

Beyond Current Initiatives: Operationalizing the Paris Temperature Target

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Abstract

The international climate policy regime is composed of different principles, obligations, and partnerships. A critical assessment of existing international arrangements shows that they are insufficient to achieve the Paris Agreement temperature target. While Internationally Transferred Mitigation Outcomes (ITMOs) aim to make emission reductions, their unfettered use could actually weaken the domestic ambition of countries buying them. To strengthen ambition and align Nationally Determined Contributions (NDCs) with the Paris target, I propose that a coalition of the willing commit to additional rules governing the use of ITMOs. Participating countries would cooperate on the determination of their NDCs so that they jointly align with the Paris target and would commit not to exchange ITMOs with countries with lenient NDCs. The paper concludes with the comparison of alternative proposals to strengthen the international climate policy regime.

Keywords: Climate policy; carbon price; SDGs; poverty; international taxation.

JEL: Q56; F38; H23; Q54; H87; F64; Q58; F53; F35.

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1 A critical assessment of the current regime

The international climate policy regime is laid down in the United Nations Framework Convention on Climate Change (UNFCCC) and its offshoot, the Paris Agreement. The consensus of the international community in favor of this regime with a common temperature target is an immense success: The UNFCCC has been universally adopted, and the Paris Agreement had been ratified by all countries but three (Iran, Libya, and Yemen) before the U.S. withdrawal. However, reliance on consensus for decision-making at the UNFCCC also results in major limitations: agreements rest on the lowest common denominator and fall short of achieving any substantial progress on international climate action. In this section, we review the current regime and its most likely developments.

1.1 Developed nations taking the lead

The UNFCCC introduces the distinction between developed and developing nations: the former shall provide financial resources to the latter to promote their sustainable development and climate action. While aimed at sharing fairly the costs of climate action, this classification dates from 1992 and is now outdated. For example, while Singapore, South Korea, Saudi Arabia and Slovenia are all richer than Greece, only the latter is considered by the UNFCCC to be a developed country with financial obligations. This outdated classification is stalling progress in critical negotiations, as newly high-income countries resist being considered developed, and historically developed countries are reluctant to increase their contributions unless all high-income countries do so.

While high-income countries have to provide resources to foster climate action in lower-income countries, the determination of required transfers would be more appropriately determined using up-to-date, continuous indicators such as the GNI per capita, rather than an outdated binary classification. A simple yet fair rule would be that a country's contributions are to be made in proportion to GNI and entitlements in proportion to population (Fabre 2025).

1.2 CBDR

In its Article 1, the UNFCCC states what is now known as the *CBDR* principle: "Parties should protect the climate system (...) on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities." This Article is commendable in its objective to guide the allocation of the burden of climate action between countries and reconcile different burden-sharing principles: common action, equity, historical responsibility, ability to pay, etc. Unfortunately, the *CBDR* principle only offers vague and inconsistent guidance. For example, does equity refer to equal per capita emissions rights or to something else (equal cost share of emissions reductions, equal access to development)? How should we balance rules that result in different allocations of emissions rights, such as common action, equal per capita, historical responsibilities and

ability to pay? As the key question of the burden-sharing rule was left unresolved by the CBDR principle and its multiple possible interpretations, countries are not able to agree on binding targets of emissions reductions and financial transfers by country.

1.3 NDCs

This absence of consensus on burden-sharing led to the system of Nationally Determined Contributions (NDCs), where each country sets its own targets. Currently, countries are not sanctioned if they miss their targets. Countries do not even have to define their target using a common indicator (such as their future cumulative emissions). As NDCs rarely specify a cumulative emissions target, researchers need to formulate hypotheses to assess whether NDCs are jointly consistent with the universally agreed temperature target.^a Even in the most optimistic hypotheses, NDCs are insufficient to meet the temperature target. If all countries respect their NDCs, global GHG emissions should be 51 GtCO_{2e} in 2030, while 41 Gt would be needed to meet the 2 °C target with a 66% chance (den Elzen et al. 2022). According to the [Climate Action Tracker](#), current policies and actions correspond to a global warming of +2.6 °C by 2100, and warming may continue to rise beyond that date.

1.4 Climate finance

An equal per capita allocation of emissions rights corresponding to the remaining carbon budget would entail transfers of 0.3% of the world's GDP from high to low emitters (on average between 2030 and 2080). North-to-South transfers would be over \$800 billion in 2035 and would exceed \$1 trillion between 2040 and 2060. Taking into account historical responsibilities for emissions, an equal per capita allocation of cumulative (past and future) emissions rights would entail even more transfers — the carbon debt that the North owes to the South is estimated at \$26 to \$192 trillion (Fabre 2024; Fanning & Hickel 2023).

At COP29, the international community reached a compromise concerning the New Collective Quantified Goal (NCQG). Developed countries committed to mobilize \$300 billion per year by 2035 for developing countries for climate action. Moreover, parties “call on all actors” to mobilize \$1.3 trillion, which would be in line with experts' recommendations, see Songwe et al. 2024; UNFCCC 2024. The quantum of \$300 billion represents a tripling of the previous climate finance goal. However, it can be reached through loans (including from the private sector), and does not specify what share should be provided

^aNote that the temperature target is itself vague. Article 2 of the Paris Agreement aims at “holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.” Yet, given the uncertainty around the climate system, this (double) target is not precisely defined: does it mean a 83% chance to limit global warming to 2 °C? A 67% chance? A 50% chance? Each probability is associated with a different carbon budget – respectively 900, 1,150, and 1,350 GtCO₂ starting in 2020, according to the IPCC (AR6, WGI, p. 39).

as grants (or grant-equivalent concessional loans). In fact, the current goal of \$100 billion is met with only \$26 billion provided in the form of grants (OECD 2024). In theory, the NCQG could be met with the same amount of grants (i.e. North-to-South transfers), or even less.

In contrast, at COP29, “India specified that the NCQG should mobilize \$1.3 trillion, of which at least \$600 billion should come in the form of grants and equivalent resources” (Earth Negotiations Bulletin 2024). India, voicing Global South concerns, stated it was “disappointed in the outcome which clearly brings out the unwillingness of the developed country parties to fulfill their responsibilities. We cannot accept it.” Transfers aligned with Global South’s demands would allow enormous progress towards the Sustainable Development Goals, including climate action but also the deployment of public services and poverty reduction programs. Conversely, an insufficient provision of climate finance does not only infringe on climate justice, it also jeopardizes decarbonization in the Global South, as many countries make their NDC conditional on the adequate provision of climate finance.

Together with more North-to-South transfers, reforms to the international financial systems are needed to reorient financial resources towards climate action. These reforms are multifaceted and are more likely to be accepted by governments in the Global North than direct transfers, since they rely on mostly painless, growth-enhancing accounting operations. The government of Barbados (supported by the UN Secretary-General) leads the movement in favor of these reforms. Their “Bridgetown Initiative” calls for debt relief for low-income countries, for a new issuance of at least \$650 billion in Special Drawing Rights by the IMF to expand the loans of Multilateral Development Banks (MDBs) to at least \$500 billion per year, and for public guarantees to lower interest rates on sustainable projects in the Global South (?). Note that although the Bridgetown Initiative is most famous for its climate finance proposals, it also calls for other reforms, such as a universal carbon price and international taxes on the super-rich to finance global public goods.

While a scaling up of climate finance is crucial, it is not sufficient to decarbonize the world as it does not cap (or directly reduce) emissions. In the worst case scenario, the expansion of low-emissions projects would mostly add up low-carbon infrastructures on top of fossil ones, failing to meaningfully reduce emissions.

1.5 JETPs

Just Energy Transition Partnerships (JETPs) are mechanisms where one developing country essentially commits to emissions reductions through the deployment of renewable energy in exchange for concessional terms on the required loans by a group of developed countries. Four JETPs have been signed so far, involving Indonesia, Vietnam, South Africa, and Senegal (Ha-Duong & Cassen 2023). In existing JETPs, the groups of developed countries pledged to offer loans ranging from \$2.5 billion (for Senegal) to \$20 billion (for Indonesia).

While JETPs offer a promising way to deliver climate finance in a way that guaran-

tees emissions reductions, they currently suffer from several shortcomings. First, their coverage is limited (in terms of sectors and countries). To improve the sectoral coverage and efficiency of JETPs, researchers have proposed to design them as a financial transfer in exchange for a national carbon price (Steckel et al. 2017). Second, as they focus on emissions reductions rather than sustainable development, JETPs do not contribute to poverty reduction. This concern could be mitigated by JETPs with a higher reliance on grants (Bolton et al. 2025). However, a higher provision of grants is difficult to achieve absent a dedicated source of revenue (such as an international tax).

Lastly, even if JETPs were improved along the previous lines, they would still fail to guarantee that the decarbonization of big emitters like China or the European Union is consistent with required global efforts.

1.6 ITMOs

The article 6.2 of the Paris Agreement allows Parties to exchange Internationally Transferred Mitigation Outcomes (ITMOs). This enables a country to nominally reduce its emissions (the emissions as counted to assess its NDC) by purchasing verified emissions reduction to another country. The latter country will then be credited with the buyer's ITMO emissions. As any bilateral agreement on ITMO is permitted, the use of ITMOs risks reducing buyers' domestic decarbonization efforts. Indeed, to the extent that the NDCs do not add up to the global emissions reductions objective, there will be "hot air" (i.e. excess emission rights): ITMOs will not reflect the required mitigation constraint, and their price will be too low. As a result, ITMOs may propagate a global lack of ambition to countries with otherwise ambitious NDCs, offering a cheap (and less effective) alternative to domestic decarbonization.

To illustrate this, let us use a fictive example with two world regions, Rich and Poor, each containing half of the world population. Say that the carbon budget is 1,000 Gt and that in a business-as-usual scenario without climate action, both regions would emit 750 Gt. Imagine that region Rich has an ambitious NDC of 500 Gt while Poor has a low ambition NDC of 1,000 Gt. In absence of international carbon trading, we can expect region Rich to emit 500 Gt (in line with its NDC) and region Poor to emit 750 Gt (as no climate action is required to fulfill its NDC). In this fictive example, region Poor may be willing to sell 250 Gt of ITMOs to region Rich at a very low price. Region Rich could then meet its NDCs with 750 Gt of emissions, resulting in world emissions of 1,500 Gt, higher than the 1,250 Gt that would have occurred in absence of ITMOs.

According to Climate Action Tracker, the sum of current NDCs would lead to global warming of around 2.5°C, far above the Paris target of "well below 2°C." In such a context, international carbon trading risks becoming a vehicle for exporting low ambition rather than reinforcing collective effort. Buyers will find it more attractive to purchase credits abroad than to accelerate the domestic transformation of their economy. In short, unregulated ITMOs can result in emissions dumping.

This dynamic is already apparent. The European Union allowed using international

credits toward its 2040 climate target. More precisely, up to 5% of emissions from 1990 could be offset through ITMOs. Since the EU Commission aims to cut EU emissions by 90% by 2040, relying on ITMOs would enable the EU to emit 50% above its domestic goal in 2040 through purchasing emission reductions abroad. Likewise, Japan plans to emit up to 53% above its goal in 2040 (Japan 2025). Switzerland has already bought ITMOs from Thailand and Ghana and may purchase ITMOs for an even larger share of its 2035 goal. Adding to that the intended purchase of ITMOs from South Korea, Norway, and Singapore, the market for ITMOs could reach 500 MtCO₂ per year in 2040.

Meanwhile, China pledges to reduce emissions by 7–10% from their peak by 2035. Yet, a reduction of around 20% is needed to align with a 2°C scenario (He et al. 2022). If China or other countries were to sell ITMOs based on such lenient trajectories, buyers would acquire credits that do not represent genuine progress toward the Paris goal.

To prevent ITMOs from weakening domestic action, countries that use them should commit to extra rules, beyond verifying the environmental integrity of the ITMO they buy. I propose such rules in the next section.

2 Aligning Carbon Trading on the Paris Temperature Target

2.1 Existing proposals

Michaelowa et al. (2019) propose to check that ITMOs are additional, in the sense that they correspond to emission reductions compared to a counterfactual scenario without said ITMOs. The authors propose a two-step procedure. A new “Article 6 Supervisory Board” would first check whether the seller’s NDC is more ambitious than the business-as-usual trend (BAU). If this is the case, the second step is not required. Otherwise, the seller’s unambitious NDC generates “hot air” and the ITMO needs to be tested at the project level. In this second step, the additionality of each specific activity financed by the ITMO would be assessed individually.

La Hoz Theuer et al. (2019) discuss the restriction of ITMOs to emission reductions beyond the BAU. They compute BAU emissions for a range of countries using four possible definitions for the BAU: extending past years’ emissions, or emission intensity, or their respective trend. They show that none of these definitions is satisfactory, as each of them would generate *hot air* for some countries, due to the BAU exceeding the emissions as projected by Climate Action Tracker. The authors propose instead to limit the quantity of ITMOs that a country can sell to a fixed share of its emissions (say 1% or 5%). They acknowledge that quantity limits would still generate some hot air, but argue that the limit can be chosen to strike a balance between reducing hot air and exploiting the gains from trade.

While La Hoz Theuer et al. (2019) show that simple definitions of the BAU are ill-suited to regulate ITMOs, Michaelowa et al. (2019) propose to leave the determination

of the BAU to independent experts, so that NDCs' ambition can be accurately assessed. In both papers, the authors agree that an NDC can be assessed at the national level, by comparing it to the country's projected emissions, and that ITMOs should be allowed whenever the NDC is more ambitious than (properly) projected emissions.

However, two issues militate against the assessment of NDCs based on national BAUs. First, even if a country's NDC target is set below its BAU, to the extent that NDCs do not align with the Paris temperature target when aggregated at the global level, there will be hot air. Consequently, both the demand for ITMOs and their price will be too low. Second, given that the amount of grant-based climate finance does not match their demands, Global South countries could legitimately set up their unconditional NDC emission targets above their BAU emissions, with the intention of using their extra emission space to sell ITMOs. Moreover, to the extent that NDC targets represent how countries should share the burden of emission reductions, low-income countries already claim less than their fair share of emissions. Therefore, the ratcheting up of ambition should arguably be borne by industrialized countries. For these reasons, assessing an NDC against the national (or project-based) BAU is neither a fair nor an effective way to prevent hot air.

2.2 The case for a joint definition of NDCs

The key problem with ITMOs is that the *global* emissions implied by current NDCs (or current trends) do not align with the Paris temperature target. Meanwhile, given the disagreement over what constitutes a fair share of the global carbon budget, countries cannot agree whether a given NDC complies with the Paris target or whether it claims excessive carbon budget. However, if a critical mass of countries agreed on a common norm such as a burden-sharing principle or on a decision rule to assess whether the global carbon budget is fairly shared, then the two issues identified in the previous paragraph could be solved.

A coalition of countries could submit a joint NDC, broken down into country-specific emission targets. The common norm would be used to check that the joint NDC complies with the global target, in which case hot air would be prevented. This coalition could also allocate its NDC between countries in a way deemed acceptable and fair, potentially allowing some countries to get a target higher than their BAU emissions.

Only at the level of the entire world or of a large coalition could we be satisfied with a rule restricting the sale of ITMOs when the NDC target is below the BAU, since this is the level for which all agree that the BAU is inadequate. Conversely, at the national level, some countries might have already implemented stringent climate policies so that their BAU emissions is ambitious enough, while some others would legitimately set a NDC target above their BAU since they deserve to sell ITMOs. In both cases, a national comparison of the NDC to the BAU would be inappropriate.

2.3 Desirable paths to regulate carbon trading

In absence of a coalition agreeing on a common norm, principled buyers of ITMOs could use other national criteria to assess the adequacy of a seller's NDC.

A sine qua non condition. As a bare minimal requirement, countries should be allowed to sell ITMOs only up to the amount by which their emissions fall below their NDC targets. Consequently, buyers should not buy ITMOs from a country which is failing its NDC target. Failures to achieve one's NDC would extend to countries that would have increased their emission target (instead of ratcheting up ambition) and whose emissions would be higher than planned in a previous target.

Principled buyers. Besides, to strengthen the additionality requirement proposed by Michaelowa et al. (2019), principled buyers would refuse to buy ITMOs from that country even when a seller's NDC target is below its BAU, if its NDC target is evidently incompatible with the Paris target. Such incompatibility would be safely assumed when a country's NDC target is both above its cost-optimal emission required to limit global warming to 2°C, and above its equal per capita share of global emissions in that 2°C scenario. Given that there are multiple ways to define a cost-optimal 2°C scenario (the carbon budget depends on the probability of achieving the 2°C target and the trajectory depends on the model used), simple substitutes could be used instead. In particular, buyers could refuse to buy ITMOs from countries with per capita emissions or GDP above the world average (unless their historical and target emissions are compatible with a 1.5°C scenario).

Sellers' conditions. While these requirements would reduce the amount of hot air, they would exclude from the trade of ITMOs low-emitting countries that set their NDC target above the BAU, at (what they consider to be) their fair share. These potential sellers of ITMOs could join forces and use their market power to negotiate guarantees of grant-based climate finance at scale. In particular, these countries could commit to set their NDC target below the BAU (and sell ITMOs) against the commitment from buyers to fairly allocate taxing rights of new international levies, to finance JETPs or debt relief. Alternatively, the conditional NDC target would replace the unconditional one in the assessment of the NDC adequacy when the country's conditions (in terms of climate finance) are met.

Limitations of the previous options As explained by Mehling (2019), restrictions to the use of ITMOs involves a trade-off between limiting hot air and exploiting gains from trade. In addition, the restrictions discussed above entail two other limitations. First, they rely on arbitrary cutoffs, which create undesirable discontinuities regarding the possibility to sell ITMOs. Second, they do not provide for an institution allowing states to negotiate in order to reach common ground regarding the overall ambition or the amount of climate finance. Yet, conflicting goals need to be resolved. While some desirable objectives would imply more stringent NDC targets (raising ambition by lowering the sum of

targets significantly below the BAU or even by aligning them with a 1.5°C scenario), other desirable goals would call for more lenient targets for countries with moderate emissions (such as an equal per capita share of emissions in a 2°C scenario).

A coalition of willing countries could arbitrate between these conflicting goals and set up precise norms for the adequacy of NDCs and climate finance contributions. The adoption of such norms by a large group of countries would alleviate the need for restrictions on the exchange of ITMOs between these countries (beyond the sine qua non condition) and overcome the above limitations.

The best case: a joint NDC submission. A coalition of the willing could submit a joint NDC (just as the European Union does for its member states). Ideally, the joint NDC would include a carbon budget aligned with the Paris target and broken down into yearly national targets. Alternatively, the joint NDC would define a minimum emission reduction rate, aligned with the Paris target. Initially, this rate could be expressed in terms of emission intensity, consistent with the practice of emerging economies. For example, the coalition's GHG emissions relative to final energy use would need to decrease by 2% each year. In the medium term, the reduction should be defined in absolute terms.

The countries most likely to join such a coalition are those with moderate emissions. Therefore, there is a tension between setting the coalition's carbon budget based on a cost-optimal allocation of global emissions (which would favor large emitters outside the coalition) or based on an egalitarian allocation (which may not sufficiently increase the ambition of decarbonization). Examples of compromise regarding the coalition's carbon budget include a cost-optimal share of a 2° (with 50% chance) world carbon budget, or an equal per capita share of a 1.5° (with 50% chance) world carbon budget. Negotiations within the coalition would be key to define fair shares.

2.4 A desirable vision

Once a large coalition of countries agree on the broad vision, this coalition can be taken as given. The coalition's emissions targets would be set below its projected emissions, with a gradually increasing wedge between BAU emissions and the target. Namely, the 2026 target would correspond to the coalition's emissions, the 2027 target would be slightly below the BAU, the 2028 more so, etc., realistically increasing the additional decarbonization effort overtime, until it reaches an emission reduction rate aligned with the Paris target. The resulting emission trajectory of the coalition should not exceed its equal per capita share of a global 2°C carbon budget (with 67% chance), and would ideally be lower.

After defining the coalition's trajectory, the disaggregation into national targets would be negotiated. It would be useful to allocate national targets starting from a focal point. For example, the focal point could be the minimum between the country's BAU trajectory and an equal per capita share of the coalition's emission trajectory. Extra emission rights would then be allocated to countries estimated to lose the most welfare due to the

increased decarbonization effort.

If new countries join the coalition, they can propose a new allocation of emission targets. If the proposed allocation is rejected by the coalition, the whole negotiation process can be reiterated. The new allocation would then be adopted at the conditions that it is accepted by a majority in the coalition and that it does not lead to a lower emission coverage (due to unsatisfied countries leaving the coalition) or to a lower projected price of ITMOs (which would indicate a reduced ambition).

A scientific council would assist the coalition by modelling the climate, economic, and distributive effects of the agreement, by providing analyses upon request, and by proposing an allocation of emission targets or other arbitrations. Each participating country would be allowed to designate a team of scientists to represent them in the scientific council. Appointed scientists could be designated by several countries at the same time. In case of disagreement in the scientific council, each team of scientists would have a voting right proportional to the population of the country (or countries) that designated them.

3 Comparison of alternative proposals for phasing out fossil fuels

In Section 1, we have reviewed the pros and cons of ITMOs, climate finance, and JETPS, which represent the international initiatives to phase out fossil fuels with the greatest chance of implementation. While these approaches are acceptable to most countries, they generally fail to guarantee sufficient emissions reductions. In this section, we assess alternative proposals to expand carbon pricing or restrict fossil fuel extraction. We then provide three tables summarizing the evaluation of each policy mentioned in this article. Table 1 presents each policy, Table 2 lists their pros and cons, and Table 3 attempts to grade the policies' properties in terms of the multiple desired objectives.

3.1 Differentiated carbon price floors

Many commentators argue that lower-income economies do not have the resources to adapt to a high carbon price and require a lower price than high-income countries (). However, this claim is misguided and is not a sound argument in favor of differentiated carbon prices (Aldy & Stavins 2012). Indeed, a uniform price is more efficient, and in a redistributive system, lower-income countries would actually *gain* purchasing power from the policy, meaning that they would obtain the required resources to adapt their economies. As long as they benefit from more emissions rights than emissions needs, they could in principle choose to keep their emissions stable and still pocket a financial transfer. Yet, the high carbon price would provide incentives to decarbonize and benefit from larger transfers.

A more reasonable argument in favor of coordinated carbon prices that would be differentiated depending on the country's income level is the claim that international transfers are not feasible (Parry et al. 2021). In this case, differentiated prices offer a second-best solution.

Note, however, that there is an economic equivalence between differentiated carbon prices and a uniform price with differentiated emissions rights (Fabre 2025). More precisely, for a given agreement on differentiated prices, the same global emission reductions and the same costs and benefits by country can be achieved with a uniform price, by appropriately calibrating the price and the emissions rights, at least when efficiency gains are assumed away. This observation should invite us to question the claim that one option is not politically feasible, given that it has the same distributive effects as the other. Besides, because a uniform price offers efficiency gains from trade but differentiated prices do not, the latter is an inferior solution.

3.2 Supply-side policies such as *fossil fuel non-proliferation*

The *Fossil-fuel non-proliferation treaty* emerged as a prominent campaign to phase out fossil fuels. The call for a treaty (which does not refer to a specific treaty proposal) has been endorsed by over one million individuals, four thousands organizations (including Greenpeace and Climate Action Network International), and 101 Nobel prizes. While the petition only alludes to a consensual call for a “binding plan to end the expansion of new coal, oil and gas projects and manage a global transition away from fossil fuels”; campaign briefings and related academic research sketch out a more detailed plan (Calverley & Anderson 2022; Fossil Fuel Non-Proliferation Treaty 2023; Review 2021, 2023).

The campaign refers to a plan called to *Fair Shares Phase Out*, which involves setting country-specific end dates for fossil fuel extraction (Calverley & Anderson 2022; Review 2023), allowing a later phase out for countries with lower income or higher dependence to fossil fuel extraction. For example, the U.S. would have to fully phase out oil extraction in 2031, Russia in 2037, Saudi Arabia in 2041, and Iraq in 2050.

This plan is problematic for at least two reasons. First, it requires the participation of all countries that export fossil fuels, yet these countries are the least likely to take action on climate change. Second, by cutting supply rather than demand for fossil fuels, this plan would increase fossil fuel rents instead of carbon price revenue. Therefore, despite the plan being touted as fair, it would probably widen inequality, as (predominantly rich) owners of fossil fuel resources would benefit while it would be difficult to compensate low-income consumers for higher fuel prices due to the lack of carbon pricing revenue. Admittedly, the plan also calls for North-to-South transfers to address the negative distributive effects, but it fails to include a specific proposal on how to fund these transfers, how to allocate them, let alone an assessment of overall distributive effects.

The aforementioned extraction end dates would also result in an inefficient location of fossil fuel extraction (Coulomb et al. 2025), with e.g. cheap oil from Qatar being phased out 13 years before dirty oil from Venezuela. An alternative policy would exhibit similar

properties without the inefficiency problem: a producer carbon price. Under this policy, producer countries would price carbon at the wellhead and retain the revenue from carbon pricing (or most of them). Some argue that producer countries would accept a producer carbon price as a compromise if climate-ambitious countries were willing to penalise them for refusing to cooperate. To achieve this, climate-ambitious countries would need to commit to decarbonizing faster and imposing trade sanctions on fuel exporter countries (thereby reducing their revenues further) if they fail to price carbon (Peszko et al. 2019). However, this solution would lack fairness compared to an equal per capita allocation of carbon price revenues, as it would grant tax revenues to producer countries (most of which are wealthy). Furthermore, its proponents acknowledge that their proposal hinges on fuel-importing countries' ability to credibly commit to unilaterally stabilizing the climate (compensating for producers' failure to decarbonize), whereas in reality, fossil-fuel exporters could doubt fuel-importing countries' willingness to make such sacrifices.

Table 1: Description of possible international policies to phase out fossil fuels.

International policy	Description
(<i>Status quo</i>) Unregulated ITMOs	Countries trade Internationally Transferred Mitigation Outcomes, bringing flexibility to the location of NDCs' emission reductions.
Partial linkage of carbon markets (Jaffe et al. 2010)	Carbon markets such as the EU ETS would accept external ETS allowance or emission reduction certificates up to some limit.
ITMOs avoiding hot air	ITMOs with extra rules (described in Section 1.6) ensuring that countries trading ITMOs have joint NDCs in line with the Paris target.
ITMOs + country-level integrity	ITMOs with extra rules preventing countries lacking ambition to participate.
(<i>Status quo</i>) JETPs (Ha-Duong & Cassen 2023)	Just Energy Transition Partnerships where one developing country obtains concessional loans from a set of HICs conditional on the decarbonization of its power sector.
JETPs with more grants (Bolton et al. 2025)	JETPs financed by grants more than loans, of \$120 billion per year.
JETPs with wider scope (Steckel et al. 2017)	JETPs with grants conditional on implementation of climate policy such as national carbon pricing.
Uniform price on CBAM sectors	International cap-and-trade on carbon-intensive manufacturing sectors, with little revenue sharing between countries.
Differentiated price floors (Parry et al. 2021)	Coordinated carbon price floors (\$25/tCO ₂ for LICs and lower-MICs, \$50 for upper-MICs, \$75 for HICs), with little revenue sharing between countries.
Diff. prices on CBAM sectors	Differentiated price floors limited to CBAM sectors, with little revenue sharing between countries.
Nordhaus-type club (Cramton et al. 2015; Nordhaus 2015; Weitzman 2017)	Uniform carbon price, with little revenue sharing between countries, with a CBAM, and dissuasive tariffs on imports from outside the club.
Fossil-Free Union (FFU)	International cap-and-trade, with revenue returned on a basis given by an equal per capita benchmark with some adjustments (cf. Section ??).
FFU + Sustainable Union (SU)	International cap-and-trade and new taxes (especially on wealth), where international transfers are proportional to the difference between a country's GNI per capita to the world average (cf. Section ??).
Uniform price floor + SU	Sustainable Union with a (negotiated) uniform carbon tax rather than a cap-and-trade.
Fossil non-proliferation treaty (Calverley & Anderson 2022; Newell & Simms 2020)	Coordinated phase out of fossil fuel extraction, with supply cuts starting in richest countries and ending with poorer, more fossil-dependent ones.
Producer carbon tax (Peszko et al. 2019)	Uniform carbon tax applied on extraction or imports of fossil fuels, with part of the revenue shared with LICs and tariffs.
Expansion of climate finance (Dafermos 2025; Green Climate Fund 2021;	Reforms to the financial system to orient investment towards sustainable projects in the Global South, through public multilateral guarantees on climate projects, expansion of Multilateral Development Banks' (MDBs) operations, rechanneling of Special Drawing Rights to MDBs' capital, debt for climate

Table 2: Pros and cons of possible international policies.

International policy	Pros	Cons
(<i>Status quo</i>) Unregulated ITMOs	Cross-border financing of efficient decarbonization projects.	<i>Hot air</i> , risks weakening domestic climate action.
Partial linkage of carbon markets	Same as ITMOs.	Same as ITMOs.
ITMOs avoiding hot air	ITMOs without hot air.	Trading between countries rather than firms, weakening enforcement.
ITMOs + country-level integrity	ITMOs with reduced hot air.	Either hot air or risks of unfair burden-sharing.
(<i>Status quo</i>) JETPs	Cross-border financing of electricity decarbonization.	Limited scope; few grants; no effect on high emitting countries.
JETPs with more grants	JETPs with North–South transfers.	Limited scope; no effect on high emitting countries.
JETPs with wider scope	Potentially full country decarbonization.	No effect on high emitting countries.
Uniform price on CBAM sectors	Efficient decarbonization of manufacturing, settling the CBAM issue.	Limited scope; no North–South transfer.
Differentiated price floors	Country-wide efficiency; ambition adapted to country circumstances.	Few North–South transfer; no gains from trade.
Diff. prices on CBAM sectors	Decarbonization of manufacturing.	Few North–South transfer; limited scope.
Nordhaus-type club	Efficient decarbonization.	Few North–South transfer; trade sanctions may fail to incentivize recalcitrant countries and will hurt the club.
Fossil-Free Union (FFU)	Efficient decarbonization with North–South transfers.	Ambition and burden-sharing rigid to changing circumstances.
FFU + Sustainable Union (SU)	Efficient decarbonization with large North–South transfers, spurring development.	Climate ambition rigid to changing circumstances; imperfect incentives for countries to implement complementary climate policies (as international transfers don't depend on the country's emissions).
Uniform price floor + SU	Efficient decarbonization with large North–South transfers, spurring development.	Climate ambition not guaranteed (price may be too low); imperfect incentives for countries to implement complementary climate policies.
Fossil non-proliferation treaty	Decarbonization.	Relies on the (unlikely) participation of fossil-fuel producing countries; would increase oil rents and hurt consumers, especially low-income ones; lacks efficiency.
Producer carbon tax	Efficient decarbonization.	Relies on the (unlikely) participation of fossil-fuel producing countries; would increase oil rents and hurt consumers, especially low-income ones.
Expansion of climate finance	Lower interest rates in LMICs, spurring sustainable development.	Does not cap emissions.
Standards and bans	Aligns one sector towards decarbonization.	Limited scope; no North–South transfer.

Table 3: Comparison summary of possible international policies.

International policy	Emission reductions	Least cost	Fair		Acceptable by			Oil countries	Flexible
			Rich pay	Poor gain	LICs	MICs	HICs		
(<i>Status quo</i>) Unregulated ITMOs	0	+	0	0	+++	+++	+++	+++	+++
Partial linkage of carbon markets	0	+	0	0	+++	+++	+++	+++	+++
ITMOs avoiding hot air	+++	+++	++	++	+++	++	+	--	-
ITMOs + country-level integrity	+	+	+	+	+	+	++	++	+++
(<i>Status quo</i>) JETPs	+	0	0	+	+++	+++	+++	+++	+++
JETPs with more grants	+	0	++	++	+++	++	+	--	+++
JETPs covering broad policy	++	+	++	++	+++	++	+	--	+++
Uniform price on CBAM sectors	++	++	0	--	-	+	+++	--	+
Differentiated price floors	+	+	0	-	-	+	+++	-	+
Diff. prices on CBAM sectors	+	+	+	-	0	++	++	--	+
Nordhaus-type club	+++	+++	0	-	+	+	+++	---	+
Fossil-Free Union (FFU)	++++	+++	++	++	+++	++	+	--	--
FFU + Sustainable Union (SU)	++++	+++	+++	+++	+++	++	0	---	--
Uniform price floor + SU	++	++	+++	+++	+++	+++	0	--	+
Fossil non-proliferation treaty	+	-	-	-	-	-	-	-	+
Producer carbon tax	++	++	--	---	---	--	-	-	+
Expansion of climate finance	++	+	+	+	+++	+++	++	+	+++
Standards and bans	++	0	0	0	+	+	++	+	0

4 Conclusion

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