and monitored. These include sectoral decarbonization strategies, long-term low-emission development strategies, just transition frameworks, and supply-side policies. The framework should help align strategies from NDCs into a comparable roadmap system across countries. Thereby, they should reform COP Negotiation frameworks to directly and Effectively Address the Transition Away from Fossil Fuel The Conferences of the Parties must overcome their reluctance and make the transition from fossil fuels a standing agenda item. They should also include transition plans in the NDCs and reform the consent principle.

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Action Insight 3: **Communicate fair, transparent, and evidence-based policies. The public generally supports climate action. The transition away from fossil fuels can be accelerated by protecting against misinformation and disinformation, including false narratives such as fossil CCS, and banning fossil fuel advertising and lobbying.**

Further details:

Public opinion plays a decisive role in shaping the political feasibility of decarbonization policies. Energy price increases, carbon taxation, and job losses in high-carbon sectors often trigger opposition when citizens perceive them as unfair, economically burdensome, or antithetical to (corporate-supported) cultural identities (Bell et al. 2019; Jones and Cardinale 2023; Finnegan 2023). The Yellow Vest (Gilets Jaunes) protests in France illustrate how climate policies framed as technocratic fiscal measures can provoke mass mobilization if they neglect social equity concerns (Driscoll 2023; Martin and Islar 2021). Political backlash against climate policy is increasingly recognized as a major constraint on transition efforts (Gourinchas et al. 2024; Patterson et al. 2026b). Designing an effective transition and building durable support requires policies balancing changes and continuities that visibly redistribute benefits and address the cultural and everyday economic concerns of households and workers (Tilsted et al. 2026).

3-I) Citizens favor renewables over fossil fuels. Build on this citizen support through transparency, communication campaigns featuring trusted sources to explain ambitions, costs, and benefits, fair societal burden-sharing mechanisms and just transition plans, and regular updates on implementation activities.

Lead-Author: Linda Steg

3-I.1: System Outcomes

What is the current state: Citizens care about the environment, are concerned about climate change, are motivated to act accordingly, support climate policy, and prefer renewables over fossil energy sources (Steg, 2023; Görsch et al., 2025). Yet, citizens as well as policy makers tend to underestimate public concern, support and engagement (Steg, 2023; Sparkman et al., 2025). Further, moving away from fossil fuels have other societal benefits that are important to people, including health benefits, energy security, and cost savings. People think that all actors (government, businesses, consumers, financial sector, media, NGOs) are responsible and capable of mitigating climate change, but most of them do not act accordingly (Wang et al., 2025). People think that particularly governments and businesses are responsible and capable of mitigating climate change, while individual professionals within governments and particularly businesses feel relatively less responsible and capable of mitigating climate change, compared to individual citizens (Wang et al., 2025), probably due to organisational barriers to act. This can result in a 'governance' trap where responsibility and capacity to act is always thought to exist elsewhere and actors pass it back and forth between themselves (Newell et al 2015).

Outcome of actionable insight implementation: Citizens and decision makers would accurately assess how much others care and act, support governmental measures and agree to burden their share and responsibility for the transition. Decision makers would base their decisions on accurate public opinions and actions as well as evidence-based consultation. Professionals within governments and particular businesses acknowledge their responsibility and capacity in mitigating climate change: they acknowledge that they contribute to climate change, that they are responsible in mitigating climate change, what actions they can take to mitigate climate change, and acknowledge that their professional actions help mitigate climate change. Governments can implement policy to support change, such as subsidies, spatial policy and information provision, to enable people to engage in climate action and make such actions more attractive. Next, they can discourage actions that increase climate risks and remove incentives that promote behaviour that increases climate risks (WKR 2026).

3-I.2: Details and Background information

It is often assumed that the public opposes climate policy because such policy restricts their freedom of choice and is personally costly.

However, evidence suggests that public support not only depends on perceived individual costs and benefits of a policy, such as perceived costs or effort. Indeed, people consider a much wider range of potential consequences, notably perceived costs and benefits for others and the environment. For example, public support of energy technologies depends on six types of impact: aesthetic, economic, environmental, community and health, temporal, and usability (Görsch et al., 2025). Communicating such positive impacts of climate mitigation strategies (i.e., positive environmental and health impacts of renewables) likely increases their public support. In addition, public support depends on the distribution of costs and benefits across groups (distributive fairness, e.g. strongest shoulders should carry heaviest weight, or the polluter pays); the extent to which open, transparent and fair decision making procedures have been followed and public concerns have been considered (procedural fairness); and trust in decision making (Steg, 2023). This does not imply that all people participate in the decision making, but rather that the public feels their concerns and interests were represented. Moreover, public support may increase after people experience the consequences of policies, as they tend to focus on costs and less on potential beneficial effects of policies before the implementation (Granulo et al 2025; Schuitema et al., 2010). Next, public support varies across individuals, and is higher the more strongly people value nature and the environment and the wellbeing of others, the more they are aware of and feel responsible for environmental problems caused by their behaviour, and the more they think personal actions help mitigate climate change (Steg, 2023). Climate policy does not necessarily restrict freedom of choice, but can actually increase freedom of choice by making climate friendly options more attractive and feasible (WKR, 2026). A wide range of factors would need to be considered and communicated to secure public support of climate policy in general, and phasing out fossil fuel in particular, including perceived costs and benefits for individuals, other people, and the environment. Acknowledging and tackling the compounding effects of old legacy and new transition injustices is vital for realizing a truly just energy transition (Hermwille et al. 2025). Perceived fairness of climate policy is enhanced by preventing vulnerable groups from being disproportionally affected (Sovacool et al 2022), and by following fair, open and transparent decision making procedures. Communicate to what extent different groups are responsible and capable to address climate change, and to what extent individuals' actions matter, and which actions matter most.

II) Claims of "clean coal," "lower carbon oil," fossil gas as "bridge" fuel, and CCS as a solution to fossil fuel emissions are not compatible with decarbonization and can instead deepen carbon lock-in.

Lead-Author: Angela Carter

3-II.1: System Outcomes

The current state:

Major producing countries and companies often claim fossil gas is a “bridge” or “transition” fuel and that oil can be “lower carbon” through the application of Negative Emissions Technologies (NETs) or carbon offsets that seek to reduce emissions associated with extraction and combustion (Si et al. 2023; Trencher et al., 2023). Likewise, coal companies continue to advance the notion of “clean coal” and using CCS to capture emissions (Future Coal, 2026). Producing companies and states have justified continued extraction and sought to obstruct climate action by using these strategies, now identified as “greenwashing,” since the 1970s (see Dembicki et al 2025 for an overview; see also Bonneuil et al. 2021; Fortin et al 2025; Franta 2021, 2022; Grasso 2020; Lamb et al 2020; Supran and Oreskes 2021; Kemfert et al. 2022).

Meanwhile since the late 1980s, lobbyists have characterized gas as a “bridge” from coal dependence to a clean energy future, arguing gas has lower emissions than coal (Ladd 2016; Delborne et al 2020; Janzwood and Millar 2022; Si et al. 2023). However, life-cycle assessments of methane leaks associated with gas extraction and supply indicate that emissions from gas are on par with, or in some cases even exceed, those from coal (Gordon et al. 2023). Similarly, oil proponents now claim some forms of oil production are “lower” carbon, via the application of technological (non-)solutions, notably using CCS and renewable energy to reduce extractive emissions (Dembicki et al 2025). This is evident in numerous major oil-producing countries, including Canada (Gunster et al. 2021), Norway (Nissen 2021), and the US, even in climate-progressive states like California (Duffy 2023).

Claims that some forms of oil production are emissions-advantageous often rest on the application of CCS technology to store emissions. However, whether CCS can reduce emissions from the oil and gas sector is questionable (Cameron and Carter 2023). Indeed carbon storage in the oil and gas industry is often used for enhanced oil recovery (Global CCS Institute, 2025), driving rather than decreasing overall GHG emissions. Despite four decades of development, CCS has not experienced significant cost reductions nor achieved a meaningful scale (Bacilieri et al., 2023) and it systemically underperforms in economic, environmental or technical terms with renewable energy for most fossil fuel uses (Jacobson et al., 2025). Therefore, CCS should be limited to usage in non-fossil fuel sectors without alternative decarbonization options (Malz et al. 2025) and geological CO2 storage should be prioritised to reabsorb legacy emissions already in the atmosphere. Note, however, that potential storage sites can barely contain fossil fuel historical emissions (Gidden et al., 2025; Friedlingstein et al., 2024).

Fossil fuel companies and other high-emission sectors as well as states significantly rely on carbon offsetting in their carbon neutrality scenarios (Trencher et al., 2024; McIntosh et al., 2025). However, the vast majority of carbon offsets fail to demonstrate additional emissions reductions (Calel et al., 2025; Probst et al., 2024; West et al., 2024). In addition, forestry usually takes place in the Global South and severely impacts local populations, exacerbating global environmental injustice (Llavero-Pasquina et al., 2025). Carbon offsets portray a false image of climate neutrality that diverts attention and funds away from a real transition away from fossil fuels (McIntosh et al., 2025).

Outcome of actionable insight implementation:

Therefore, governments, companies, and other stakeholders committed to TAFF should stop promoting and supporting fossil gas, CCS, carbon offsets, and the electrification of fossil fuel infrastructure as part of the transition roadmap. Only nature-based CCS solutions can provide a scalable way to remove CO2 from the atmosphere in the first half of the century, while also having a positive effect on other planetary crises (Schmidt et al., 2024). However nature-based CCS should not be used to offset or make fossil fuels appear environmentally friendly. It should strictly be used to bend the curve and capture impossible-to-abate CO2 emissions.

3-II.2 Details and Background information

These strategies deflect attention from the need to phase out the production of fossil fuels by claiming to reduce emissions. These false claims allow major producers to argue expanding oil production is aligned with net-zero by 2050 commitments. In reality, these claims serve "to prolong the fossil fuel economy and neutralise socio-political pressures and demands for a systemic transformation of social, political and economic norms" to prolong fossil fuel use (Llavero-Pasquina et al. 2025, p. 3). Appeals to gas as a "bridge," oil as "lower carbon," or the use of CCS, and offsets are diversionary tactics to prolong fossil fuel extraction that distract from the vital work of phasing out oil and gas production. Negative emission technologies should be used to remove already emitted CO2 from the atmosphere and bend the curve to reach net negative emissions in the second half of the century. Technical solutions such as direct air carbon capture and storage will not likely make a significant contribution until the middle of the century. They are not cost-effective and are often energy-intensive (Schmidt et al., 2024). However, nature-based solutions such as reforestation and enhanced rock weathering are promising techniques that, if implemented effectively, could generate multiple benefits (Fernandes et al., 2016; Stahl et al., 2023; Berling et al., 2024; Geerts et al., 2025). These techniques could reach 7 to 9 GtCO2 per year by 2050. Hence, they are not capable of completely offsetting current emissions, while technical CDR methods currently do not even contribute 0.1% to total CDR (Schmidt et al., 2024).

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3 - III) Tobacco-style bans/ restrictions on marketing and lobbying for fossil products and industries are an effective and low-cost measure to reduce demand, constrain political influence blocking/undermining the energy transition and to denormalize high carbon consumption.

Advertising: Any public communication with a commercial, marketing or public relations objective that is paid for, either in cash or in kind. This includes commercial advertising in TV, Radio, newspapers; online advertising, including in social media; street advertising in transport or street billboards; or sponsorships of events, organisations, places, positions, scholarships, programmes, etc. Fossil fuel companies: Any company involved in the extraction, transportation, processing and/or commercialisation of coal, oil and/or gas.

Fossil fuel products: Coal, oil, gas, and any of their derivatives consumed for energy purposes, including electricity, heat and transport uses. Products consuming fossil fuels: Refers to any appliances or consumer products that require the consumption of fossil fuels for their operation. This includes internal combustion engine vehicles, boilers, stoves, aviation and electricity generators.

3-III.1: System Outcomes

The current state:

Active disinformation campaigns and the use of public relations and lobbying by the fossil fuel industry serve as a major barrier to the transition away from fossil fuels. Advertising of fossil fuel products stimulates demand for high carbon products, misleads the public about the causes and solutions of climate change through greenwashing and is used to purchase social license to delay climate action. Fossil fuel companies' ability to shape public discourse and policy processes through advertising and lobbying blocks and delays health-protective climate policies and regulatory actions in the energy transition. Research on "social tipping interventions" suggests that advertising restrictions can contribute to cascading norm changes that accelerate a transition away from fossil fuels (Otto et al 2020) and can also induce innovation in low carbon alternatives (McDowall and Underthun 2025).

The vested interests of powerful groups foster the frame of climate policy restricting individual freedom of choice, and shape the public debate and policy making (as they do have relatively good access to politicians; WKR, 2026). Yet, many climate policies would increase individuals' freedom of choice by making such actions more feasible and attractive, including subsidies or infrastructural changes (e.g., better cycling or public transport infrastructure). Also, fossil fuel advertisements also shape individuals choices, but is not interpreted as an undesirable influence on individual freedom of choice (WKR, 2026).

Fossil fuel advertising contributes to climate change by changing social norms to boost aspiration levels and stimulate unsustainable economic growth (Hartmann et al., 2023; Bouman et al., 2025). In addition, fossil fuel advertising "enables producers of harmful commodities to manipulate public discourse in order to delay or derail the energy transition" (Kaupa, 2024). The largest 29 fossil fuel companies spent an estimated $7 billion on media, creative advertising and PR annually across 2021, 2022 and 2023 (Clean Creatives, 2025).

Research has found that exposure to two 30-second ads is sufficient to make people view fossil fuel companies' environmental efforts more favourably (Friedman & Campbell, 2023). This effect is not reversed by factual information on companies' actual renewable investments (Friedman & Campbell, 2023), and when both high-carbon advertising and green normative advertising are shown to subjects, high-carbon norms prevail (Castro-Santa et al., 2023). This evidence would justify a fossil fuel advertising ban as an effective measure to prevent the influence of fossil fuel actors on social norms.

Outcome of actionable insight implementation:

Banning fossil fuel advertisements would cut a key mechanism of power for the industry to continue delaying the fossil fuel phase-out. By reframing public discourse away from the normalization of fossil fuel consumption and toward the positive health, environmental, and socio-ecological benefits of a phase-out—while simultaneously curbing the influence of the fossil fuel industry lobby—the mobilization of political support for a broad, global societal coalition committed to implementing an ambitious fossil fuel phase-out would be facilitated significantly. (Dasandi et al., 2022; Green & Temper, 2026). In addition to hindering fossil fuel companies' influence on social norms, a fossil fuel ban also sends a normative message that fossil fuels are not socially accepted. The ban itself becomes a powerful symbol of the social rejection of fossil fuels, which can in itself condition social norms to accelerate the phase-out of fossil fuels (Green, 2018; Bouman et al., 2025).

3-III.2: Details and Background information

As tobacco companies resisted bans on tobacco advertising, fossil fuel companies will resist restrictions on marketing and lobbying (Neuman et al., 2002; Ibrahim & Glantz, 2006; Yadav & Glantz, 2022). They have already argued that advertising is a central pillar of a functioning market, and a ban damages their commercial interests. However, the fossil fuel industry is generally defined by an oligopolistic structure with imperfect competition far from a free market situation (Hassler et al., 2010). Fossil fuel advertising is more about changing social norms than empowering consumers with informed decisions.

It has been argued that a ban on advertising is a violation of their free speech rights. However, an advertisement ban does not forbid them from communicating and freely expressing themselves; it just bans them from paying to amplify their message. In fact, Dutch courts already dismissed a case brought against the Hague ban by the travel industry arguing a violation of free speech and customers' access to information (Rechtbank Den Haag, 2025). Legal scholars have established that a fossil fuel ban "conforms the to the requirements of European law, especially if it is modelled after the tobacco advertising ban" (Kaupa, 2024:312).

Media outlets, PR companies and sponsored public events might argue that banning fossil fuel advertisements can impact their revenues and test their financial viability (McGivern, 2025). However, advertisements from fossil fuel companies represent less than 1% of global marketing spending (Clean

Creatives, 2025). If the financial losses suffered by the media due to the restrictions are not sufficiently offset by increased advertising, local and independent media and initiatives in particular should receive new sources of funding through institutional advertising and public awareness campaigns. This would have a ripple effect by which the media would gain economic independence from the fossil fuel industry and would be freer to challenge their practices in the public domain.

France and more than 40 cities worldwide have already banned fossil fuel advertising (Green & Temper, 2026). In the Netherlands, the Hague and Amsterdam have already banned fossil fuel advertising in their municipal jurisdictions (Bouman et al., 2025; Hughes, 2026). There have already been calls to legislate a ban across the EU (Kaupa, 2024). In this respect, a ban on fossil fuel advertising has been shown to be a feasible policy measure that can be implemented in a very short timescale and requires minimal funds (Bouman et al., 2025). Yet simple, such a ban can be a highly effective catalyst to adopt more far-reaching policies to restrict the use of fossil fuels, just as the ban on tobacco advertising led to wider restrictions on smoking (Bouman et al., 2025).

3. Key intervention points and opportunities

A realistic assessment of broad public support, combined with decision-makers taking responsibility, contributes to effective climate action and a just transition, and increases the likelihood that policy measures will be implemented quickly and on a large scale. 1) establish and strengthen open, transparent and fair decision making procedures to strengthen procedural fairness and trust in the process. 2) more to come.

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Action Insight 4: **Appeal to human values and wellbeing to convey the need to transition. Frame transition away from fossil fuels as a moral, economic, and human health necessity that delivers energy security, greatly improved health, economic and fiscal stability, and prosperity for all.**

Further details:

I.) Fossil fuel pollution is a leading cause of avoidable premature death and ill health worldwide, which places an enormous burden on national economies and health systems. The human health and health-economic benefits of a fossil fuel phase-out will accrue rapidly, especially in countries that take the most decisive action. Main-Authors: Ed Maibach Group of countries the statement is most relevant to: All nations, especially those with the highest levels of fossil fuel air pollution.

I.1: System Outcomes

The current state:

Air pollution from fossil fuels is one of the world's leading causes of premature death and ill health, which places an enormous health economic burden on every nation (Brauer 2021; Hay 2025; Lelieveld 2019, 2020, 2023; Vohra 2021, 2025). The World Health Organization estimates that aerosol air pollution causes about 7 million premature deaths annually worldwide (WHO 2023), leading to monetary costs and welfare loss of approximately $8.1 trillion per year, roughly 6 percent of global GDP (Word Bank 2022). Additionally, increasingly high levels of CO2 and other greenhouse gas pollution from fossil fuel extraction, transportation, and combustion also cause serious health harms directly through rising temperatures and indirectly through other effects of climate change including increasingly dangerous storms and flooding, and increases in insect-, food-, and water-borne diseases, food insecurity and malnutrition, and mental health problems. Moreover, the full picture of health harms from fossil fuels is not yet known due to a relative dearth of research on many relevant topics including: health harms from non-combustion aspects of the fossil fuel lifecycle (exploration, extraction, processing, transportation, and disposal); fossil fuel pollution other than air pollution (water and plastic pollution); and non-fatal health harms including lifelong neurodevelopmental consequences for children (including reduced IQ, ADHD, autism: Zhang 2023) and impaired brain health for older adults (including Alzheimer's and other dementias and Parkinson's Disease)—although the existing research strongly suggests that each causes significant health harms and economic burdens. Together, these costs increase the long-term burden of fossil fuel-dependent development pathways.

Outcome of actionable insight implementation:

Unlike the climate benefits from fossil fuel phase-out, which accrue more slowly and distantly, the human health and health economic benefits from clean air accrue rapidly and locally, especially in countries with the worst air pollution and those that take the most decisive action (Romanello, 2022, 2025; Whitmee 2024). Rapidly accruing health benefits include reductions in asthma attacks, cardiovascular events, and associated emergency room visits and hospitalizations, while others unfold over decades—for example, avoidance of cognitive loss associated with exposure to air pollution during pregnancy and childhood (Bell 2025; Karlsson 2020; Markandya 2018; Reis 2022; Rice 2025; Roca-Barcello, 2024). These health improvements also produce substantial economic benefits. Research shows the economic value of health benefits may exceed the global costs of phase-out, possibly by a wide margin in some countries (Roca-Barcello, 2024; Sampedro 2020, Xie 2026). One study of 145 nations concluded that phase-out costs can be recouped in approximately one year (Jacobson 2022). Fossil fuel phase-out offers a win across many domains—a cleaner environment, less global warming, healthier people and less-strained, more affordable healthcare systems, and enhanced energy security (Rice 2025; Roca-Barcello, 2024; Thurston 2025).

I.2: Details and Background Information:

The health harms and health-economic costs of the fossil fuel lifecycle (exploration, extraction, processing, transportation, combustion, disposal) are often incompletely measured, if measured at all. Even when the health harms and their associated economic costs are known, they are rarely taken into account in energy policy decisions. Accounting for fossil fuels' health harms and associated economic costs, indexing the many health benefits of decarbonization, and making international, national, and subnational policymakers and program managers aware of this information is crucial for guiding energy policy and programmatic decisions. This evidence reveals substantial human health and economic advantages of clean energy over fossil fuel energy (Jacobson 2022; Xie 2026).

More fully accounting for and publicizing these health and related economic costs and benefits will also help build public support for a fossil fuel phase-out and may more fully activate the health community to advocate for a phase-out. Advocacy by health professionals and health organizations can play an important role worldwide in building the necessary political will for fossil fuel phase-out (Chan 2026; Desandi 2022; Kotcher 2021, 2023; Their 2025; Uppalapati 2026).

Policymakers should direct public health scientists (including epidemiologists and biostatisticians) and health economists to prioritize collecting, synthesizing, and publicizing data on the health impacts and health economic costs of the fossil fuel lifecycle and the benefits of phase-out in their nation, including the health gains and associated economic benefits from reduced fossil fuel pollution that some nations are already experiencing. In turn, policymakers should communicate these benefits to the public and other key stakeholders, encouraging further ambition for fossil fuel phase-out and protecting human and planetary health more broadly—including in their Nationally Determined Contributions (NDCs) under the Paris Agreement (Beagley, 2025). Only a small proportion of nations (about 10%) currently highlight the health and health economic benefits of decarbonization actions in their NDCs (WHO 2023). Every nation should initiate a process in which relevant experts—for example, in public health and medicine, electricity generation, transportation, agriculture, and the built environment—lead a public dialogue and develop an assessment framework to identify national decarbonization pathways that maximize human health, well-being, and prosperity.

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II) Zero carbon prosperity: renewable energies are naturally available, technologically feasible and financially affordable and enable employment, growth and wellbeing ensuring sustainability and prosper.

Main-Authors: Jiahua Pan and Jiaqi Lu

Group of countries the statement is most relevant to: (1) emerging and developing economics, particularly countries in the Global South with rapidly growing energy demand and expanding industrialization; e.g. Southeast Asia, Central Asia, most African countries; (2) oil and gas importing countries, in particular those with high reliance on fossil fuel import, subject to supply chain disruption; e.g. EU member states like Germany and France, Asian countries like China, India, Japan, and South Korea; (3) countries where prices of electricity and gasoline are high and unaffordable to low and middle income class; e.g. poor households in the developing and even in the rich worlds cannot pay high price of electricity

and oil. (4) countries that suffer health and social-economic losses from air and water pollutions from fossil fuels, including India and China.

II.1: System Outcomes

The current state:

The old development pathway depends on fossil fuels and centralized electricity systems built around coal and natural gas. This model requires high upfront capital investment and long construction timelines for both resource extraction and power generation infrastructure. Upstream oil and gas projects often require multi-billion-dollar investments and development timelines of 15–20 years from exploration to production (GEM 2026; IEA 2025). Compared to cheap utility scale and distributive renewable energy (IRENA 2025), coal- and gas-based electricity systems similarly require costly centralized plants and extensive transmission networks.

These large capital requirements create long-lived infrastructure that can lock countries into existing energy systems for decades, making energy expansion slower and more financially risky for rapidly growing economies (Lazarus and Van Asselt 2018; Klitkou et al. 2015; Steckel et al. 2015; Unruh 2000). Unfortunately, for the importing countries, even with all those expensive investments, the fossil-fuel supply chain is extremely vulnerable to disruption, as demonstrated in recent wars in Ukraine and Iran (Colgan et al. 2023; also see actionable Insight XYZ). Fossil-fuel-based energy systems also impose significant health and socio-economic burdens (see actionable insight ABC). The World Health Organization estimates that air pollution causes about 7 million premature deaths annually worldwide costing welfare loss for around $8.1 trillion per year, roughly 6 percent of global GDP (Awe et al. 2021). Together, these costs increase the long-term burden of fossil-fuel-dependent development pathways.

Outcome of actionable insight implementation: A zero carbon prosperity pathway can employ renewable energy, energy storage and flexible electricity systems to support economic prosperity, secure energy access, peaceful co-existence between nations and long-term wellbeing for all. Non-hydro renewable energy resources such as solar and wind are widely available and can be deployed more rapidly than fossil fuel infrastructure. Once they are installed, they can provide a stable flow of energy free from short term supply chain disruption. In recent years, renewable energy has become the dominant source of new electricity capacity worldwide, accounting for more than 90 percent of new global power capacity in 2024 (IRENA 20245). In fact, about 91 percent of newly deployed renewable projects now produce electricity more cheaply than fossil-fuel alternatives, with solar power 41 percent cheaper and onshore wind 53 percent cheaper than the lowest-cost fossil generation (IRENA 2025). Clean energy supply chains also generate strong employment growth. Globally, 34.8 million people now work in clean energy sectors, compared with 32.6 million in fossil fuel industries (IEA 2024). Together, these trends show that renewable-based energy systems can support sustained development (Dai et al. 2016; Omri 2015), job creation (Yuan et al. 2025; Zhang et al. 2024; Llera et al. 2013), and improved wellbeing (Jaiswal et al. 2022; Buonocore et al. 2016) while providing a more scalable and resilient foundation for long-term prosperity.

II.2: Details and Background information

Despite the growing economic and technological viability of renewable energy systems, many countries remain locked into incumbent fossil-fuel-dependent development pathways due to a combination of infrastructure and political inertia (Breetz et al. 2018; Aklin and Urpelainen 2018; Aklin and Urpelainen 2013), financial structures (Fisch-Romito et al. 2021), and institutional incentives (Buschmann and Oels 2019; Seto et al. 2016). Existing fossil fuel energy systems involve large-scale capital investments in extracting infrastructure (IEA 2025), power plants, pipelines, and transmission networks designed to operate for several decades (Semieniuk et al. 2022). Once built, these assets create strong economic incentives for governments and industry to continue using them to recover sunk costs (Auger 2021).

This infrastructure lock-in slows the adoption of alternative energy systems even when cleaner technologies become more competitive (Diluiso et al. 2021). Financial and regulatory systems also reinforce this dependence. Fossil fuel industries have historically received substantial government support through subsidies, tax incentives, and public investment in energy infrastructure. According to the International Monetary Fund, direct fossil fuel subsidies reached about $725 billion in 20224, representing roughly 70.6 percent of global GDP (Black et al. 2025). Such policies reduce the effective cost of fossil energy and make it more difficult for emerging clean technologies to compete on equal terms. Electricity system design further reinforces the existing pathway. Many national grids were built around centralized coal and gas generation, which require large baseload power plants and long-distance transmission systems (Xu 2016). Integrating variable renewable energy into these systems often requires grid modernization, expanded transmission networks, and energy storage capacity (Wu et al. 2021; Wagner 2019; Go et al. 2016).

These upgrades require additional investment and institutional coordination (Lin and Purra 2019; Aguero et al. 2017), creating short-term barriers even when renewable energy technologies themselves are cost competitive. It is often neglected within cost comparisons that also these aging fossil infrastructures would need reinvestment. Finally, concerns about economic stability and employment can slow the transition. Fossil fuel industries remain important sources of government revenue and employment in many regions, making policymakers cautious about rapid structural change (Aklin and Mildenberger 2020). These reinforcing feedback loops, including capital lock-in, subsidy structures, infrastructure inertia, and employment dependence, help sustain the existing fossil fuel pathway (Bücker et al. 2025; Lim et al. 2023; Steckel and Jakob 2021). Overcoming them requires coordinated policy reform, investment in modern electricity systems, and financial mechanisms that accelerate renewable energy deployment while supporting economic transition (Yanguas Parra et al. 2025; Hermwille et al. 2025).

III) Efforts to build public support and political will for a phase-out should emphasize health and feature a wide range of trusted health professionals.

Main-Authors: Ed Maibach

Relevant to all democratic nations.

III.1: System Outcomes

The current state:

Public support for phasing out fossil fuels is strong, although support levels vary considerably between nations: approximately three-quarters of people in much of the world support their country rapidly phasing out fossil fuels (IPSOS 2022, UNDP 2024), although support may be lower in Australia, China, Saudi Arabia, and some European and North countries (Globescan 2025). More generally, over two-thirds say responding to climate change should be a high or very high priority for their government (Leiserowitz 2023). The strength of public support is not necessarily politically decisive, however. It matters most when the issue is electorally salient (influences people's votes), proposed policies are credible and visible, support for the policies is strong (not only widespread), and trusted policy advocates actively counterbalance opponents to the proposed policies (Burstein 2003). Many of these conditions are not currently sufficiently present in most nations.

Outcome of actionable insight implementation:

Making the health case for fossil fuel phase-out has high potential to strengthen public support and political will for the phase-out. Fossil fuel pollution is the leading cause of avoidable morbidity and mortality worldwide, placing an enormous burden on every nation's economy (WHO 2023, World Bank 2022). Moreover, the human health and health-economic benefits of a fossil fuel phase-out accrue rapidly, especially in countries that take the most decisive action (Romanello, 2022, 2025; Whitmee 2024). Research conducted in several nations has shown that communicating the potential to improve health is one of the most effective strategies for increasing support for climate policy (Chan 2026; Desandi 2022; Goldwert 2026; Their 2025; Uppalapati 2026). As one of the—if not the—most trusted categories of professionals in nearly every nation (Edelman Trust Institute 2024; Ipsos 2024, 2025), health professionals (doctors, nurses, etc.) are ideal spokespeople to make the case for phase-out, bringing congruence between the message and the messengers (Maibach 2021, 2024; Temme 2026). Moreover, large numbers of health professionals (Kotcher 2021; Lee 2021) and more than 200 health organizations worldwide (GCHA undated) are interested in advocating for climate solutions, and many are already doing so. Efforts to build public support and political will for the fossil fuel phase-out should therefore heavily emphasize health and platform a wide range of trusted health professionals (Campbell 2025).

III.2: Details and Background information

Historically, the efforts to build public support and political will for—and against—climate action have been led primarily by scientists and scientific societies, environmental activists and organizations, political parties and politicians, and self-interested corporations and industry associations (especially the fossil fuel industry, which has nearly limitless financial resources with which to communicate its case against fossil fuel phase-out). Although proponents of climate action have been successful in building public concern about climate change and strong public support for a fossil fuel phase-out, opponents have been more effective at building the political will necessary to sustain the fossil fuel industry's status quo.

Health professionals and organizations have the potential to change this dynamic by communicating the health case for phase-out, including the health harms of fossil fuels and climate change, the health benefits of decarbonization, and the existing social norm that most people in most nations worldwide favor phase-out (Chan 2026; Desandi 2022; Kotcher 2021, 2024; Their 2025; Uppalapati 2026). Moreover, and importantly, when health professionals call attention to those who oppose climate action and a fossil fuel phase-out (i.e., fossil fuel CEOs and lobbyists who have long used deception and influence-peddling to oppose climate solutions), this strengthens public trust in the health professionals making the case for climate action (Kotcher 2023). Lastly, as credible voices in the health community become more vocal in making the health case for fossil fuel phase-out, additional members of the health community are likely to join in efforts to advocate for a phase-out (Lee 2021).

An evidence-based formula for effective public communication is "simple clear messages, repeated often, by a variety of trusted and caring voices" (Maibach 2023). The health community has simple, clear messages that have been proven effective at building support for phase-out, and it has myriad trusted, caring voices worldwide. For their messages and voices to be politically decisive, however, those voices must achieve higher levels of reach and frequency—i.e., message repetition (Ettinger, 2025; Peters 2022; Smith 2025). The health community should be supported in its efforts to communicate the health imperative of a fossil fuel phase-out. For far too long, the fossil fuel industry has used its financial resources to create and amplify voices in the media whose messages advocate climate denial and delay. What the world needs now is to use those same communication tools to make the health case for phase-out.

Key intervention points and opportunities

A distributed zero-carbon energy prosumer system in which solar and wind generation, battery storage, and electrified end-use technologies are integrated at the level of households, communities, business buildings, and industrial parks. 1) additional investment and institutional coordination, creating short-term barriers even when renewable energy technologies themselves are cost. 2) Include health related issues in climate change reports, economic assessments of climate change and political decision.

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Action Insight 5: **Take immediate measures to prevent future emissions. Ban new fossil infrastructure, mandate deep legally binding cuts to methane emissions in the energy sector, accelerate electrification of energy end uses. Inscribe fossil fuel phase down targets in NDCs while supporting renewable energy pathways in low-and middle-income countries.**

Further details:

To prevent infrastructure lock-in, states should immediately stop permitting all new fossil fuel infrastructure/projects. This would require immediate action that would be easy to verify, with benefits for accountability and trust-building.

Lead author: Fergus Green

System Outcomes

The current state:

Despite unprecedented state and corporate commitments to achieve net zero emissions by 2050 and growing talk of phasing out fossil fuels, fossil fuel consumption and production are still expanding and more than US$11 trillion was invested in fossil fuel infrastructure in the decade since 2015, the year the Paris Agreement was negotiated (IEA 2024; SEI, IISD, and Climate Analytics 2025; UNEP 2025). Governments attending the Santa Marta conference must not fall into the same trap of merely negotiating long-term objectives, as these facilitate the constant deferral of action.

Stopping new fossil fuel projects is an urgent priority. Once a fossil fuel project receives a final investment decision (FID), multiple economic, political and legal mechanisms work to "lock-in" those emissions for decades (see next section). Focusing international cooperation on this key "leverage point" (Meadows 1999) makes sense from a system-transformation paradigm of climate governance (Green 2025).

It is because of such lock-in mechanisms that the scientific community speaks of "committed emissions" from fossil fuel projects/infrastructure (Davis and Socolow 2014; Matthews 2014). Committed emissions from the world's existing fossil fuel projects (those already producing or that have received production consent or FID) would exceed the remaining global carbon budget for 1.5°C by a very long way (Trout et al. 2022; UNEP 2023). Developing new fossil fuel projects would therefore exacerbate that excess, making it extremely difficult to achieve the goals of the Paris Agreement (Muttitt, Green and Pye 2025; UNEP 2023).

Outcome of actionable insight implementation:

New fossil fuel capacity, moreover, is not needed: projected production from existing oil, gas and coal fields is sufficient to meet or exceed demand for those fuels in 1.5°C scenarios published by the International Energy Agency (IEA 2021), and in the vast majority of 1.5°C scenarios published by the Intergovernmental Panel on Climate Change (IPCC) that do not exceed IPCC feasibility and sustainability thresholds on carbon sequestration (Green et al. 2024).

The case against new fossil fuel projects is strengthened by the International Court of Justice's recent Advisory Opinion on climate change (van Asselt and Rao 2026).

Governments should therefore agree to immediately ban, or at least stop permitting, the development of new fossil fuel projects (i.e. stop licences for exploration and/or government approvals for development/production). This commitment should include extraction projects, mid-stream infrastructure (oil pipelines, gas terminals, coal ports, etc.) and large-scale consumption infrastructure (e.g., coal-and gas-fired power stations).

I.2: Details and Background Information

Investment in new fossil fuel projects by business corporations in market contexts is primarily driven by relative profitability (Christophers 2024). This relative profitability is a function of the regulatory environments in which fossil fuel investment occurs: typically, fossil fuel companies benefit from government subsidies and are enabled to shift their environmental and social costs (including of greenhouse gas emissions) onto third parties (Black et al. 2025). This regulatory environment is, in turn, shaped by the political activities of the fossil fuel industry and large fossil energy-intensive industries (Roberts et al. 2025), by states' geopolitical interests, by governments' responsiveness to consumer preferences for secure and low-cost energy (though those preferences are shaped in significant part by the fossil fuel industry's actions), and by political institutions (Hughes and Lipscy 2013). A key reinforcing feedback loop thus links the profitability of fossil fuel investments to the greater power of the industry to secure a policy environment that is conducive to yet greater profits (Green and Healy 2022).

The above causal factors explain why stopping new fossil fuel projects is challenging from a political economy perspective. Nonetheless, these factors are nowhere near as powerful as the economic, political and legal factors that ensure the "carbon lock-in" (Unruh 2000) of existing fossil fuel infrastructure once investors have sunk their capital into a new project (see Green et al. 2024). Stopping new projects is therefore much less difficult than phasing out existing ones.

Moreover, building international cooperation around a commitment to cease or ban new fossil fuel projects would catalyse favourable political-economy feedback effects (see Green et al. 2024): i) Because 'no new fossil fuels' embodies a concrete normative standard, it would help build an international moral, social and legal norm (Green 2018a, 2018b); ii) Because the commitment to cease or ban something creates an expectation of immediate policy action, the leaders making the commitment (not leaders decades in the future) can be held accountable if they fail to comply, making compliance much more likely (Green 2018b); iii) Accountability is further enhanced by the fact that state actions regarding fossil fuel projects, and the physical projects themselves, can easily be monitored and verified by third parties in real-time (unlike GHG emissions) (Green and Denniss 2018; Green and Kuch 2022). Furthermore, international cooperation predicated on such commitments can harness a "trust and verify" strategy that has proven effective in addressing other challenging multilateral issues, even in divided geopolitical contexts (Bell et al. 2012; Green et al. 2024); iv) By stopping new fossil fuel projects, states would undermine the fossil fuel industry's long-term profitability, reversing the pernicious feedback loop between profits, power and policy identified earlier (Butler-Sloss, Bond, and Benham 2021; Green et al. 2024). These feedback effects would make it more feasible to achieve the more demanding goal of phasing out existing fossil fuel projects and infrastructure.

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5-II) Major reductions in energy demand are needed for a rapid transition, and are consistent with increasing the energy services needed for a more prosperous and socially just world.

II.1: System Outcomes

The current state:

Existing outcome: In the current global energy system, two-thirds of primary energy is wasted in conversion processes and does not provide useful energy .

Outcome of actionable insight implementation:

Future outcome: Clean energy systems, based on efficient use of renewable electricity can halve waste and double the efficiency of primary energy use, by eliminating most waste heat (Eyre, 2021).

This change will enable significant growth in the services provided by energy, which is needed to improve living standards in the countries of the Global South, to be achieved whilst reducing global primary energy supply (Grubler et al, 2018). In OECD countries, the transition to an efficient electrified energy system will allow current European levels of energy services to be delivered with less than the current global average per capita final energy use (Barrett et al, 2021).

Switching from fossil fuel to renewables in electricity generation enables large reductions in energy waste in the energy sector itself, as solar photovoltaics, wind and hydropower result in very little energy waste, whereas fossil fuel and nuclear generation typically has an efficiency of less than 50%. And switching major uses of energy from direct use of fossil fuels to electricity has an even larger effect, as the main electrotech solutions - electric vehicles and heat pumps - are three to four times as efficient as the fossil fuel technologies they replace.

Energy demand can further be reduced without loss of welfare through similar changes in other systems. In the material system, waste reduction, reuse and recycling can lower demand for virgin materials and energy intensive processing. And in transport systems, moving away from private car use to mass transit and more sustainable modes reduces energy use without reducing mobility.

II.2: Details and Background Information

The energy transition to efficiently used renewable energy is more than a simple substitution - it is a system change in the broadest sense. Switching from fossil fuel to renewable power generation and switching major uses of energy from direct use of fossil fuels to electricity are mutually reinforcing through a positive feedback loop of renewable energy supply, electrification and higher efficiency use.

There are some important barriers to this type of change that need to be understood and taken into account. Although the overall economics of the transition are positive due to the declining costs of solutions based on efficiently used renewables, the scale of investment needed, both in energy supply and switching to electrified technologies, is high. This poses real issues for ‘capital poor’ participants in the system, notably countries of the Global South, low-income households and small businesses. The number of individual investments required is several billion, by diverse actors, some of whom are currently affected by misinformation and/or disinformation by malign actors. Across whole societies, rapid change can only be achieved with high levels of public support. Many of decarbonisation projects will need to be undertaken by small businesses and in the informal economy, where the supply chain capacity and skills levels do not currently allow change at the required speed. Although many of the technologies that need to be deployed are commercially available, there remain areas where improved technologies are required, e.g. aviation and some industrial processes.

Each of these barriers needs to be addressed. They also interact, and therefore failure to address any one can increase other barriers. The implication is that a package of public policies will be required in each country for transition to be feasible by mid-century.

III) Cutting fossil and other anthropogenic methane emissions could reduce temperatures by up to 0.3°C by 2050 and therefore a solid legally binding basis is needed.

System Outcomes

The current state:

An immediate and practical first step on the pathway toward phasing out fossil fuels is to stop wasting methane gas through routine flaring, venting, and leaks across the oil and gas sector (Saunois et al. 2025). Eliminating this waste is one of the fastest and most effective ways to slow near-term warming, reduce the risk of climate tipping points, and protect frontline communities. However, despite clear benefits and available technologies for methane mitigation, global methane governance remains inadequate. The Global Methane Pledge and the Oil & Gas Decarbonization Charter are not mandatory, and methane emissions continue to rise (UNEP 2025). Even if current Paris Agreement and Global Methane Pledge commitments were fully implemented, they would only deliver an 8% methane reduction below 2020 levels by 2030, far short of the 1.5°C pathway (UNEP 2025) To avoid or at least delay the many climate tipping points that are just ahead, it is critical to move from voluntary pledges and promises to binding methane measures at all levels of governance.

Outcome of actionable insight implementation:

Methane traps more than 80 times as much heat as CO2 over a 20-year period[18] and accounts for ~45% of current warming.[19] Unlike CO2, methane has a shorter atmospheric lifetime (~12 years),[20] enabling fast-acting climate benefits. Rapid methane mitigation this decade could avoid nearly 0.3°C of warming by the 2040s and slow the overall rate of warming by 30%.[21] Methane mitigation combined with tripling renewable energy and doubling energy efficiency by 2030 could halve warming rates by 2040 and limit peak warming at ~1.7–1.8°C.[22]

This was recognized in 2020 and 2021 when the European Commission and European Parliament called for a legally binding international methane framework [5]. In 2024, the European Union agreed on a landmark Methane Regulation that mandates binding mitigation in the fossil fuel sector, with implementation progressively increasing through 2030.[6] Several countries and sub-national governments have also enacted binding methane mitigation meanwhile [7][8][9].

Mandatory methane mitigation from fossil fuel operations would function as a climate emergency brake by slowing warming rates, avoiding or at least delaying irreversible tipping point risks, and creating the political and financial conditions necessary for a full, fair, fast, and funded fossil fuel phaseout.

III.2: Details and Background Information

Every fraction of a degree matters. However, current fossil fuel transition strategies focus almost exclusively on carbon dioxide (CO2). While deep decarbonization is crucial for long-term climate stabilization, CO2 reductions alone will not cool the planet quickly enough because reducing fossil fuels will also reduce co-emitted cooling aerosols. Because the co-emitted aerosols fall out quickly in days to weeks, this “unmasks” hidden warming that could add as much as 0.5°C by mid-century.[17] This highlights the urgent need to counteract near-term warming to reduce the threat of irreversible tipping points. In this context, reducing methane is the fastest way to slow warming in the near-term.

The energy sector offers the largest and most cost-effective methane mitigation opportunity,[25] responsible for ~35% of anthropogenic methane emissions.[26] (Actual emissions may be up to 80% higher than officially reported.[27]) Energy sector methane emissions could be reduced by 75% by 2030[28] at a cost equivalent to just 2– 4% of the energy sector’s net income in 2023.[29] i) The greatest potential is in the oil and gas sector, where the mitigation potential is 18–67 Mt CH4/yr.[30] Mitigation measures include eliminating routine venting and flaring,[31] mandating leak detection and repair (LDAR) systems,[32] and replacing high-emitting equipment with zero- or low-emission alternatives.[33] ii) In the

coal mining sector, the mitigation potential is 8–27 Mt CH4/yr.[34] Mitigation measures include pre-mining degasification, [35] methane oxidation,[36] and flooding of abandoned mines.[37] iii) Across the sector, robust monitoring, reporting, and verification (MRV) systems are essential to ensure transparency, accuracy, and enforcement.[38]

Methane mitigation also delivers major co-benefits. Reducing emissions lowers tropospheric ozone, preventing nearly one million premature deaths, avoiding significant crop losses, and reducing heat-related labor impacts—yielding substantial economic gains.[23] It also enhances energy security: capturing wasted gas (approximately 210 bcm annually) can ease supply constraints and reduce price volatility, while lowering the risk of conflict-related methane surges from damaged infrastructure.[24] Therefore, any roadmap away from fossil fuels risks being incomplete and ineffective without immediate, mandatory methane mitigation.

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[1] Coal bed methane is another priority for fossil fuel methane. Between 2010 and 2019, a third of fossil fuel methane emissions came from coal mines. Saunois M., *et al.* (2025) *Global Methane Budget 2000–2020*, Earth Syst. Sci. Data 17(5): 1873–1958, 1885 (Table 3).

[2] Nobre C. (31 March 2026) *Metano é o ponto de partida do fim dos combustíveis fósseis*, O Globo [Translation: *Methane Is the Starting Point for the End of Fossil Fuels*.] Nobre’s conclusion is reinforced by an essay by Henrique Bezerra, who stated: “The proposal led by Brazil to build a Global Transition Away From Fossil Fuels Roadmap — the TAFF Roadmap — marks a new level in the international climate debate. For the first time, countries are beginning to confront a question that has long been avoided: in what order should oil, gas, and coal be phased out, and based on which scientific criteria? To turn ambition into concrete action, it is essential to include in this equation what is currently the most overlooked—and paradoxically most powerful— factor in climate policy: methane (CH_4). … The most effective emergency brake we still have to slow global warming lies in the immediate mitigation of methane. Aggressive cuts in this super-pollutant over the next few years are among the very few actions capable of producing meaningful impact within the critical window that remains.” *See* Bezerra H. (27 March 2026) *O freio de emergência da crise climática tem nome: metano*, Valor [Translation: *The Climate Crisis Emergency Brake Has a Name: Methane*].

[3] United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 15 (“Methane’s atmospheric concentrations have more than doubled since pre-industrial times. According to new modelling for this report, global anthropogenic emissions of methane reached approximately 352 million tonnes (Mt) per year in 2020 and, under current legislation, are projected to continue rising, reaching 369 Mt per year in 2030, 5 per cent above 2020.”).

[4] United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 17 (“The NDC and MAP commitments, if fully implemented, would translate into a reduction of annual global anthropogenic methane emissions by up to 42 Mt by 2030 compared with the current legislation (CLE) for 2030, equivalent to 8 per cent below 2020 levels.”).

[5] Forster P., Storelvmo T., Armour K., Collins W., Dufresne J.-L., Frame D., Lunt D. J., Mauritsen T., Palmer M. D., Watanabe M., Wild M., & Zhang H. (2021) *Chapter 7: The Earth’s Energy Budget, Climate Feedbacks, and Climate Sensitivity Supplementary Material*, *in* Climate Change 2021: The Physical Science Basis, *Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Masson-Delmotte V., *et al.*

(eds.), Table 7.SM.7.

[6] Intergovernmental Panel on Climate Change (2021) *Summary for Policymakers*, *in* Climate Change 2021: The Physical Science Basis, *Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Masson-Delmotte V., *et al.* (eds.), Figure SPM.2. *See also* United Nations Environment Programme & Climate & Clean Air Coalition (2022) Global Methane Assessment: 2030 Baseline Report, 5 ("The Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment shows that human-driven methane emissions are responsible for nearly 45 per cent of current net warming. The IPCC has continuously emphasized the critical urgency of reducing anthropogenic emissions – from methane and from other climate pollutants – if the world is to stay below 1.5° and 2°C targets."). [7] International Energy Agency (2025) Global Methane Tracker 2025, 16 ("Methane (CH4) has a much shorter atmospheric lifetime than carbon dioxide (CO 2) – around 12 years, compared with centuries – but it absorbs much more energy while it remains in the atmosphere.").

[8] United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 8 ("Reducing human-caused methane emissions is one of the most cost-effective strategies to rapidly reduce the rate of warming and contribute significantly to global efforts to limit temperature rise to 1.5°C. Available targeted methane measures, together with additional measures that contribute to priority development goals, can simultaneously reduce human-caused methane emissions by as much as 45 per cent, or 180 million tonnes a year (Mt/yr) by 2030. This will avoid nearly 0.3°C of global warming by the 2040s and complement all long-term climate change mitigation efforts. It would also, each year, prevent 255 000 premature deaths, 775 000 asthma related hospital visits, 73 billion hours of lost labour from extreme heat, and 26 million tonnes of crop losses globally."). *See also* Ocko I. B., Sun T., Shindell D., Oppenheimer M., Hristov A. N., Pacala S.W., Mauzerall D. L., Xu Y., & Hamburg S. P. (2021) *Acting rapidly to deploy readily available methane mitigation measures by sector can immediately slow global warming*, Environ. Res. Lett. 16(5): 1–11, 1 ("Pursuing all mitigation measures now could slow the global-mean rate of near-term decadal warming by around 30%, avoid a quarter of a degree centigrade of additional global-mean warming by midcentury, and set ourselves on a path to avoid more than half a degree centigrade by end of century. On the other hand, slow implementation of these measures may result in an additional tenth of a degree of global-mean warming by midcentury and 5% faster warming rate (relative to fast action), and waiting to pursue these measures until midcentury may result in an additional two tenths of a degree centigrade by midcentury and 15% faster warming rate (relative to fast action).").

[9] Climate Action Tracker (2025) *Three key near-term actions could bend the warming curve; bringing projected warming below 2 °C*, ii, iii ("Unlike any other action taken by, or under, the Paris Agreement, tripling renewable energy by 2030, doubling the rate of energy efficiency improvements, and reducing methane would rapidly reduce the rate of warming in the next decade and result in warming peaking at 1.7–1.8°C. The rate of human-induced warming is currently (in 2025) around ~0.25°C per decade. These actions would reduce this by around 10% by 2030 and, when continued, essentially halve it by 2040. Contrast this with the fact that under governments' current policies, the warming rate even accelerates slightly by 2030 before very slowly declining—but warming will not peak this century and would continue increasing in 2100."; "The combination of reduced CO2 emissions—and the resulting slowdown in CO2 concentration in the atmosphere—together with rapid reductions in methane emissions, would slow and then rapidly reduce the human induced forcing of the climate system.").

[10] In 2020, the European Commission supported the coordination of international actions to rapidly reduce methane emissions as part of the EU Methane Strategy. *See* Communication from the Commission (14 October 2020) *On an EU strategy to reduce methane emissions*, 18 ("The Commission will contribute to a series of key international events in the build up to the UN General Assembly in New York in September 2021, with the objective of securing at that meeting a UN-based pathway to reduce methane emissions in the years 2021-2031. The goal will be to provide support for the coordination of international actions to rapidly reduce global atmospheric methane and promote longer-term action, notably through the creation of a legally-binding framework at international level for methane emission reduction."). The following year, in 2021, the European Parliament passed a resolution calling upon the European Commission "to suggest and negotiate a binding global agreement on methane mitigation at the COP26" in Glasgow. In that resolution, the European Parliament "calls on the Commission to make methane emissions reduction a top priority in its climate diplomacy and to … spearhead an international agreement on methane mitigation, promoting coordinated action to reduce methane emissions . . ." *See* European Parliament (2021) *European Parliament resolution of 21 October 2021 on an EU strategy to reduce methane emissions*, 2021/2006(INI)).

[11] *See* Regulation (EU) 2024/1787 of the European Parliament and of the Council of 13 June 2024 on the reduction of methane emissions in the energy sector and amending Regulation (EU) 2019/942, 2024 O.J. (L 2024/1787).

[12] At the sub-national level, Colorado and New Mexico have implemented stringent methane regulations in the U.S. *See e.g.* Venting or Flaring Natural Gas, 2 Colo. Code Regs. § 404–1-903 (2022); Drilling units - pooling interests, Colo. Rev. Stat. § 34-60-116 (2024); Venting and Flaring of Natural Gas, 19.15.27.8 N.M. Admin. Code (2022); *and* Hearing Officer's Report, 20.2.50 N.M. Admin. Code (2022). At the national level, Mexico and Canada have

established comprehensive national regulations for the oil and gas sector. *See e.g.* Disposiciones Administrativas de carácter general que establecen los Lineamientos para la prevención y el control integral de las emisiones de metano del Sector Hidrocarburos [General Administrative Provisions Establishing Guidelines for the Prevention and Integral Control of Methane Emissions from the Hydrocarbons Sector], Diario Oficial de la Federación [DOF] 06-11-2018 (Mex.); Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector), SOR/2018-66 (Can.); *and* Regulations Amending the Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector), SOR/2025-280 (Can.).

[13] Prime Minister Mia Mottley of Barbados and President Emmanuel Macron of France have led calls for a legally binding international agreement on methane modeled after the Montreal Protocol. During New York Climate Week 2025 at the Climate & Clean Air Coalition High-Level Solutions Dialogue on Methane, Prime Minister Mottley of Barbados stated that: "[A]s we go into COP[30], we … need a legally binding global agreement for methane reduction. … I feel that we do not need to reinvent the wheel. The Montreal Protocol that allowed us to reduce HFCs is the most successful climate agreement in history. We can replicate it…." President Macron of France agreed, stating: "We need binding objectives on methane. We know that this is a reachable goal…. This is the best way to reduce our emissions and it's also a G7 priority." The call for an international methane agreement among a coalition of the willing was echoed by President Wesley W. Simina of the Federated States of Micronesia and Prime Minister Feleti Teo of Tuvalu. At the Climate & Clean Air Coalition High-Level Solutions Dialogue on Methane, President Wesley W. Simina of the Federated States of Micronesia stated: "Voluntary methane pledges are failing to reduce emissions. Markets cannot align and polluters cannot be held accountable without stronger mandatory measures at national, regional, and global level. We need clear, predictable, mandatory approaches to ensure success. … [W]e have done this before. When the ozone layer was in crisis, leaders forged the Montreal Protocol—a binding, enforceable system that saved lives, created markets, and restored balance. We must summon that same courage for methane."; and Prime Minister Teo of Tuvalu stated: "Tuvalu therefore calls on major emitters to … step up methane action with binding commitment. … The ICJ Advisory Opinion on Climate Change has made it crystal clear that inaction is not just immoral, it is unlawful. Together, we must rise to the challenge of honoring both legal and moral responsibility in safeguarding our shared future and pulling the emergency brake on methane. Cutting methane is the fastest scalable way to slow global warming, avoiding up to 0.3 degrees centigrade of warming by 2040 and buying critical time for long-term CO2 decarbonization strategies to take effect."). [14] Lelieveld J., Klingmüller K., Pozzer A., Burnett R. T., Haines A., & Ramanathan V. (2019) *Effects of fossil fuel and total anthropogenic emission removal on public health and climate*, Proc. Nat'l. Acad. Sci. 116(15): 7192–7197, 7194 ("Finally, our model simulations show that fossil-fuel-related aerosols have masked about 0.51(±0.03) °C of the global warming from increasing greenhouse gases (Fig. 3)."). *See also* Intergovernmental Panel on Climate Change (2021) *Summary for Policymakers*, *in* Climate Change 2021: The Physical Science Basis, *Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Masson-Delmotte V., *et al.* (eds.), SPM-2 (Figure SPM.2c shows that Sulfur dioxide (SO2) contributes –0.49 °C (–0.10 to –0.93 °C) to observed warming in 2010–2019 relative to 1850–1900); *and* Dreyfus G. B., Xu Y., Shindell D. T., Zaelke D., & Ramanathan V. (2022) *Mitigating climate disruption in time: A self-consistent approach for avoiding both near-term and long-term global warming*, Proc. Nat'l. Acad. Sci. 119(22): 1–8, 1 ("We find that mitigation measures that target only decarbonization are essential for strong long-term cooling but can result in weak near-term warming (due to unmasking the cooling effect of co-emitted aerosols) and lead to temperatures exceeding 2°C before 2050. In contrast, pairing decarbonization with additional mitigation measures targeting short-lived climate pollutants (SLCPs) and N2O, slows the rate of warming a decade or two earlier than decarbonization alone and avoids the 2°C threshold altogether. These non-CO2 targeted measures when combined with decarbonization can provide net cooling by 2030, reduce the rate of warming from 2030 to 2050 by about 50%, roughly half of which comes from methane, significantly larger than decarbonization alone over this timeframe.").

[15] Intergovernmental Panel on Climate Change (2023) AR6 Synthesis Report: Climate Change 2023, *Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Arias P., Bustamante M., Elgizouli I., Flato G., Howden M., Méndez C., Pereira J., Pichs-Madruga R., Rose S. K., Saheb Y., Sánchez R., Ürge-Vorsatz D., Xiao C., & Yassaa N. (eds.), 42 ("Risks associated with large-scale singular events or tipping points, such as ice sheet instability or ecosystem loss from tropical forests, transition to high risk between 1.5°C–2.5°C (*medium confidence*) and to very high risk between 2.5°C–4°C (*low confidence*). The response of biogeochemical cycles to anthropogenic perturbations can be abrupt at regional scales and irreversible on decadal to century time scales (*high confidence*). The probability of crossing uncertain regional thresholds increases with further warming (*high confidence*)."). *See also* Lenton T. M., Rockstrom J., Gaffney O., Rahmstorf S., Richardson K., Steffen W., & Schellnhuber H. J. (2019) *Climate tipping points—too risky to bet against*, Comment, Nature 575(7784): 592–595, 594 ("In our view, the clearest emergency would be if we were approaching a global cascade of tipping points that led to a new, less habitable, 'hothouse' climate state11. Interactions could happen through ocean and atmospheric circulation or through feedbacks that increase greenhouse-gas levels and global temperature. Alternatively, strong cloud feedbacks could cause a global tipping point12,13.We argue that

cascading effects might be common. Research last year14 analysed 30 types of regime shift spanning physical climate and ecological systems, from collapse of the West Antarctic ice sheet to a switch from rainforest to savanna. This indicated that exceeding tipping points in one system can increase the risk of crossing them in others. Such links were found for 45% of possible interactions14. In our view, examples are starting to be observed. … If damaging tipping cascades can occur and a global tipping point cannot be ruled out, then this is an existential threat to civilization. No amount of economic cost–benefit analysis is going to help us. We need to change our approach to the climate problem. … In our view, the evidence from tipping points alone suggests that we are in a state of planetary emergency: both the risk and urgency of the situation are acute….").

[16] Climate & Clean Air Coalition & International Energy Agency (2023) The Imperative of Cutting Methane from Fossil Fuels, 9 ("Under the STEPS trajectory of fossil fuel demand, deploying all available methane abatement measures in the fossil fuel industry would avoid nearly 0.1 °C of warming in 2050 compared with a scenario with no additional methane abatement.").

[17] United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 28 ("Fossil fuels: release during oil and gas extraction, pumping and transport of fossil fuels accounts for roughly 23 per cent of all anthropogenic emissions, with emissions from coal mining contributing 12 per cent.").

[18] International Energy Agency (2025) Global Methane Tracker 2025, 4 ("As more measured data has become available, it appears that most national inventories are underreporting emissions: our estimate of total energy-related methane emissions globally is about 80% higher than the total reported by countries to the UN Framework Convention on Climate Change (UNFCCC). This gap is narrowest in Europe, where countries regularly submit inventories and some producers report emissions based on measured data.").

[19] International Energy Agency (2023) Credible pathways to 1.5 °C - Four pillars for action in the 2020s, 1–15, 11 ("In the NZE Scenario, methane emissions from the energy sector fall by around 75% between 2020 and 2030 and total methane emissions from human activity fall by around 45%. The IEA's latest update of its Global Methane Tracker found that methane emissions from oil and gas alone could be reduced by 75% with existing technologies. Around $100 billion in total investment is needed over the period to 2030 to achieve this reduction— equivalent to less than 3% of oil and gas net income in 2022. To address methane emissions from fossil energy production and consumption, countries covering over half of global gas imports and over one-third of global gas exports released a Joint Declaration from Energy Importers and Exporters on Reducing Greenhouse Gas Emissions from Fossil Fuels at COP27 calling for minimizing flaring, methane, and CO2 emissions across the supply chain to the fullest extent practicable.").

[20] United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 114 ("Energy sector measures have the highest annual costs in 2030, at nearly US$98 billion, and the required investments are capital intensive, requiring about US$96 billion per year in upfront investment. Of these totals, coal sector measures entail US$11 billion in annual costs and an upfront investment of US$3 billion per year. Upstream oil and gas interventions have estimated annual costs of US$6.6 billion and capital costs of US$6.5 billion per year, while midstream and downstream measures have annual costs of US$80 billion and upstream capital costs of US$87 billion. Relative to MTFR 2030 mitigation potential, upstream oil and gas measures are extremely cost-effective at US$0.12 billion per million tonnes of methane emissions reduced. The IEA provides alternative, lower estimates suggesting that around US$43 billion in total annual spending and around US$35 billion in new capital expenditure is needed annually for 2025–2030 to reduce energy sector methane emissions by 75 per cent (IEA 2025). Primary responsibility for investing in methane mitigation lies with fossil-fuel companies, and the varying estimates of annual costs represent just 2–4 per cent of the sector's US$2.4 trillion in net income in 2023 (IEA 2024).").

[21] United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7).

[22] Clean Air Task Force, *Oil and Gas Mitigation Program* (*last visited* 11 March 2026) ("Venting is even more harmful than flaring, since methane warms the climate so powerfully, and VOC and toxic pollutants are released unabated. Venting of this gas should be prohibited in all cases as an absolutely unnecessary source of harmful air pollution. There are numerous low-cost (and usually profitable) ways to utilize natural gas from oil wells. Flaring should be a last resort: only in the most extreme cases should oil producers be allowed to flare gas, and it should be strictly a temporary measure. Rules prohibiting venting of natural gas can easily reduce emissions by 95%."). *See also* International Energy Agency (2025) Global Methane Tracker: *Documentation*, 26 ("Policies designed to achieve zero non-emergency flaring and venting can reduce methane emissions by as much as 3 Mt CH4. Alternatives to flaring include transferring methane offsite via pipeline; capturing it for re-use on site; or compressing captured gas for transfer to processing facilities by truck. Clamping down on flaring can also sometimes create perverse incentives to vent – an even worse outcome from an emissions perspective. This underscores the importance of an integrated approach to flaring and venting policy. Another area often overlooked by regulators is the combustion

efficiency of flaring systems. When properly designed, maintained and operated, a flare should emit a minimal amount of methane. But malfunctions, as well as changes in weather or production conditions, can sometimes allow higher amounts of gas to escape. Occasionally, a flare may be totally extinguished, resulting in direct venting to the atmosphere of gas that should be combusted. New IEA analysis, included in the World Energy Outlook 2021, estimates that, in 2020, flares leaked on average around 8% of the natural gas and natural gas liquids that should have been combusted – more than double previous estimates. Incomplete combustion from flares accounted for about 10% of total oil and gas methane emissions, 95% of which was avoidable."); United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7); *and* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1).

[23] International Energy Agency (2025) Global Methane Tracker: *Documentation*, 22 ("Leak detection and repair (LDAR) programmes are the main mechanisms for mitigating fugitive emissions along the production, transmission and distribution segments of the value chain. The costs of carrying out inspections and undertaking repairs differ depending on the segment in question, since it takes longer to inspect a compressor on a transmission pipeline than in a production facility. It is assumed that inspections can be carried out annually, twice a year, quarterly, daily, or be based on continuous monitoring systems, with each option included as a separate mitigation option in the marginal abatement cost curves. Daily LDAR is used to tackle emissions from large leaks that occur sporadically such as those detected by satellites. Annual inspections are assumed to mitigate 40% of fugitive emissions, biannual inspections mitigate 60%, quarterly inspections mitigate 75%, and a continuous LDAR programme reduces fugitive emissions by 90%; based on current technology, it is assumed that the remaining 10% cannot be avoided."). *See also* International Energy Agency (2022) Curtailing Methane Emissions from Fossil Fuel Operations: *Pathways to a 75% cut by 2030*, 25 ("Leak detection and repair programmes are the main tool for addressing fugitive emissions from leaking components and malfunctioning equipment. The reduction potential of leak detection and repair programmes depends on their scope as well as the frequency of inspections and the inspection methods used. Current techniques often involve an on-the-ground inspection with optical gas imaging cameras, but new and emerging technologies – including continuous monitoring sensors, aircraft, drones and satellites – can significantly reduce the cost of detecting fugitive sources when combined with on-site surveys. The more frequently inspections take place, the sooner leaks can be detected and abated – but costs increase with frequency. For the purposes of this assessment, we assume on-site inspections take place once per quarter. We estimate quarterly leak detection and repair reduces fugitive emissions by about two-thirds – or about 5 Mt CH 4."); United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7); *and* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1).

[24] International Energy Agency (2022) Curtailing Methane Emissions from Fossil Fuel Operations: *Pathways to a 75% cut by 2030*, 25 ("Technology standards are designed to reduce emissions associated with the normal operation of certain equipment, such as compressors or pneumatic devices. There are a range of technologies that can perform the same function as these components, but with lower – or even zero – emissions. Regulations that set limits on emissions from certain types of equipment or that require their replacement with emission-free alternatives can significantly reduce methane. For the purposes of this analysis, this category includes mandates for installation of well-known technologies at new facilities or the replacement of higher-emitting components with these lower-emitting alternatives at existing projects. Adopting these measures in the committed countries would lead to a reduction of around 3 Mt CH4 of methane."). *See also* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1).

[25] United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7)

[26] International Energy Agency (2025) Global Methane Tracker: *Documentation*, 32–33 ("Higher-concentration sources of methane can be captured if measures are planned prior to the start-up of mining operations. Degasification wells and drainage boreholes can capture methane in coal reservoirs (coal seams or strata), reducing the potential of leaks during production. These systems can also be applied to working mines before operations move to new areas of coal exploration or after operations have ceased in an area. While underground mines hold the greatest potential for abatement through these systems, degasification programs have also been successfully applied to surface mines (see, for example, the case of North Antelope Rochelle Mine). … When the amount of drained gas is limited and there are no feasible alternatives to use its energy content, flares can combust methane to reduce its climate impact. Flare systems include open flares and enclosed combustion systems. This abatement measure is assigned to degasification systems of mines with annual emissions below 1 kt CH4. Flares are also used to handle the variability of methane flows in CMM utilisation projects. In this sense, this measure is also assigned to 10% of emissions from degasification systems in mines with drained CMM utilisation. Drained CMM utilisation includes several technologies that could be used at mines with total emissions above the

threshold established for flaring. This includes: • Degasification for power generation … • Degasification for pipeline injection … • On-site use in coal drying or mine boiler … • Combined heat and power generation … • Alternative and innovative technologies …"). *See also* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1).

[27] International Energy Agency (2025) Global Methane Tracker: *Documentation*, 34 ("Underground coal mines use ventilation systems to move fresh air into the mine, dilute methane released into the mine workings as coal is extracted and maintain safe working conditions. Methane concentrations are kept low inside mines to avoid explosion risks. As a result, ventilation air exhausts contain very low concentrations of methane (typically less than 1%). However, since these are generally large-scale systems with high flow rates, they are the largest source of CMM emissions. Ventilation air methane can be directed to processes such as blending or oxidation to make it usable as an energy source or destroy it. Ventilation air methane oxidation. Thermal or catalytic oxidation technologies are technically feasible at low methane concentrations (between 0.25% and 1.25%) and enable the destruction of VAM to reduce its climate impact. This is the abatement measure assigned to ventilation systems of mines with a methane intensity below 10 kgCH 4/t of coal or total annual CMM emissions below 10 kt. On-site recovery and use is the abatement measure assigned to ventilation systems of mines with methane intensities and total emissions above the thresholds established for VAM oxidation. Where methane concentrations are high enough and operational characteristics suitable, oxidation technologies allow for heat recovery. This recovered heat can support shaft heating during winter or coal drying systems. VAM can also be used a supplemental fuel, serving as combustion air for engines, turbines and boilers (see the US EPA's Ventilation Air Methane Utilization Technologies)."). *See also* United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7); *and* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1 Emissions control measures included in at least one of the mitigation analyses).

[28] International Energy Agency (2022) Curtailing Methane Emissions from Fossil Fuel Operations: *Pathways to a 75% cut by 2030*, 52 ("Mine flooding is the most effective way to reduce methane emissions from abandoned coal mines as it stabilises the hydrostatic pressure on the coal seams, leaving only residual emissions. In cases where flooding is not technically feasible due to site conditions, mines can be sealed, with drainage systems directing the emerging gas to use – similarly to what can be done before mines start operations. Regulations on mine closure and specific policies for legacy sites can ensure these measures are broadly applied."). *See also* United Nations Environment Programme & Climate & Clean Air Coalition (2025) Global Methane Status Report, 46 (Table 2.7); *and* United Nations Environment Programme & Climate & Clean Air Coalition (2021) Global Methane Assessment: *Benefits and Costs of Mitigating Methane Emissions*, 107 (Table 4.1).

[29] International Energy Agency (2025) Global Methane Tracker: *Documentation*, 36 ("Robust measurement-based monitoring regimes combined with additional regulations can encourage additional abatement. Within the IEA methane emissions model, additional measures correspond to the following abatement options: replace with electric motor; continuous leak detection and repair; daily leak detection and repair; monitor and plug abandoned wells; other. These actions can be driven by a combination of different policies, including enhanced technology standards, performance standards, emissions pricing, financing instruments, and monitoring, reporting and verification regimes. More information about these additional measures can be found in Curtailing Methane Emissions from Fossil Fuel Operations."). *See also* International Energy Agency (2022) Curtailing Methane Emissions from Fossil Fuel Operations: *Pathways to a 75% cut by 2030*, 42–44 ("Monitoring, reporting and verification regimes are a centrepiece of methane abatement strategies and will be key in driving further emissions reductions. We estimate that a global standard based on robust measurement could potentially lead to a reduction in methane emissions of close to 25 Mt if applied across the entire oil and gas industry. This would effectively remove barriers that prevent companies from addressing leaks and emissions that they are unaware of, allowing them to take advantage of the vast extent of cost-effective abatement opportunities (provided companies are able to prioritise capital for abatement and that infrastructure barriers can be addressed). More importantly, a functional and reliable monitoring, reporting and verification regime is a prerequisite for many policy tools that can drive deeper cuts in emissions in an efficient manner, including market-based instruments, performance standards and trade measures.... Better and more accessible data can enable further methane reductions, both in committed countries and other jurisdictions. However, current satellite technology has important limitations – including that they are impaired by cloud coverage and do not provide reliable measures in equatorial, offshore, and northern regions. Thus, a monitoring, reporting and verification regime should rely on a suite of measurement tools, building from the growing pool of available technologies that includes drone-based and other aerial surveys, ground-based surveys and continuous monitoring devices. These can support the detection of ongoing emissions events, verify the success of repair measures and facilitate enforcement actions.... We estimate that around 2 Mt of methane associated with large emissions events could be reduced using today's instruments and capabilities. This amount is poised to grow over time, as satellite detection matures and new instruments come online.").

[30] Climate & Clean Air Coalition & International Energy Agency (2023) The Imperative of Cutting Methane from Fossil Fuels, 13 ("Based on the Climate and Clean Air Coalition's models and methodology developed for the Global Methane Assessment, methane abatement in the fossil fuel sector in the NZE Scenario would reduce ozone exposure worldwide, avoiding nearly 1 million premature deaths through 2050, which is equivalent to the current population of Amsterdam, Netherlands. Reduced ozone would also avoid nearly million asthma-related emergency room visits and between 50 and 60 thousand hospital admissions for persons aged 65 and over. Reduced heat exposure would avert around 85 billion hours of lost labour, which is equivalent to 41 million fulltime jobs. The reduced ozone and the avoided climate change caused by reaching methane reduction targets would avert about 95 million tonnes of crop losses for wheat, rice, soy and maize (corn). These savings are equivalent to roughly 60% of the volume of wheat, rice, soy and maize produced in Africa in 2021.The economic benefits of avoiding these labour and crop losses, as well as additional losses in forestry due to reduced ozone exposure, provide direct economic benefits valued at more than USD 260 billion between 2020 and 2050, in addition to significant health benefits.").

[31] International Energy Agency (2022) The Energy Security Case for Tackling Gas Flaring and Methane Leaks, 3 ("Substantial gas resources currently are being produced that do not make it to market because they are lost to flaring and leaks across the oil and gas supply chain. Reducing flaring, venting and methane leaks would offer more immediate relief to gas markets than investing in new supply, bringing a double dividend: relief for very tight gas markets and reduced greenhouse gas emissions.1 We estimate that nearly 210 billion cubic metres (bcm) of natural gas could be made available to gas markets by a global effort to eliminate non-emergency flaring and reduce methane emissions from oil and gas operations.").

[32] The European Union, Japan, and Korea together represented slightly over half of natural gas imports in 2024. International Gas Union (2025) 2025 World LNG Report, 32–33 (Table 3.2). In July 2023, the European Commission, alongside the United States, Japan, South Korea, and Australia agreed to form a new monitoring mechanism for methane emissions from the LNG sector, called the Coalition for LNG Emission Abatement Towards Net Zero (CLEAN). *See* Japan Ministry of Economy, Trade, and Industry (19 July 2023) *Joint Statement on Accelerating Methane Mitigation from the LNG Value Chain*, Press Release ("To support the Coalition, Japan and the European Commission expressed their vision to create a globally aligned methane emission assessment of LNG projects and to incentivize methane mitigation by LNG producers by facilitating the information collection process of methane leakage counter measures and methane reduction targets announced by LNG producers, moving toward collection of methane emissions and emissions intensity data at the cargo, portfolio, and operator level").

[33] Zaelke D. (2026) *How the Montreal Protocol Saved the World Twice and Could Do it Again*, Env. Law Inst. 56: 10030, 10036 ("A binding agreement to limit methane emissions from fossil fuels could start with the European Methane Regulation,41 which comprises: strict standards for the EU market, including prohibitions on routine venting and flaring; extensive requirements on measuring, reporting, and verification; mandatory leak detection and repair; and robust performance standards. It also will set rigorous standards for imported oil and gas, which has global significance because the EU is their single biggest importer, with the United States as the biggest exporter into the EU. The next step would be to "multilateralize" the European standard to Japan and South Korea. These three jurisdictions represent over half of global natural gas imports.42 Once buyers align their methane gas import standards, such as reporting, data accuracy, and low methane intensity performance standards, they will have the market muscle to require sellers to meet them. A key advantage is that such a "Natural Gas Buyers Club" can exclude traditional blockers that might otherwise slow progress . . . Another step would be to link the Natural Gas Buyers Club to the Oil and Gas Decarbonization Charter.43 Launched at COP28 by 56 oil and gas companies, including 34 national companies, this included promises to cut routine gas flaring by 2030 and to reduce upstream methane leaks to near zero, defined as 0.2% or less methane intensity. These promises by producers representing nearly 40% of the market would match up well with the European Methane Regulation.").

[34] Hunter D. B., Salzman J. E., & Zaelke D. (*updated* 7 October 2025) *Chapter on the Climate Change Advisory Opinions*, *in* International Environmental Law and Policy (6th ed. 2022), UCLA School of Law, Public Law Research Paper, 3 ("A key contribution of the Advisory Opinions is the integration of climate science into the core of legal reasoning. The three Courts repeatedly cite the findings of the Intergovernmental Panel on Climate Change (IPCC), particularly regarding the dangers of passing the 1.5°C guardrail and the risks of crossing planetary tipping points. These findings are presented as binding benchmarks that shape the scope of States' obligations under international law. Scientific consensus on the serious and irreversible nature of climate damage thus shapes the legal conclusions of all three Opinions. Both the Inter-American Court of Human Rights and the Law of the Sea Tribunal address the danger of passing abrupt and irreversible tipping points such as the loss of ice caps and tropical forests, while the ICJ notes the IPCC's very high confidence that climate losses and damage will escalate with every additional increment of global warming. As the Inter-American Court of Human Rights explains, "[States] must take all necessary measures to reduce … risks derived … from the degradation of the global climate system." Because these risks are scientifically measurable, the requirement to follow the "best available science" becomes a legal standard. Climate science thus plays a normative role, defining the content of due diligence, the adequacy of

adaptation plans, and the effectiveness of mitigation measures. This approach represents a powerful convergence between law and science. By grounding legal duties in climate science, the Courts put climate science as a legal foundation to measure the pace and scale required by States actions to respond effectively to the climate crisis."); *discussing* *Obligations of States in respect of Climate Change*, Advisory Opinion No. 187, I.C.J., ¶ 254 (July 23, 2025); *Climate Emergency and Human Rights, Advisory Opinion OC-32/25*, Inter-Am. Ct. H.R. (ser. A) (May 29, 2025); *and Request for Advisory Opinion submitted by the Commission of Small Island States on Climate Change and International Law*, Advisory Opinion, ITLOS Rep. (May 21, 2024).

Action Insight 6: **Implement carbon pricing with international harmonisation and phase out fossil fuel subsidies. Use revenues to support the transition and reduce negative social impacts. Form international coalitions for implementation.**

Further details:

Details and Background Information

Insight III) Fossil fuel subsidies hinder the transition away from fossil fuels by distorting prices and diverting finance from clean energy. Effective reform requires careful planning, targeted support, and transparent communication.

Fossil fuel subsidy reform is for all countries as they are provided to both production and consumption and developed (mostly in the form of tax reductions) and developing countries (mostly in the form of prices set below market costs):

- *First movers: the 17-members of the* Coalition on Phasing Out Fossil Fuel Incentives Including Subsidies (COFFIS) are leading on this topic internationally. Launched by the Netherlands, the coalition includes Antigua and Barbuda, Austria, Belgium, Canada, Costa Rica, Denmark, Finland, France, Ireland, Luxembourg, Spain, Colombia, New Zealand, the Marshall Islands, Switzerland, and the UK.
- *Success examples: Various countries have made successful fossil fuel subsidy reforms over the past decade: this includes, among others, India, Indonesia, Zambia, Morocco, Nigeria, Egypt, Colombia, Sweden, Netherlands, Germany, Italy, and Canada (Gerasimchuk et al., 2025).*

System Outcomes

The current state:

In 2024, public financial support for fossil fuels totalled at least **USD 1.25 trillion**. This includes **USD 921 billion** in subsidies (budgetary transfers and tax expenditures) (Organisation for Economic Cooperation and Development & IISD, n.d.) and **USD 296 billion** in capital expenditure by State-Owned Enterprises (SOEs) (Jones, 2026). In addition, international public finance continues to flow toward fossil fuels, although it has decreased to **USD 37 billion** as of 2024 (Public Finance for Energy Database, n.d.). Despite reform efforts in some countries, these levels remain among the highest on record, underscoring how entrenched fossil fuel support remains within existing policy systems.

Fossil fuel subsidies are typically introduced to address objectives such as affordability, industrial competitiveness, or energy security, and many date back several decades. However, their scale and effectiveness are rarely reassessed in light of technological progress and evolving policy priorities. This leads to inconsistencies and outdated structures that continue to favour fossil fuel consumption and production. Reform efforts, where they occur, tend to be incremental and reactive—often triggered by short-term fiscal pressures or external shocks—and are frequently not durable, particularly when rising international prices increase pressure on governments to maintain affordability (Mahdavi et al., 2025).

Outcome of actionable insight implementation:

Moving beyond this requires greater transparency on all subsidy measures through comprehensive inventories and, based on this information, the development of robust reform strategies that enable sustained and systemic implementation (Kuehl et al., 2025; Urazova et al., 2025). These strategies should shift support away from fuels toward targeted support for people, particularly vulnerable households and businesses. Gradual and well-sequenced approaches can help cushion impacts, complemented by alternative policies or, where necessary, more targeted and time-bound subsidies during the transition (Beaton et al., 2013; Gencer & Arizu, 2024; IMF, 2013; Jonassen et al., 2023; McCulloch, 2023; OECD, 2021). Clear communication of the rationale, benefits, and use of public revenues is essential to build public trust and support, enabling more durable reform outcomes (Bharadwaj & Innocenti, 2026; Harring et al., 2023).

III-2: Details and Background information

The persistence of fossil fuel subsidies is driven by reinforcing political, economic, and institutional dynamics that create strong lock-in effects and make reform difficult, even when the long-term benefits are widely recognized.

A central feedback loop relates to the public sensitivity of energy prices. Fossil fuel subsidies lower end-user prices, increasing consumption and embedding reliance on fossil fuels across households and businesses. This dependence raises the perceived cost of reform, as removing subsidies translates into immediate price increases. Public opposition to reform efforts is quite common, particularly during periods of economic stress, creating political risk for governments (McCulloch et al., 2022; von Uexkull et al., 2024).

A second reinforcing dynamic concerns competitiveness. Energy-intensive industries benefit from subsidized fossil fuels, which lowers production costs and shapes investment decisions. Over time, this further locks in carbon-intensive economic structures and increases exposure to reform risks. Firms and industry groups, concerned about cost increases and international competition, actively resist subsidy removal. Governments, wary of potential impacts on jobs, trade, and economic stability, often maintain subsidies to preserve competitiveness, perpetuating the cycle.

Entrenched interests further strengthen these dynamics. Subsidies create concentrated benefits for specific actors—such as fossil fuel producers, utilities, and certain industrial sectors—while their costs are distributed across the broader public. These beneficiaries often have strong political influence and incentives to advocate for maintaining support, making reform politically challenging despite its broader societal benefits (McCulloch, 2023).

Institutional fragmentation adds another layer of complexity. Fossil fuel subsidies are often dispersed across multiple policy instruments and government bodies, including tax systems, pricing regulations, and sectoral policies. This fragmentation obscures their full scale and impact, limits accountability, and complicates coordinated reform efforts. Without clear ownership and comprehensive data, reforms remain partial and inconsistent. So far, only few countries established such structures, such as Italy which created an Interministerial Committee for Ecological Transition, chaired by the Prime Minister and advised by a Technical Support Committee, that coordinates and plans national policies for the ecological transition, including the elimination of fossil fuel subsidies (Italy Ministry of the Environment and Energy Security, 2024).

Together, these interconnected feedback loops—price sensitivity, competitiveness concerns, entrenched interests, and institutional fragmentation—create a self-reinforcing system that sustains fossil fuel subsidies. To break these loops and move to a system that supports people and not fuels requires coordinated, transparent, and well-communicated reform strategies that address underlying dependencies while building political and public support for lasting change.

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Literature:

STILL TO BE ADDED

Action Insight 7: **Establish enabling standards and monitoring requirements for fossil fuel transition targets and timetables. Mandate public reporting on transition trajectories and closure liabilities.**

Further details:

7-I) territorial emissions account for the full life cycle of extracted resources.

Lead-Author: Angela Carter

I.1: System Outcomes

The current state:

Currently, global emissions reporting is focused on territorial emissions. These account only for the emissions associated with extracting and burning fossil fuels. However, this approach obscures the emissions resulting from the consumption of fossil fuels that are exported (SEI et al. 2025). Further, fossil fuel reserve classification systems are designed to serve shareholders of individual companies. There is no systemic obligation to publish data which would enable better planning of the end of the fossil fuel era.

Outcome of actionable insight implementation: Accounting for both the territorial and exported emissions (Harrison 2015) using a full life cycle analysis—including extraction, upgrading, refining, transportation, and final consumption—will provide more clarity as to which governments and companies are most responsible for the fossil-fulled climate crisis and which must act to phase out extraction.

A revision of the PRMS classification (see below) allows governments to oblige extraction companies to include information on decline curves, abandonment liabilities and funding status, and emissions, amongst other things.

7-I.2: Details and Background information

Major fossil fuel producing countries continue to claim climate leadership, or bluntly deny the existence of climate change, while expanding oil and gas extraction domestically and abroad through subsidies (Morgan and MacNeil 2025; SEI et al. 2025). Extraction-based emissions accounting frameworks exist (Erickson and Lazarus 2013), but current UNFCCC global emissions accounting practices focused only on territorial emissions obscure the full responsibility of these countries (Moss and Pye 2025). This is especially important for producing countries like Canada (Janzwood et al 2026), Norway (Harrison and Bang 2022), and most crucially the United States (Wolf et al. 2025) which have the capacity to transition their energy systems and historical and current responsibility for emissions from their oil and gas sectors (Moss and Pye 2025), yet continue to expand extraction or see limited efforts to reduce production (Lujala et al. 2022). Justified by economic growth, energy security, or geopolitical dominance (Deberdt et al. 2025), as well as the ultimate responsibility of consumers for scope 3 emissions, this current state of affairs is locked-in by UNFCCC consensus-based rules and the obstruction of fossil fuel incumbents (Newell and Paterson 1998; Timmons et al. 2025). Supplier product responsibility (Wang et al. 2025) as well as climate loss and damage liabilities on profits from fossil fuel exports (Dellinger 2023) can inform climate and energy governance regimes, including supply-side mechanisms (Newell 2026). While such principles are pursued through ad hoc litigation and a growing body of international legal opinions (Gaulin and Le Billon 2020; van Asselt and Rao, under review), a more systematic approach requires major changes in power relations within climate negotiations.

Governments must improve how they report reserves. Now that policy makers, finance leaders, and the broader public understand the need to close down fossil fuel industries, new indicators must be applied to track expected production decline by field/project, asset-level break-even/economic limit assumptions (before and after carbon pricing), and the extent of decommissioning and closure liabilities.

II) Establish an extension of the Petroleum Resources Management System (PRMS)

Lead-Author: Johnny West & Kjell Kühne

II.i: System Outcomes

current state:

Fossil fuel reserve classification systems are designed to serve shareholders of individual companies. This has two major consequences: first, the companies themselves are the originators and main custodians of reserves data. Governments sit downstream of asset-level information flows; second, the current systems do not factor in end-of-life economics.

Outcome of actionable insight implementation: A task group will be convened to develop specifications to extend the PRMS and implement a pilot in several countries attending the Santa Marta conference. The group will include petroleum engineers and geologists, as well as government regulators. Once a pilot has delivered fuller insight into fossil fuel project economics - including information on abandonment liabilities decline curves, and capital expenditure planned for further development - demand for market intelligence can drive broader adoption.

II.2: Details and Background information

The Petroleum Resources Management System (PRMS), maintained by SPE and partner professional bodies (SPE/WPC/AAPG/SPEE/SEG/EAGE 2018), classifies reserves by commercial recoverability and geological certainty — reflecting its origins as a tool for investor disclosure, not public policy (Etherington et al. 2019; Hodgin and Harrell 2007). Securities regulators, notably the US SEC (2008), reinforce this by tying reserves to "existing economic and operating conditions," making the framework inherently backward-looking and company-centric. National systems like Russia's GKZ or China's GB/T 19492 share this limitation: they certify what is commercially viable today, not what the economics of decline and closure will look like (Poroskun et al. 2004).

The resulting information asymmetry is well documented. While the EITI (2019) has improved fiscal transparency, asset-level technical data — reserves estimates, production forecasts, development plans — remain proprietary, with governments dependent on company self-reporting (Manley and Heller 2021; Natural Resource Governance Institute 2017). Even Norway's Petroleum Directorate, among the most capable regulators globally, builds its resource accounts on licensee-submitted data (Norwegian Petroleum Directorate 2023). In weaker institutional settings the gap is wider still (Lahn and Bradley 2016).

The PRMS itself recognises in principle that classification depends on demonstrating economic viability: reserves must meet a "commercial" threshold requiring, among other conditions, "evidence of a firm intention to proceed with development within a reasonable time frame" and that the project is "economically viable" under "defined conditions" (SPE/WPC/AAPG/SPEE/SEG/EAGE 2018, §2.1.3). The architecture for lifecycle economics thus exists in principle. But in practice decommissioning liabilities are disconnected from reserves reporting (Kaiser 2017; Osmundsen and Tveterås 2003; UK National Audit Office 2019). Meanwhile, a significant share of proved reserves may become uneconomic under climate-constrained scenarios (McGlade and Ekins 2015; Carbon Tracker Initiative 2013; Mercure et al. 2018), yet classification systems continue to book these volumes as viable. Extending the PRMS's own economic viability criteria to incorporate decommissioning costs, decline curves, and capital expenditure still planned, would give governments the analytical foundation to manage the fiscal dimensions of the energy transition (Caldecott et al. 2016; Ingelson and Hunter 2014).

Key intervention points and opportunities

Countries also account for exported emissions and their future trends, as a complement to emissions within their national borders or due to subsidies to foster extraction abroad. 1) Revision of the PRMS classification to include information on decline curves, abandonment liabilities and funding status, and emissions.

2.) Exported emissions reported by states and companies should be independently verified by an arm-length auditing firm under an international tri-partite board including representatives from states, businesses and NGOs, akin to EITI (Extractive Industries Transparency Initiative) validation process (Rustad et al. 2017), under an international supply-side instrument.

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Action Insight 8: **Implement harmonised fossil fuel supply levies to incentivise demand shifts and fund just transitions. Track economic risks, pursue development benefits and ensure a fair, inclusive transition.**

Further details:

Implement harmonised fossil fuel supply levies to incentivise demand shift and fund transitions. Track economic risks, pursue development benefits and ensure a fair, inclusive phase-out.

Unchecked fossil fuel oversupply risks lowering prices, which incentivises consumption and delays electrification. Harmonised national supply levies allow governments to stabilise prices, aligning market signals with decarbonisation while capturing revenue for regional transitions. This coordination prevents non-participants from undercutting progress. Simultaneously, governments must transition from tracking production metrics to monitoring economic vulnerabilities, including stranded assets, revenue shortfalls, and decommissioning liabilities.

As global demand peaks, fossil fuel-dependent jurisdictions face significant fiscal risks that must be foregrounded to counter misinformation. The transition offers substantial rewards; clean energy investment now nearly doubles fossil fuel spending, creating millions of new jobs. Foregrounding these benefits—and ensuring worker-led, inclusive planning—is essential to overcome political resistance. By combining fiscal interventions with transparent risk-benefit analysis, producing regions can transform the inevitable decline of fossil fuels into a predictable, well-funded pathway toward economic diversification and long-term social welfare.

climate actors and ministries: *Ministries of Energy, Finance, Foreign Affairs, and Environment*

Lead-Authors:, Angela Carter[2], Frank Jotzo[1]

I) Adopt internationally harmonised fossil-fuel supply levies to prevent price erosion that prolongs demand, while directing revenues to support social, regional, and technological transitions in fossil-fuel-dependent communities.

I-1: System Outcomes

The current state:

- Prospect of decreasing price of fossil fuels as demand declines as anticipated
- Slow transition due to falling fossil fuel prices around 2030 and subsequently
- Erosion of government revenue and stranded infrastructure and assets in fossil fuel supplying countries

Outcome of actionable insight implementation:

- Stable or increasing fossil fuel supply prices as a result of harmonized fossil fuel supply levies
- Accelerated transition by avoiding falling prices
- Generating revenue for government which can be used to support communities and economic diversification away from fossil fuels

I-2: Details and Background Information

Demand for fossil fuels is anticipated to decline in the near term due to demand-side policies and the rise of alternative energy sources. Competition among fossil-fuel producers will drive prices down farther. This in turn would slow the transition to clean energy and electrification, and erode profits and government revenues, reducing options for public investment to support the transition, in a negating feedback loop. Stabilising prices through supply levies in a situation of declining demand becomes a key leverage point for accelerating the transition, by hastening the transition away from fossil fuels and providing greater opportunity for government support for the transition.

Insight details II) The economic risks to exporting governments of continued dependence on fossil fuel extraction—as well as the economic benefits of energy transition—must be tracked and foregrounded.

8-II.1: System Outcomes

The current state:

Global oil demand is anticipated to peak around 2030 then decline irreversibly (IEA 2025, p. 208), a trend acknowledged even by consultancy firms and oil companies (Wood Mackenzie 2024)(ExxonMobil 2024; BP 2024, p.31).

With falling demand, government revenues from oil, gas, and coal are jeopardized, with “major shortfalls in future revenue streams” expected for all oil-producing governments (Prince et al. 2023). However the more that governments are dependent on fossil fuel exports and revenues, the more they are vulnerable. Oil-producing governments, even in a “moderate-paced energy transition” based on the IEA’s Announced Pledges Scenario, stand to lose more than 50% of expected oil and gas revenue with the highest-cost producers bearing the largest losses (Prince et al. 2023, p. 1, 3).

In international coal markets, levies or taxes on coal production or exports, harmonized across the major exporters, could consistently yield significant tax revenues, possibly sufficient to offset reductions in quantities during a period of transition to leave coal exporting countries with a net sector level welfare gain approximated by the sum of producer surplus, consumer surplus, and tax revenue (Richter, Mendelevitch and Jotzo 2018). The resulting price uplift in the global coal market would also help reduce coal consumption. A unilateral export tax by contrast has a much smaller impact on global emissions and global coal prices as other countries would compensate for reduced export volumes from the taxing country (Richter, Mendelevitch and Jotzo 2018). This suggests the need for a coalition of major coal exporters.

Governments dependent on fossil fuel production are exposed to asset stranding. Losses would extend across economies but will fall predominantly on private investors, largely in rich countries, who face substantial exposure via pension funds and financial markets (Semieniuk et al. 2022).

Outcome of actionable insight implementation:

Fossil fuel supply levies can help keep fossil fuel supply prices stable or increasing, even with declining demand. To achieve this in international markets, supply levies need to be coordinated between major producers and especially exporters.

Avoiding falling fossil fuel supply prices helps accelerate the transition, by providing extra price based incentives for the shift to clean energy and electrification.

Fossil fuel supply levies also can generate revenue for government that can be used to support fossil fuel workers and invest in economic diversification in regions hit hardest by the phase out.

8-II.2: Details and Background Information

Global investment has already tipped from oil and gas toward clean energy. In 2022, for the first time in history, investment in wind and solar energy surpassed that in oil and gas (Coffin and Prince 2023). By 2024, global investments in clean energy were nearly double those in fossil fuels (IEA 2024c). The value of the clean technology market is expected to rival today's global crude oil market by 2035 (IEA 2024a, p. 19).

Building out a renewable energy economy represents extensive employment and economic diversification benefits. Jobs in renewable energy have more than doubled since 2012, now representing over 16 million jobs globally (IRENA 2025, p. 15). While the phase out of oil and gas production will result in job losses, they are more than replaced by jobs created from decarbonization sectors (IRENA & ILO 2021, p. 68). Meanwhile, jobs in oil and gas in major oil producing states are in decline (for example in Canada, Stanford and Bennett 2025).

The recent surge in oil profits given conflict in the Ukraine and Middle East is an anomaly. Given the pace and scale of renewable energy adoption, it is unlikely that the energy transition can be reversed.

Society-wide awareness about the risks of continued dependence on oil and gas extraction— and on the benefits of managing a phase out of the sector—is needed to counter misinformation by fossil fuel proponents that intervene in politics to slow energy transition to secure their short term profit benefits (Gentile and Gupta 2025; InfluenceMap 2024).

Governments dependent on fossil fuel extraction are increasingly vulnerable to stranded assets, therefore employment and revenue losses as well as to decommissioning liabilities (eg "orphaned" wells, fields and mines). Meanwhile governments that are transitioning their energy systems early are gaining a range of benefits (energy access, employment, revenue, and economic diversification).

Unless the oil and gas production phasedown is fair and inclusive, those who stand to lose from the change will oppose the transition. Phasing out the oil and gas sector is perceived as threatening particularly to workers in the sector and the unions and associations that represent them. Therefore, ensuring the phase out is equitable and building awareness about the job and broader socio-economic benefits of phasing out oil and gas production and decarbonizing energy systems is essential to energy transition. Workers and their unions/associations must be involved, or ideally take a leadership role, in energy transition (Gambhir et al. 2018; Healy and Barry 2017; Katowice Committee of Experts on the Impacts of the Implementation of Response Measures, 2022; Krawchenko and Gordon 2021; Normann and Tellmann 2021).

Uncertainties and trade-offs

Key questions for a new international legal instrument will include:

- How to ensure that any commitments made are fair and equitable, taking into account the challenging situation of lower-income, fossil fuel-dependent nations, as well as the rights and interests of affected communities.
- How to broaden participation to major fossil fuel producers over time? What kind of incentives can be included to induce participation (including both carrots and sticks)?

Policy recommendations (SMART)

1. Implement or strengthen carbon taxes or emissions trading schemes with broad coverage and policy settings geared for ambition.
2. Implement border carbon adjustments for traded energy intensive commodities to create an international level playing field.
3. Phase out subsidies on fossil fuel production and consumption.

4. Form international coalitions to cooperate on carbon pricing, border carbon adjustments and fossil fuel phase-out.

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Action Insight 9: **Leverage central banks' financial and price stability mandates to reduce the financing costs of clean energy, electrification and enabling infrastructure. Alongside other financing instruments, foster systemic clean energy integration to control inflation, underpin energy security and long-term economic resilience.**

Further details:

I) Central banks and financial regulators must act within their core mandates to reduce fossil fuel dependence and support a stable, renewable-based clean energy transition.

Lead author: Kjell Kühne, Nick Robins, Group of countries the statement is most relevant to: all countries

I.1 System Outcome

What is the current state: Over the past decade, central banks have adopted and developed analytical tools to assess climate related risks for financial stability, among other macroeconomic impacts. They have also introduced a growing range of policies and measures to manage the risks of climate change (and nature degradation) across their specific monetary, prudential and wider mandates (eg financial inclusion). Some central banks, such as China's PBOC, have taken action to mobilise capital for green transition opportunities for a new growth path (Zheng, 2025). Internationally, these actions are supported by guidance and tools (such as scenarios) from the Network for Greening the Financial System (NGFS). At COP30 in 2025, the NGFS highlighted "the rising economic costs of climate inaction" and reaffirmed its "commitment to supporting a well-managed transition" (NGFS, 2025). The dangers of fossil fuel dependency are rising up the agenda, notably price shocks (so-called fossilflation coined by the ECB's Isabel Schnabel). In some cases, domestic fossil fuel supply has cushioned external shocks, but this has not prevented volatility or broader spillovers to inflation, output and financial conditions.

At the same time, the capital intensive nature of the transition (such as the upfront costs of renewables) makes it highly sensitive to interest rates (particularly in developing countries). Rising interest rates to curb fossilflation will make clean energy investments harder to make, perpetuating fossil fuel dependency.

Outcome of actionable insight implementation:

The organisers of the Santa Marta Pre-Conference workstream on central banks are making three recommendations for consideration:

1. Commitment: Central banks and prudential supervisors should commit to take the necessary actions to support the transition away from fossil fuels in line with their mandates (including as part of national roadmaps).
2. Prioritised Actions: Central banks and supervisors should identify and implement prioritised actions to address the systemic instabilities of fossil fuels and support the TAFF. Reducing the cost of capital is key, particularly in the Global South. This could include de-risking clean energy investments by leveraging central banks' financial and price stability mandates. In addition, central banks could foster systemic clean energy integration to control inflation, underpin energy security and long-term economic resilience.
3. International Cooperation: To help share experience and strengthen international collaboration, a study group on the transition away from fossil fuels and financial stability, comprising central banks, policymakers and researchers should be established. The aim would be to identify key challenges, emerging practices and present recommendations for action. This task force could be co-hosted by the Network for Greening the Financial System and the research community. It would build on the successful model of the earlier NGFS-INSPIRE Study Group on Biodiversity and Financial Stability which resulted in nature becoming part of the NGFS priorities (NGFS & INSPIRE,

2022).

I.2: Details and Background information

Financial stability is at stake due to non-addressed climate-related financial risks, such as fossil fuel dependence. A narrow interpretation of central bank mandates could hold back a proactive engagement with the energy transition away from fossil fuels and thereby undermine financial stability. The Santa Clara conference as well as the development of an international Roadmap for the TAFF by the COP30 Presidency can help to establish a clear direction of travel, with a strategic signal of the key role that central banks will need to play.

Central bank actions to address fossil fuel instabilities and support the TAFF will cover all parts of their mandates, including monetary policy, micro- and macro-prudential policy, financial stability, research as well as international cooperation to support the greening of the financial system (see, for example, Borradores de Economía, 2024; IDB, 2024). In addition, individual central banks will need to consider the TAFF within their specific mandates, for example on financial inclusion and supporting broader government policies.

The current crisis has resulted in central bankers underscoring the risks that fossil fuel dependence pose for the core mandate of price stability (Elderson, 2026). Monetary policy tools that central banks could consider for the TAFF include collateral rules, preferential refinancing operations and broader approaches such as dual green interest rates (see Monnet & van't Klooster, 2023; ECB, 2025), as well as asset purchase programmes where design features can influence the relative cost of capital across sectors. In addition, innovative research proposals have been made, for example for a 'carbon bailout plan' (Kroll & Kühne, 2024). In terms of prudential policy, central banks and supervisors could explore how corporate and financial sector transition plans need to address scaling up clean energy investments and phasing down fossil fuels to minimize stability risks.

Cutting across these actions is the imperative of ensuring that the transition away from fossil fuels is just, orderly and inclusive (Monnin & Robins, 2022). For countries in the Global South, central bank mandates for financial inclusion are particularly important levers for guiding the transition (Rambarran, 2024; Volz & Knaack, 2023). The TAFF could also have implications for the short- and long-term scenarios developed by the NGFS, as well as the stress tests designed and implemented by individual central banks. Finally, in terms of international cooperation, the recommended Study Group on the Transition Away from Fossil Fuels and Financial Stability could focus on the particular priorities facing Emerging Markets and Developing Economies, with special consideration for those that have large fossil fuel endowments. These countries face elevated costs of capital and require transformational solutions to deliver the $1.3trn in international financial flows required each year by 2035 (UNFCCC, 2025). The NGFS has previous experience in examining similar international cooperation issues, such as blended finance (NGFS, 2023).

II) **Renewable-based zero carbon energy production**, mostly distributed and combined with storage and efficient end use technologies, is a cheap and universally applicable solution, which provides affordable energy access and energy security locally and transitions energy systems away from fossil fuels globally.

Lead author: Jiahua Pan and Jiaqi Lu

Group of countries the statement is most relevant to:

(1) developing countries, in particular those with large populations lacking access to electricity; e.g. many Sub-Saharan African and central Asian countries;

(2) Oil-importing economies that rely heavily on imported fossil fuels and therefore face high exposure to supply disruptions and price volatility, including EU member states, as well as East Asian economies such as China and South Korea;

(3) Countries where electricity and fuel prices impose a heavy burden on households, especially low- and middle-income populations in both developing and developed economies that struggle to afford rising electricity and gasoline prices;

(4) Countries rapidly expanding renewable energy capacity, including many European and developing economies, where declining costs and improved resource availability have accelerated deployment but where intermittency remains a major challenge for stable and reliable electricity supply;

(5) Countries with growing battery storage markets, such as Germany and China, where power batteries are increasingly used for energy storage at both household and industrial levels, but where integration with renewable generation and end-use consumption remains a key challenge;

(6) Countries piloting integrated zero-carbon energy systems, particularly China, where technologies have matured and market deployment is accelerating.

II.1: System Outcomes

The current state:

Geopolitics has long accompanied fossil fuel extraction and supply, making energy systems vulnerable to conflict and market shocks (Van de Graff 2026; Slothuus 2026). Recent events illustrate these risks. The Russia–Ukraine war caused severe damage to Ukraine's energy infrastructure, with reconstruction needs estimated at USD 90.6 billion (World Bank 2026). Meanwhile, the 2026 Iranian Crisis disrupted global energy markets, threatening about 19% of global LNG supply linked to Qatar and placing around 20% of global oil shipments through the Strait of Hormuz at risk, contributing to oil price increases from roughly $ 60 to to more than $ 100 per barrel within a few days. In the UK for instance, the cost to the economy of a single energy price shock from the Ukraine conflict is estimated to be more than the entire cost of the net zero-transition (CCC, 2026).

Industrialized countries rely on capital-intensive centralized electricity systems, while many developing countries remain price-takers in global energy markets and lack the financial and technological capacity to build reliable domestic supply. Large thermal power plants and national grid networks also require substantial capital investment, advanced technologies, and skilled labor.

As a result, energy poverty remains challenging in large parts of the developing world. About 16% of the world's rural population lacks access to electricity, and deficits are particularly severe in Sub-Saharan Africa, where some countries have electrification rates below 10% (World Bank 2024), partially because centralized grid expansion remains costly and slow. In addition, large, inflexible, centralized power systems are vulnerable to cascading failures caused by extreme weather events and market disruptions (Panteli and Mancarella 2015, Karagiannakis et al. 2025).

Climate-change impacts on energy sources and infrastructures are expected to grow sixfold by mid-century, and to amount to more than ten times the present damage of €3.4 billion per year by the end of the century (Forzieri et al. 2018). Electricity demand is also expected to grow rapidly with increasing electrification and the expansion of AI data centres.

Outcome of actionable insight implementation:

A distributed zero-carbon energy system in which solar and wind electricity generation, battery storage, and electrified end-use technologies are integrated at the level of households, communities, commercial buildings, and industrial sites. Renewable resources are widely available and increasingly affordable. Over the past 15 years, the cost of solar power has declined by about 90%, wind power by 70%, and battery storage by roughly 95% (IRENA 2025a), allowing solar, wind, and storage technologies to compete directly with conventional thermal power generation.

In some regions, the levelised cost of electricity from solar PV has fallen to about $ 0.015 per kWh, much more attractive than fossil fuel alternatives. Distributed renewable prosumer systems are already expanding (Fox 2023). In Germany, more than 75% of installed batteries are used for residential storage, while “Bring-Your-Own” generation models in the United States enable consumers to produce electricity through rooftop solar systems. China is accelerating deployment through zero-carbon industrial parks and demonstration projects, integrating renewable generation, battery storage, and digital energy management platforms.

Between 2020 and 2035 the number of countries in the world rises from 90 to 140 where self-consumption of solar PV electricity from residential rooftops costs less than grid supply (Keiner et al. 2023). Smart inverters, digital platforms, and peer-to-peer electricity trading allow decentralized coordination and bidirectional power flows. Distributed nodes could allow independent operation during disturbances and collectively strengthen grid resilience against climate risks and market volatility (RMI 2025). Systems can also scale rapidly as demand from electrification increases. Together, these developments show how a zero carbon energy prosumerage system can enhance energy security, reduce costs, and accelerate the transition away from fossil fuels.

II.2: Details and Background

Current lock-in results from a reinforcing cycle among fossil fuels, geopolitics, infrastructure inertia, and institutional path dependence (Newell et al. 2026). First, geopolitical conflicts and energy prices create a self-reinforcing feedback loop. The 2026 Iranian crisis placed roughly 20% of global oil supply at risk, while the ongoing Russia–Ukraine war has caused massive damage to Ukraine’s energy infrastructure, with reconstruction needs estimated at $90.6 billion (World Bank 2026). Each crisis pushes fossil fuel prices higher, strengthening short-term incentives for continued investment in fossil fuel extraction and delaying energy transition.

Second, existing infrastructure creates a sunk-cost trap. Industrialized countries have built capital-intensive centralized electricity systems designed to operate for decades. Utilities and grid operators therefore prioritize maintaining existing assets rather than adopting disruptive alternatives. At the same time, centralized grids remain vulnerable to cascading failures caused by extreme weather events and system disruptions (Dyson and Li 2020). Developing countries face a different constraint: many lack the capital and technical capacity to build large, centralized grids, yet remain dependent on imported fossil fuels and volatile global energy markets, resulting in both electricity access deficits and price instability (Foster et al. 2021).

Third, distributed energy systems face institutional inertia. Despite dramatic cost reductions in solar PV, wind power, and battery technologies, electricity markets, regulatory frameworks, and pricing systems remain structured around centralized power generation. Distributed systems require new market rules, technical standards, and financing mechanisms. Re-design of regulations of the electricity industry takes time. Digital technologies offer solutions—encrypted energy trading and smart grid platforms demonstrate the potential for bidirectional electricity flows and decentralized coordination (Hussain et al. 2025).

The International Energy Agency estimates that distributed energy resources could provide around 30% of future power system flexibility (IEA 2025a), yet regulatory reforms lag technological progress. Fourth, energy system modeling has shown that solar PV prosumers are part of a least-cost energy system (Benalcazar et al. 2024; Kirchem et al. 2025). Solar PV prosumer solutions can cover end-user electricity demand, can contribute to heat demand via effective heat pumps or electric boilers, and can contribute to charge battery-electric vehicles (Keiner et al. 2023; Rahdan et al. 2024). Solar PV electricity revolutionized the end-user electricity supply in Pakistan (Bourgault and Moin 2025), where the fastest solar PV ramp-up in history can be currently observed, driven by high energy demand, high prices, low-cost solar PV and batteries, and self-empowerment of people.

The solar prosumer system provided stable and reliable electricity supply, even in conflict zone (Al-Attar 2024). Fifth, other lower carbon options - nuclear and fossil fuel with CCS - cannot deliver anything like the required output on the required timescales or at an acceptable cost, considering the cost of nuclear power is much higher than that of renewables (IEA 2025b, IRENA 2025b). CCS technologies lock in fossil fuel and energy price shock dependence. The costs of these technologies are high and are not coming down as fast as electrification costs (e.g. PV and batteries). Breaking this lock-in requires both technological integration and institutional innovation. Demonstration projects such as China's Huanghua Port and Xining industrial park illustrate how integrating renewable electricity generation, battery storage, and digital energy management can create resilient distributed energy systems.

Fortescue, an Australian mining company, aims to electrify its operations to run off solar power by 2028 saving $1billion of diesel a year. The UK is aiming to have 95% low-carbon electricity generation by 2030. Uruguay replaced 99% of its fossil fuel-based electricity with renewables in just a decade. Scaling such models worldwide requires modernized and decentralized grid operations, supportive market frameworks, and regulatory reforms that enable distributed energy participation (IEA 2025a). Ultimately, energy security must shift from a model relied on centralized supply toward one based on resilient, interconnected, and decentralized energy systems.

3. Key intervention points and opportunities

A distributed zero-carbon energy prosumer system in which solar and wind generation, battery storage, and electrified end-use technologies are integrated at the level of households, communities, business buildings, and industrial parks. 1) Adequate regulatory reforms, technical standards, and financing mechanisms are needed. Consider digital technology solutions: For example, encrypted energy trading and smart grid platforms demonstrate the potential for bidirectional power flows and decentralized coordination 2) Include central banks in the investment workflow to enlarge the RE-investment sum and stabilize inflation and omit "fossilflation".

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Action Insight 10: **Strengthen international cooperation on transitioning away from fossil fuels within and outside the UNFCCC, including through the possible adoption of a dedicated international legal instrument on fossil fuel supply.**

Further details:

System Outcomes

current state:

It has long been acknowledged that international cooperation is essential to address collective action problems such as climate change (Patt et al. 2022). The transition away from fossil fuels likewise requires international cooperation. However, international climate cooperation through the UNFCCC process has largely avoided addressing the role of fossil fuels as one of the primary drivers of climate change. In recent years, this has begun to change with a recognition of the importance of transitioning away from fossil fuels, as well as the need for phasing out inefficient fossil fuel subsidies and unabated coal-fired power.

The importance of addressing fossil fuel supply were further emphasised in the 2025 Advisory Opinion by the International Court of Justice, which suggested that fossil fuel production, fossil fuel consumption, the granting of fossil fuel exploration licences or the provision of fossil fuel subsidies may constitute international wrongful acts (ICJ 2025). These high-level signals have however not been accompanied by any mechanisms or processes under the UNFCCC to address fossil fuel supply in light of the Paris Agreement goals (Piggot et al. 2018; van Asselt and Green 2023). This gap has to a limited extent been filled by "clubs" involving a limited number of states, addressing oil and gas production (Beyond Oil and Gas Alliance, BOGA), coal-fired power (Powering Past Coal Alliance, PPCA), fossil fuel subsidies (Coalition on Phasing Out Fossil Fuel Incentives Including Subsidies, COFFIS), public finance for fossil fuels (Clean Energy Transition Partnership), and just energy transitions (Just Energy Transition Partnerships, JETPs) (van Asselt and Newell 2022; Koppenborg 2025).

What is still missing, however, is a comprehensive international framework that would govern a just and orderly transition away from fossil fuels. Such an international framework can complement the UNFCCC and Paris Agreement by offering a clear direction of travel for both states and non-state actors on phasing out fossil fuels and the imperative of limiting new fossil fuel infrastructure, ensure fairness and equity in the transition, strengthen transparency and accountability for states and non-state actors, and provide for implementation mechanisms, including access to clean technology and finance.

Outcome of actionable insight implementation:

International cooperation on fossil fuel supply is crucial for providing financial and technical support to fossil fuel-dependent states that have limited capacity to shift to alternative energy sources. International cooperation can help to avoid the risk of stranded assets and stranded nations by ensuring that fossil fuel-dependent states plan for a future under the carbon constraints needed to keep global warming below 1.5 °C (Bos and Gupta 2018). International cooperation can further mitigate the problem of leakage, where the reduced fossil fuel supply by one state would partially be substituted by another (Harstad 2012; Fæhn et al. 2017; Asheim et al. 2019), helping to ensure the effectiveness of a fossil fuel phase-out.

International cooperation on transitioning away from fossil fuels should continue under the UNFCCC process, which offers a range of opportunities, such as the inclusion of fossil fuel supply-side commitments and plans in Nationally Determined Contributions and long-term strategies (Piggot et al. 2018; Jones and Yanguas Parra 2024). Moreover, efforts through existing clubs such as BOGA and COFFIS should be strengthened. This should be complemented by a comprehensive international governance framework on fossil fuel supply, which can take the form of a dedicated international legal instrument on fossil fuel supply. Such a framework can offer a clear direction of travel for both states and non-state

actors by setting out an objective and principles governing the transition away from fossil fuels.

Such a framework can further ensure fairness and equity in the pursuit of transitions away from fossil fuels, among others by providing for the participation by affected communities. It can also strengthen transparency and accountability for states and non-state actors through monitoring, reporting, and review. Lastly, it can provide for implementation mechanisms, including access to finance and clean technologies, to support the transition in countries with lower capacities.

2: Details and Background information

The development of an international framework to govern the just and orderly transition away from fossil fuels can follow different - though not mutually exclusive - pathways. A first pathway consists of strengthening existing clubs to ensure they achieve their goals and gradually expand their membership. The dynamic and informal nature of clubs can facilitate a speedy response, including to changing scientific insights and political conditions.

However, this approach could result in a patchwork of initiatives that on their own would not be able to deliver systemic change, and where backsliding following changes in national governments remains a real risk (van Asselt and Newell 2022; Newell 2026). A second pathway would be to operationalise the signal of "transitioning away from fossil fuels" through the UNFCCC and Paris Agreement, for instance through the development of fossil fuel phase-out roadmaps, sharing experiences under existing work programmes, or expressly addressing the issue at the second global stocktake. Multilaterally agreed rules would confer those rules with a high degree of legitimacy.

However, such efforts will be inherently limited by the prevailing consensus-based decision-making process: with the very mention of "fossil fuels" in COP decisions remaining contested, any rule development remains unlikely in the foreseeable future. A third option is therefore to develop a new international legal framework governing the transition away from fossil fuels outside the context of existing international forums. This could be in the form of a legally binding treaty or a soft law instrument addressing fossil fuel supply. Suggestions in the literature include a dedicated coal elimination treaty (Burke and Fishel 2020) as well as a fossil fuel non-proliferation treaty (Newell and Simms 2020; Newell et al. 2022).

Key questions in developing a new legal framework concern the trade-off between depth (i.e. stringency of commitments) and breadth (i.e. participation), as well as the strategy of how to grow both over time (Barrett 2005; Bodansky and van Asselt 2024). Initially, an international legal framework could be "narrow but deep", involving a limited set of participating states that sign up to deeper commitments (e.g. in the form of more stringent obligations or more clearly legally binding obligations). Incentives, including economic ones (e.g. trade measures, financial support mechanisms) or reputational (e.g. naming and shaming non-participants) would be needed so as to grow participation over time.

Because of the ease of third-party verification of fossil fuel production (volumes) and fossil fuel projects, this increases the likelihood of state compliance and provides a basis for ratcheting up cooperation over time through a reliable "trust but verify" strategy, and largely avoiding interminable debates over "transparency" of greenhouse gas emissions under the UNFCCC (Green and Kuch 2022). Alternatively, an agreement could start "broad but shallow", aiming to secure wide participation but with less stringent or non-legally binding commitments, for instance through the adoption of a soft-law instrument. Again, over time, those commitments could be "hardened", either by changing the legal form of an instrument or by accompanying non-binding instruments with follow-up mechanisms such as reporting and review. Another way of balancing between "narrow but deep" and "broad and shallow" would be to limit the scope of an international agreement by focusing on a particular issue, such as a commitment to not support any new fossil fuel projects (Green et al. 2025).

3. Key intervention points and opportunities

The aim is for states to acknowledge the clear international governance gap on fossil fuel supply, and to pursue concrete efforts to advance international cooperation on transitioning away from fossil fuels, not only through the UNFCCC process but also through exploring a dedicated international legal instrument on fossil fuel supply. To achieve this, states can agree to initially discuss the broad objective, scope, and principles of a dedicated international legal instrument on fossil fuel supply, including its complementarity to the UNFCCC/Paris Agreement and existing international cooperative efforts.

As an alternative, countries involved in clubs can seek to broaden participation or deepen commitments made.

Key questions for a new international legal instrument will include: - How to ensure that any commitments made are fair and equitable, taking into account the challenging situation of lower-income, fossil fuel-dependent nations, as well as the rights and interests of affected communities. - How to broaden participation to major fossil fuel producers over time? What kind of incentives can be included to induce participation (including both carrots and sticks)?

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Action Insight 11: **Integrate all forms of knowledge and development imperatives in planning for just transitions. Define success through tangible social progress and improved human welfare.**

Further details:

I.1 System Outcomes

current state:

Many people and communities are suffering the consequences of fossil fuel extractivism and renewable energy (RE) generation (including pollution of land, water and broader ecosystems, displacement, health challenges, human rights abuses etc) and yet do not benefit from the promised potential of such activities nor are they included in negotiating such benefits (Corral-Montoya et al., 2022). Instead, fossil fuel phase-out is driven by market forces and corporate decisions, resulting in abrupt closures, social disruption, and uncoordinated public responses (Cardoso et al.,2026). This primarily manifests through planning and decision making processes that excludes affected communities who are purported beneficiaries of these plans and decisions (Gudynas, 2018).

Outcome of actionable insight implementation:

Given the history and persistent experiences of marginalization and social exclusion that communities impacted by extractivism encounter, clear mechanisms for meaningful stakeholder engagement need to be instituted to guide the transition away from fossil fuels, in respect of local worldviews and territorial autonomy with long-term territorial development and community-led development. Such mechanisms should avoid technocratic approaches to engagement in order to prioritize the needs and interests of communities. This could include government-sanctioned public interest committees and gender-based consultative groups that will serve as a forum for engagement but also a conduit between community needs and high-level policy priorities.

I.2 Details and Background information

Dominant transition frameworks reproduce coloniality by separating nature from culture and privileging Global North priorities (Álvarez & Coolsaet, 2020; Lang, 2024). Consultation processes often become coercive or symbolic, deepening mistrust and marginalization (Rougeon et al., 2023). Decolonisation is inhibited by epistemic hierarchies that devalue non-Western knowledge and by market-driven transition narratives that prioritise speed and scale over justice (Segovia-Tzompa et al., 2024; Newell et al., 2022). However, projects that do not respect procedural, recognition and distributional justice are likely to spark socioecological conflicts (Scheidel et al., 2018). Most importantly, socioecological conflicts negatively impact the local community, but they also affect the project proponents reputation, and crucially, they delay project implementation (Larsen et al., 2018). Therefore, fairness and speed are not necessarily incompatible, rather just transitions can be faster, more ambitious and durable than their market-driven exclusionary alternatives (Ciplet & Harrison, 2020; Newell et al., 2022). From notions of deliberative democracy to 'Free Prior and Informed Consent' (FPIC) that is enshrined in the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), there is widespread recognition in the extant literature on extractivism that effective or 'meaningful' public participation can potentially make some difference (see Parkins & Mitchell, 2005; Bjoergo, 2023; Neto & Mallett, 2023; Buhmann et al., 2024).

In other words, public participation in extractive landscapes including mining but also RE generation (e.g. Windparks) is not merely procedural but it represents an activity that enhances democratic governance, builds public trust, and sustains the broader social legitimacy for certain policy directions governments may want to take (Pantić et al. 2025). This is important because old problems such as inequalities, colonial legacies, patriarchal governance structures, racism (eg. against Afro-descendant communities), institutional bottlenecks, and overall marginalization of women, youth, Indigenous peoples have historically shaped consultations in ways that limit their outcomes (see Parkins et al., 2017; Riofrancos,

2017; Garcia, 2022; Banerjee, 2022; Haslam et al., 2025) or even reinforced gender inequalities and ethno-racial discrimination in social, political and labour relations (e.g. Ulloa et al., 2020; Vargas Guevara et al., 2022).

Reimagining old ways of doing things would include an understanding of the difference between rightsholders and stakeholders in respective contexts and the various processes required to consult and engage meaningfully with these diverse communities. This could ensure that the 'just transition' shapes and is shaped by the practice of both procedural and material/distributive justice (see Armeni, 2023; Suboticki et al., 2023; Fritz, 2024).

The concentration of economic and political power creates a causal chain that perpetuates exclusion. First, extraction generates economic dependence in a region on a single industry, which often provides formal employment primarily for male workers. Second, the economic importance of the sector gives corporations significant influence over local governance and development priorities. Third, decision-making spaces, such as negotiations over mining operations, compensation, or regional development planning, remain dominated by political elites, corporate actors and traditional labour organisations. These structures systematically marginalize women, youth and racialised communities whose livelihoods, cultural practices and territorial rights are deeply affected by mining expansion (Cardoso, 2015; Santamaría Guerrero et al., 2022). Further, such power asymmetries generate reinforcing feedback loops that lock in the current state.

Economic dependence on revenues constrains local governments' willingness to challenge such extractive interests, which in turn sustains governance arrangements that privilege industry actors instead of transforming them (Gudynas, 2019; Svampa, 2022; Rivera-Albarracín, 2020). At the same time, socio-environmental impacts, such as land dispossession, water scarcity and displacement, disproportionately affect Indigenous and Afro-descendant communities, further weakening their capacity to participate in political processes (Gilbertson, 2020; Censat Agua Viva & Cinep/ppp, 2023). As participation becomes limited or symbolic, communities lose trust in institutional processes, reinforcing cycles of exclusion and conflict, and preventing proactive phase-out planning (Snell, 2018; Rivera-Albarracín, 2020). It is therefore incumbent to imagine transformative ways of embedding principles of fairness and justice as part of the transition away from fossil fuels and other old forms of extractivism. This is because we cannot assume that processes of stakeholder or public engagement actually work or will work to the needed extent for various actors to feel heard, recognized, and accepted as valuable contributors to such processes.

3. Key intervention points and opportunities

Overcome inequalities and colonial legacies, increase trust in institutional processes, and guarantee fair participation in the benefits of the transition away from fossil fuels for all stakeholders.

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Action Insight 12: **Realign international legal frameworks to support just transitions away from fossil fuels. Collectively act to neutralise the barrier from Investor-State Dispute Settlement (ISDS) to the transition.**

Further details:

System Outcomes

current state:

When countries adopt measures to reduce or phase out fossil fuel extraction, consumption, licensing, and subsidies—consistent with their international legal obligations (ICJ AO, para 427)-–they may face claims from foreign investors. Fossil fuel investments are often protected by long-term contracts between companies and governments, national laws, and more than 2500 bilateral and multilateral investment treaties, many with provisions for investor-State dispute settlement (ISDS) (UNCTAD, n.d.). These contracts, laws, and treaties allow foreign investors to sue host states directly when new policies or regulations affect the value of their investments or undermine their expectations (UNCTAD 2024b).

Over the past decade, the number of ISDS cases has more than doubled, with investors in extractive industries and the energy sector being the most frequent users (UNCTAD 2024a). Numerous investors have already challenged policies related to the energy transition, including coal power phase-out policies, rejections of proposed coal power plants and coal mines, and restrictions on oil and gas projects and related infrastructure (UNCTAD 2022; Di Salvatore et al. 2023; Morgera 2025). The number of ISDS claims is anticipated to grow as states adopt more direct supply-side action to address the climate crisis, with an estimated annual 1.64 gigatonnes (Gt) CO2e of emissions currently covered by ISDS protections (E3G 2024). ISDS claims are extremely costly to litigate. Average awards increased more than tenfold between 1994-2003 and 2014-2023 (UNCTAD 2024a). While the average award in non-fossil fuel cases is around USD 126 million, it exceeds USD 600 million in fossil fuel cases (Di Salvatore 2021; Clemence and Damji 2023). To date, fossil fuel cases have resulted in awards totaling more than USD 80 billion (Di Salvatore et al. 2023). The mere risk of such arbitration can deter States from regulating and phasing out fossil fuels (IPCC 2022: 14-72, 14-81; ICJ AO para 428).

Outcome of actionable insight implementation:

The First Conference on Transitioning Away from Fossil Fuels in Santa Marta, Colombia presents an opportunity for States to come together and agree to act collectively to remove ISDS as a barrier to the transition and reclaim policy space to take the scientifically necessary and legally required steps to phase out fossil fuels.

At present, States have no plurilateral or multilateral forum dedicated to assessing and addressing the impact of ISDS on climate action. A coordinated response to ISDS could help shield fossil fuel phase-out measures from challenges by incumbent industry actors, prevent polluters from making it prohibitively expensive for governments to regulate their climate-destructive conduct, and send a powerful signal of opposition to ISDS for fossil fuel projects.

Even countries that do not themselves face substantial or any threats of investor claims have an interest in ensuring that others are not prevented or discouraged from joining collective fossil fuel action because of the risk of ISDS claims. As such, all countries that want an effective coalition of States working on the transition away from fossil fuels have an interest in eliminating the ISDS barrier, because doing so would enable fossil fuel phase-out without costly ISDS cases that force States to pay polluters as the price for taking climate action. Furthermore, the erga omnes nature of States' obligations to protect the climate system (ICJ AO, paras. 440-446) means that the corresponding duty to phase out fossil fuels cannot be overridden by legal obligations owed to a select class of actors, such as foreign investors under investment treaties.

Once States take action, within the applicable legal framework to annul contracts and treaties, they will no longer face investment law barriers to fulfilling their international legal obligations to phase out fossil fuels. Committing to exclude ISDS from future bilateral and multilateral agreements, working to remove ISDS from existing agreements, and expressly allowing amendments in the public interest–including the reduction of sunset clause durations–will better secure States' ability to regulate fossil fuels. A commitment to include explicit provisions permitting termination in the public interest in future contracts would likewise help protect policy space.

Details and Background information

ISDS is not necessary to facilitate foreign direct investment (Brada, Drabek and Iwasaki 2021), including for investment in sectors essential for the transition away from fossil fuels (Mehranvar and Sasmal 2022), but it does constrain policy space in the renewable energy and critical minerals sectors, posing a threat to a just energy transition (Tienhaara 2025). In response to increased ISDS claims in recent years, many countries have taken steps to extricate themselves from the system. Canada and the United States excluded ISDS from their relationship under the US-Mexico-Canada Agreement (USMCA). The EU and several European States, including France, Germany, Italy, the Netherlands and the UK, have withdrawn from the Energy Charter Treaty (ECT), in part due to its incompatibility with the Paris Agreement and policies such as the EU Green Deal (European Commission 2024; UK Government 2024). Countries such as South Africa, Indonesia, India, and Australia have terminated or renegotiated bilateral investment treaties to reduce ISDS exposure (Mehranvar et al. 2024; Government of Australia, n.d.). However, these efforts remain fragmented and insufficient, particularly given the prevalence of sunset clauses that continue to protect existing investments for 5-20 years after treaty termination (Bernasconi-Osterwalder, et al. 2020), and which generally can only be neutralized through mutual agreement (European Union 2020).

Key intervention points and opportunities

The aim is to enable countries to phase out fossil fuels without the risk of facing costly legal claims from investors and to use the money that would otherwise be required to defend against those claims and pay awards to instead fund the transition away from fossil fuels. To achieve this, countries can stop including ISDS in new agreements and work to remove the threat of ISDS in existing investment agreements and contracts through coordinated and collective actions.

Recent initiatives, including the EU agreement terminating intra-EU investment agreements (European Union 2022), have demonstrated the effective use of plurilateral agreements and could prove instructive in the development of a similar agreement to modify or cancel all investment agreements between parties to such an agreement. Such an agreement could complement unilateral actions.

Uncertainties and trade-offs

Unilateral action to reduce ISDS exposure through termination and renegotiation of individual agreements can be effective on a case by case basis, but is time consuming and can be difficult due to power imbalances between parties. With thousands of investment agreements and contracts that include ISDS provisions, renegotiating each individually is an impossibility. Collective action, including through a new plurilateral agreement similar to the EU agreement terminating intra-EU investment agreements (Mehranvar, et al. 2024) or integration into a new or existing plurilateral agreement, could simultaneously modify many investment agreements and effectively eliminate the risk for the fossil fuel phase out from ISDS cases between the parties.

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