

International climate finance as a win-win: The economic case for coalitions of disposed developed countries to fund decarbonisation in developing countries

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1 INTRODUCTION

The majority of 21st century emissions are projected to come from emerging and developing market economies (EMDEs). Even if developed countries decarbonise as they have promised to do and rapidly reach net zero, they will still be exposed to the effects of EMDE emissions if these countries do not embrace decarbonisation at scale and speed up their energy transition. Under current policies, the world is projected to face a dangerous rise in average temperatures above pre-industrial levels of between 2.8°C and 3.1°C by the end of the century (UNEP, 2024), whilst climate science finds that the Paris Agreement goal of 1.5°C is a critical limit not to exceed: every extra 0.1°C beyond this limit significantly increases tipping point risk and the occurrence of extreme climate events.

In this chapter, we examine the economic case for coalitions of self-interested advanced countries to provide climate finance at scale to those developing countries that commit to decarbonising their power sectors and cannot pay for the energy transition themselves, building on earlier research by Bolton et al. (2024), who examined the economic case for an advanced country coalition to pay for the phase-out of coal in EMDEs. Here, we broaden the analysis to the replacement of all fossil fuel power sources rather than just coal.

1 We thank Yuktha Bhadane, Rudy Tanin, Fhrad Panahov and Heejin Han for their excellent research assistance. We also thank Jeromin Zettelmeyer, Tobias Adrian, Ottmar Edenhofer and Johan Rockström, who have contributed to the research underpinning this chapter. We further thank Jean-Pisani Ferry, Beatrice Weder di Mauro and Jeromin Zettelmeyer for their valuable feedback on the chapter.

Climate finance is rooted in climate agreements. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) climate agreement classified countries into “developing” (non-Annex I) and “developed” (Annex II). Based on this classification and on the principle of “common but differentiated responsibilities” (CBDR) formed at the 1992 UNFCCC, developed countries have been expected to take the lead in reaching net zero. The CBDR principle also led to the pledge by developed countries to provide \$100 billion of climate finance per year by 2020 to help developing countries decarbonise and adapt to climate change. This pledge was part of the COP21 Paris Agreement in 2015 under Article 9 about climate finance:

“In accordance with Article 9, paragraph 3, of the Agreement, the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement shall, *before 2025*, set a **new collective quantified goal from a floor of USD 100 billion per year**, *taking into account the needs and priorities of developing countries*”

The good news is that an agreement on climate finance was reached at COP29 in 2024, referred to as the “New Common Quantified Goal” (NCQG), as planned. However, as we show here, the agreed amount was too little, too late, and of too low-quality climate finance.

Indeed, the agreement reached at COP29 was that “developed country Parties taking the lead, [would] provide at least USD 300 billion per year by 2035 for developing country Parties for climate action from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources in the context of meaningful and ambitious mitigation and adaptation action”. Article 7 of the NCQG [agreement text](#)² additionally “calls on all actors to work together to enable the scaling up of financing to developing country Parties for climate action from all public and private sources to at least USD 1.3 trillion per year by 2035”.³

Following COP29, in a joint statement with leading climate scientists and climate finance academics⁴ we explained how this goal falls short of what is needed to limit global warming to 1.5°C. The NCQG goal is too late, because the climate finance should have been made available by 2025 not 2035; it is too little, because no pure public climate finance commitment by developed countries has yet been made; and it is of too low-quality, because no definition is agreed on what counts as public climate finance. Only

2 <https://unfccc.int/documents/643641>

3 Whilst developed countries were keen to expand the contributor base of climate finance - by including countries (such as China) that are still classified as “developing” according to the UNFCCC agreement, but have grown wealthy enough to support their own transition and contribute to that of others - ultimately a reclassification of developed and developing countries did not get unanimous buy-in. Instead, the NCQG agreement *encourages* developing country Parties to make contributions [to climate finance], including through South-South cooperation, on a voluntary basis.

4 <https://e-axes.org/research/joint-statement-on-the-new-common-quantified-goal-ncqg-of-climate-finance-and-its-delivery-on-the-1-5c-paris-agreement-goal-addressed-to-all-states-party-to-the-convention-mr-simon-stiell/>

grants or equivalents should count, not market-based or concessional loans accounted for at their notational value, as is currently done. Notional loans, even at concessionary rates, add to developing countries' debt burdens and fail to provide the catalytic and early closure grant-equivalent funds needed.

As we argue in Bolton et al. (2025), a key reason why climate finance is not forthcoming in time is that it has not been explicitly tied to emissions reductions in developing countries. We show that the provision of climate finance from developed to developing countries is in the economic interest of developed countries, whenever they can tie it to emissions reductions in developing countries. Their economic benefits from the provision of climate finance – in terms of avoided climate damages and adaptation costs to themselves – exceed the cost of climate finance provision. Moreover, we show that climate finance at scale is also fiscally affordable to developed countries.

It has proved impossible to reach an agreement that explicitly ties financing to decarbonisation, partly because of opposition from oil-producing countries. To be able to move forward, therefore, an agreement has to be sought that does not necessarily include all parties – an agreement between disposed developed countries and developing countries following the lines of Nordhaus' general idea of climate clubs (Nordhaus, 2015; 2020). The countries in the European Union, in effect, are setting up a climate club with the European Emissions Trading System (EU ETS) the introduction of the Carbon Border Adjustment Mechanism (CBAM).

Carbon taxes – a stick-based approach – make fossil fuels (and related goods) more expensive. Climate finance – a carrot-based approach – makes renewables cheaper. In a world where only 28% of global greenhouse gases (GHGs) are taxed,⁵ according to the World Bank, and the average global net carbon price is \$4/tCO₂ according to the Kepos Carbon Barometer,⁶ the provision of climate finance plays an important complementary role to the woefully inadequate levels of carbon taxation.

In this chapter, we propose an approach based on the formation of 'climate finance coalitions' of self-interested, disposed developed countries that collectively fund renewable energy development in those developing countries that commit to decarbonisation. Climate finance coalitions and climate carbon clubs work harmoniously together. To the extent that carbon border taxes make exports by developing countries to climate club countries more expensive, climate finance provision – in grant-equivalent form – helps them switch to renewables, essentially for free. Climate – finance and carbon – clubs, if implemented along-side each other, thus provide a double incentive, at the requisite speed and scale, for global decarbonisation.

Our approach is guided by the following economic principles that together underpin the cost-effective financing of EMDE decarbonisation:

5 <https://carbonpricingdashboard.worldbank.org/compliance/coverage>

6 <https://www.carbonbarometer.com/policy-overview>

1. A ton of avoided CO₂ yields the same global benefit, no matter where it is reduced. Accordingly, developed countries should support emissions reductions where abatement is cheapest – often in EMDEs – so long as the economic benefits to them exceed the cost.
2. Decarbonisation should be structured at the jurisdictional level through coordinated pipelines: one for phasing out fossil fuel plants and one for phasing in renewable capacity. A system-wide approach enhances cost-efficiency, increases predictability for investors, and reduces the risk of carbon leakage.
3. Climate finance needs to cover both the phase-out cost (the opportunity cost of retiring fossil fuel plants early) and the cost of investments required to cover the growing share of demand unmet by phased-out coal and other fossil fuels. The latter should take into account the projected increase in energy demand.
4. Public finance is an essential component of climate finance, both because the opportunity costs of phasing out fossil fuels cannot be covered by private finance and because the costs of capital are often (still) too high in many countries, relative to the profitability of renewables investment, to make the phase-in pipeline commercially viable. Hence, some public subsidy may be necessary to crowd in private investment. We assume that public finance must cover 100% of fossil fuel phase-out costs, and 25% of renewable investments – a benchmark that may range from below 10% to above 25%, depending on country-specific risk profiles.
5. To the extent that the public portion – delivered as grants or equity – is covered by external funding (such as by a climate finance coalition advocated in this chapter), it should be disbursed conditionally, based on avoided emissions (through the implementation of the phase-in and phase-out pipeline) or other implementation milestones. The authority to disburse the public funds on a conditional basis could be given to an agency (or committee) representing developed donor countries and multilateral development banks (MDBs), playing a role similar to that of the IMF when granting emergency funding to countries in financial distress. This agency – call it the International Climate Fund (ICF) – would enter into a ‘programme’ agreement with an EMDE (possibly based on a country platform), specifying the conditional financing and implementation.

In what follows, we report our baseline empirical estimates – and underpinning data and methodology – of climate finance needs to decarbonise developing market economies in Section 2. We evaluate the economic case for distinct coalitions of self-interested, disposed developed countries to finance decarbonisation in various sets of recipient developing countries in Section 3. Section 4 lays out policy considerations. We then conclude.

2 THE COSTS OF DECARBONISING THE POWER SECTOR IN DEVELOPING COUNTRIES

This section reproduces cost estimates for decarbonising the power sector in developing countries, based on Bolton and Kleinnijenhuis (2025). The basis for the estimates is a dataset by Forward Analytics that contains plant-level data on all power sector assets (fossil fuels and renewables) and their relevant characteristics (capacity, emission intensity, ownership, etc.). Country-level estimates can be calculated through the following steps:

1. Project energy demand and associated emissions under current policies ('business as usual'), based on each country's current energy mix.
2. Calculate the emissions pathway the country would need to follow to implement 1.5°C-aligned decarbonisation ('net zero').
3. Determine the *phase-out pipeline*: which fossil fuel assets must be phased out when to implement the carbon budget-aligned net-zero pathway of emissions established in Step 2.
4. Estimate the *cost of the phase-out pipeline* (i.e., the opportunity cost of phasing out fossil fuels) as the expected missing cash flows to fossil fuel plants from closing early, plus retraining costs, plus wage compensation at prevailing wages for five years. The latter is taken as a proxy for the costs that might be incurred until workers in the fossil fuel sector find employment in new sectors.
5. Determine the *phase-in pipeline*: how much renewable capacity of what type (wind and solar) must be phased in, when, and where (including also energy storage capacity and grid extension) to replace fossil fuel capacity and keep up with any growth in energy demand. In our baseline estimates, we assume that each country chooses a mix of renewables to phase in (i.e., phase-in weights) equal to their current renewable energy mix (we check this does not exceed land availability).
6. Estimate the *cost of the phase-in pipeline* by taking current investment costs in each renewable type, storage capacity and grid expansion, and projecting how these may fall in the future as a function of learning-by-doing effects. We model the latter using the empirically calculated 'Wright's law' (i.e., assuming that the unit cost of renewable energy declines exponentially as a function of cumulative global deployment).

Table 1 reports an extract of our country-level estimates (see Appendix Table A1 for the full information). The left set of columns show the *investment costs* of implementing the phase-in pipeline, while the middle set shows the *opportunity costs*. The right set shows the total, both for the entire 11-year period of 2024-2035 and per year, with the last

column giving a crude estimate of the annual fiscal costs of transition. We assume that public climate finance must cover 100% of the opportunity costs of fossil fuels, as it does not generate a revenue stream and alternatives are not reliable, but only cover 25% of the renewables investment costs, with the rest covered by private finance.⁷

The results can be summarised as follows:

1. The total cost of the power sector transition to net zero in developing countries, including China, over the next 11 years is about \$9.7 trillion, or \$883 billion per year. Excluding China, the total cost drops to about \$5.1 trillion, or \$464 billion per year. About 77% of this corresponds to the cost of building new wind and solar plants; 12% to creating electricity storage (batteries), 8% to grid expansion, and just 2.3% to the opportunity costs of closing fossil fuel plants early. Most of the latter is for worker compensation and retraining. The reason that the opportunity costs for owners are relatively low is that our calculation does not try to cover the opportunity costs of not burning remaining coal, oil, and gas reserves, merely compensate owners for the early retirement of fossil fuel plants, many of which are already close to the end of their productive age.
2. Costs vary greatly by country, depending on economic size and current energy mix. Reflecting the size of its power sector, the cost of power sector transition in China is the highest (\$4.6 trillion, of which \$4.5 trillion is renewables investment and the rest opportunity costs). The next most expensive power sector to decarbonise is India's, with \$1.1 trillion in renewable investment cost and \$26 billion in opportunity costs.
3. Including China, the total average annual fiscal cost of power sector transition is in the order of \$238 billion per year between 2025 and 2035. If China is excluded, this falls to \$124 billion per year. If we were to include *all* countries listed as developing in the Annex to UNFCCC (1992), some of which now may be high-income – including China, but also South Korea, Saudi Arabia, and some other gulf states which are excluded from Table 1 (see table note) – then the total annual fiscal cost would rise to \$256 billion per year.

7 The IEA and IFC (2023) estimate that, with some public 'de-risking' (on average, about \$1 dollar in donor finance for \$10 in private finance), about 80% of the energy transition costs could be privately funded. This implies an overall public sector share of around 25-30%.

TABLE 1 COST OF 1.5°C-ALIGNED DECARBONISATION OF THE POWER SECTOR IN SELECTED DEVELOPING COUNTRIES, 2024-2035 (US\$ BILLION)

Country	Renewables investment costs (RC)				Opportunity costs (OC)				Total climate finance need		
	Total RC	Renewable energy sources	Storage	Grid extension and other	Total OC	Owners	Workers	Total need, 2024-2035	Total need, annual	Annual fiscal cost (25% RC + 100% OC)	
China	4602.20	4498.70	583.10	425.20	103.47	0.00	103.47	4602.20	418.38	114.00	
India	1141.25	1115.55	164.21	115.48	25.70	1.06	24.64	1141.25	103.75	28.27	
Iran	409.66	365.10	28.58	15.98	6.75	2.62	4.13	416.41	37.86	9.92	
Egypt	404.57	344.46	31.20	28.91	0.39	0.16	0.24	404.97	36.82	9.23	
Indonesia	338.71	268.17	44.52	26.01	5.35	2.26	3.09	344.06	31.28	8.18	
Iraq	298.25	268.33	18.75	11.17	7.05	1.77	5.28	305.30	27.76	7.42	
Mexico	237.80	189.83	28.12	19.77	6.89	5.55	1.34	244.69	22.25	6.03	
Viet Nam	220.81	166.34	31.15	23.32	5.53	0.45	5.08	226.34	20.58	5.52	
South Africa	212.73	158.11	32.25	22.37	5.26	0.02	5.24	217.98	19.82	5.31	
Thailand	192.43	160.18	19.68	12.58	1.72	0.03	1.70	194.16	17.65	4.53	
Brazil	153.44	115.50	23.11	14.82	15.61	12.47	3.14	169.05	15.37	4.91	
Malaysia	138.26	108.71	17.61	11.93	2.31	0.95	1.35	140.57	12.78	3.35	
Bangladesh	116.61	82.75	19.95	13.91	5.99	0.90	5.09	122.60	11.15	3.20	
Nigeria	78.79	67.06	7.88	3.86	0.63	0.04	0.60	79.43	7.22	1.85	
Pakistan	75.71	54.84	12.65	8.22	2.80	0.27	2.53	78.51	7.14	1.98	
Algeria	76.22	62.80	7.80	5.61	0.44	0.04	0.40	76.66	6.97	1.77	
Kazakhstan	74.84	57.28	10.03	7.54	1.12	0.19	0.93	75.96	6.91	1.80	
Argentina	72.17	54.92	10.44	6.81	0.52	0.03	0.49	72.69	6.61	1.69	
Philippines	68.39	51.24	10.15	7.00	2.73	0.25	2.48	71.12	6.47	1.80	
Other developing	706.22	538.78	102.40	65.04	22.83	6.11	16.71	729.06	66.28	18.13	
Developing inc. China	9593.37	8448.97	1203.65	845.55	223.09	35.16	187.92	9712.99	882.10	238.31	
Developing exc. China	4991.17	3950.27	620.55	420.35	119.62	35.16	84.45	5110.79	464.62	124.31	

Note: "Developing countries" refers to set defined by UNFCCC (1992), excluding Bahrain, Brunei Darussalam, Kuwait, Qatar, Saudi Arabia, South Korea and United Arab Emirates. "Storage" refers to the sum of short-term and long-term storage, "Grid extension and other" to the sum of Grid extension and Renewables to power electrolyzers (see Table A1). "Workers" to the sum of workers' 5-year wages and workers' retraining. See notes to Table A1.

Source: Bolton and Kleijnijenhuis (2025).

3 THE NET BENEFITS OF FUNDING DECARBONISATION IN EMDEs

This section estimates the net benefit of funding the power sector decarbonisation of developing countries for various groups of advanced countries (referred to as ‘climate finance coalitions’ or ‘financier coalitions’ below). We obtain these with the following steps.⁸

1. For each developing country, we compute cumulative avoided emissions associated with the power sector transition as the cumulative difference between country-level emissions under business-as-usual and the carbon budget-aligned net-zero scenarios for the power sector (the same that were used in the cost estimates above).
2. *Global* benefits are computed by multiplying these country-level cumulative avoided emissions by an estimate of the global social cost of carbon (SCC). We use two estimates that together represent a reasonable range: \$190/tCO₂ (Biden administration estimate; Rennert et al., 2022) and \$1056/tCO₂ (in line with Bilal and Känzig, 2024).
3. *Country-level* benefits of avoided emissions are obtained by multiplying the global avoided emissions benefit computed in step 2 with each country’s share in the SCC, using country-level SCC shares estimated by Ricke et al. (2018). For example, the estimated SCC share of the United States is 29%, the shares of the European Union and China are about 11.2% each, India 6.5%, and Japan 2.8%. The SCC share of all advanced (developed) countries as defined in UNFCCC (1992), Annex II, is 48%.
4. Finally, we compute net benefits as the difference between fiscal costs (i.e., the public part of the climate finance need) and benefits for the financier coalition, on the assumption that the financier coalition pays the entire fiscal cost of the power sector transition. In Bolton et al. (2024), we show how the net benefits would differ if each developing country contributes to the fiscal cost to the full extent of its private benefit in terms of avoided emissions. Taking these private benefits into account makes a big difference for China in India – because of their large share in the global SCC – but a much smaller difference for the remaining recipient countries. In this chapter, we disregard this aspect.

In the remainder of this section, we first compare the costs and benefits of fiscal support for power sector decarbonisation in developing countries from the perspective of a group of advanced financier countries. Our baseline case is that *developed countries* (those classified as Annex II countries under the 1992 UNFCCC agreement) provide climate finance to *developing countries* (those classified as non-Annex I countries under the

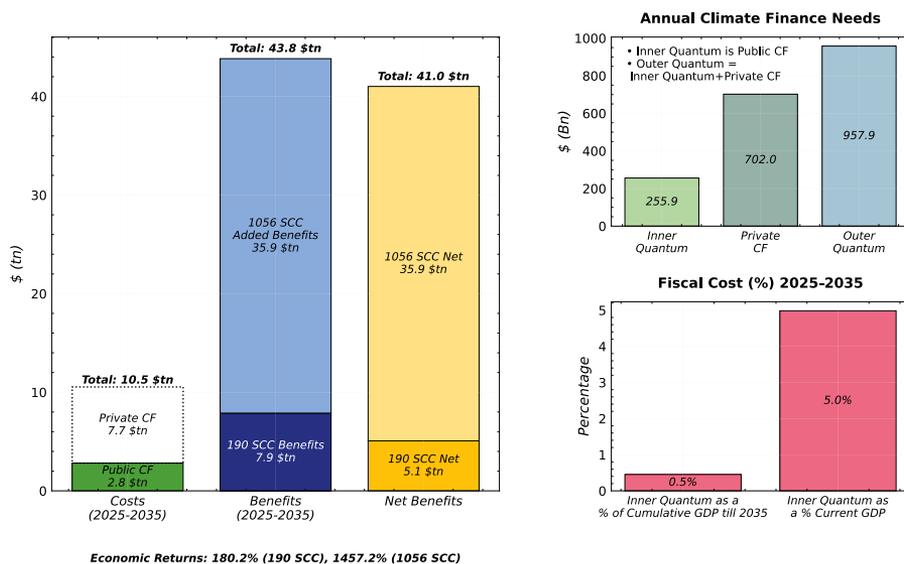
8 For more details on the methodology, data, and conceptual foundation see Adrian et al. (2022), Bolton et al. (2024) and Bolton and Kleinnijenhuis (2025).

1992 UNFCCC agreement). In addition, we examine the politically more realistic case in which the recipient group excludes China and the countries that have become high income in the meantime, while the financier group excludes the United States. We next examine net benefits of decarbonising power in a group of specific developing countries.

3.1 Net benefits of funding the energy transition of developing countries as a group

Figure 1 examines the case in which all developed countries as a group subsidise the energy transition of all developing countries as a group. The left plot compares the costs of decarbonising all developing countries in the 1992 definition (including both fiscal costs and the portion that can be covered by private finance, left bar) with the economic benefits of decarbonisation for developed countries. The main result is that the benefits to developed countries as a group greatly exceed the fiscal costs of \$2.8 trillion. Even if the lower SCC of \$190/tCO₂ is assumed, the financier coalition would enjoy a ‘profit’ of over \$5 trillion.

FIGURE 1 COSTS AND BENEFITS TO DEVELOPED COUNTRIES (UNFCCC ANNEX II) OF FINANCING 1.5°C-ALIGNED TRANSITIONS IN DEVELOPING COUNTRIES (UNFCCC NON-ANNEX I)



Note: the left bar of the left plot shows the total costs (outer perimeter) and fiscal cost (green box) of decarbonising the power sector of all developing countries in the definition of UNFCCC (1992), non-Annex I. This corresponds to all countries covered by Table 1, plus Bahrain, Brunei Darussalam, Kuwait, Qatar, Saudi Arabia, South Korea, and United Arab Emirates. The middle bar of the left panel shows the benefits of funding this decarbonisation to the developed countries in the definition of UNFCCC (1992), with an assumed SCC share of 48%, (Ricke et al., 2018), based on the assumption that the global SCC is either \$190/tCO₂ (Biden administration estimate; Rennert et al., 2022) or \$1056/tCO₂ (in line with Bilal and Känzig, 2024). The top-right plot splits annual climate finance into the annual “inner quantum” of public climate finance which must be offered in grant-equivalent terms (fiscal costs), and the “outer quantum” of total climate finance including mobilized private climate finance. The bottom-left plot shows the fiscal affordability to financier countries. The left bar shows the total 2025-2035 fiscal cost to financier countries as a percentage of the financier countries’ 2025-2035 cumulative GDP. The right bar shows the total 2025-2035 public climate finance costs to financier countries (as shown in bottom-stack part of left bar of the left plot) expressed as a percentage of financier countries’ 2024 GDP. The latter estimates by how much sovereign debt of financier countries would rise as a percentage of their GDP if they would pay for the 2025-2035 climate finance fully at the beginning, in 2024, by issuing sovereign debt.

Source: Bolton and Kleijnjehuis (2025).

The upper-right plot expresses fiscal costs (i.e., public climate finance; left bar) and private finance costs (middle bar) in annual average terms; the right bar (“outer quantum”) is the sum of the two. The latter (\$958 billion) is broadly consistent with the \$1 trillion that Bhattacharya et al. (2024) estimate developing countries need by 2030. In our calculations, however, this need arises immediately (in 2025) rather than by 2030 (as the High-Level Expert Group on Climate Finance, or HLEG, recommends) if the goal is to implement Paris-aligned Nationally Determined Contributions (NDCs) in 2025 and for the world to stay within the 1.5°C carbon budget.

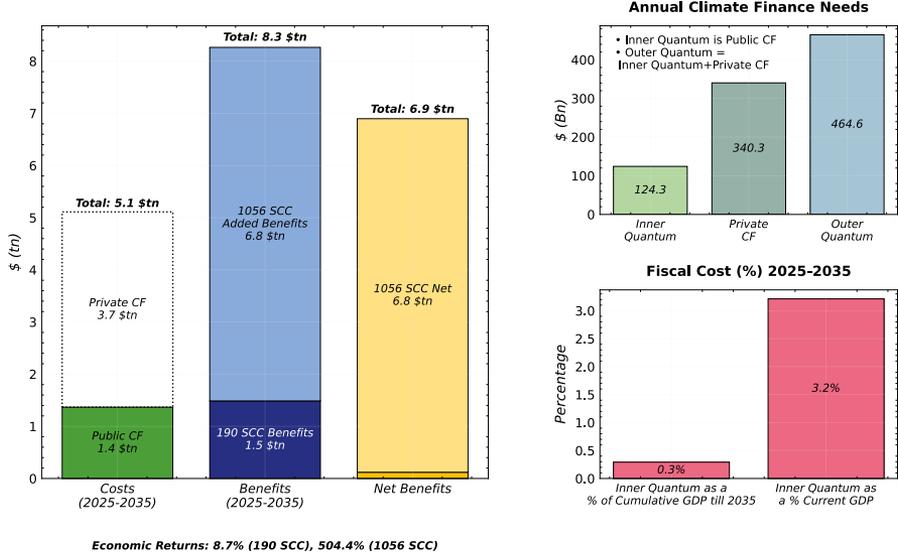
Finally, the lower-right plot shows that the fiscal costs of funding developing country energy transition are moderate as a share of GDP of the financier countries, at 0.5% of total GDP over the same time period, or 5% of GDP if the entire fiscal cost 2025-2035 is expressed as a percentage of 2024 annual GDP.

While useful as a benchmark, the case shown in Figure 1 is unrealistic in the sense that both the financier and the recipient groups are too broad. The latter includes all developed countries including the United States, which would not participate in any international climate funding at least for the duration of the present administration, while the latter includes China and several countries that are now considered high-income.

Figure 2 shows how the results change if these are eliminated from the recipient group and the financier group now consists only of the G7 excluding the United States, the remaining EU countries, Norway, Switzerland, Australia, and South Korea. The elimination of China and the oil-producing countries from the recipient group has a dramatic impact on costs, with total costs falling from \$10.5 trillion to \$5.1 trillion, while fiscal costs fall from \$2.8 trillion to \$1.4 trillion (left plot, left bar). But since the GDP of the financier group is smaller, fiscal costs as a share of GDP do not fall as dramatically – from 0.5% of GDP to 0.3%, or from 5% percent of GDP to 3.2% if the entire 2024-25 fiscal cost is expressed as a share of 2024 GDP (bottom-right plot). The main result is that net benefits for the financier coalition remain positive, even at the relatively low SCC of \$190/tCO₂, although the financier coalition is now much smaller, with an SCC share of only around 21% based on Ricke et al. (2018), and although the avoided emissions financed by this coalition are not as high (because China, South Korea, and several oil producers are excluded).

In summary, Figure 2 shows that even if the United States does not join the developed countries coalition, it is still in the economic interest of the European Union and other coalition members to provide climate finance at the needed scale to those developing countries that need it and commit to credible decarbonisation. It is also fiscally affordable to them, at 0.3% of their GDP.

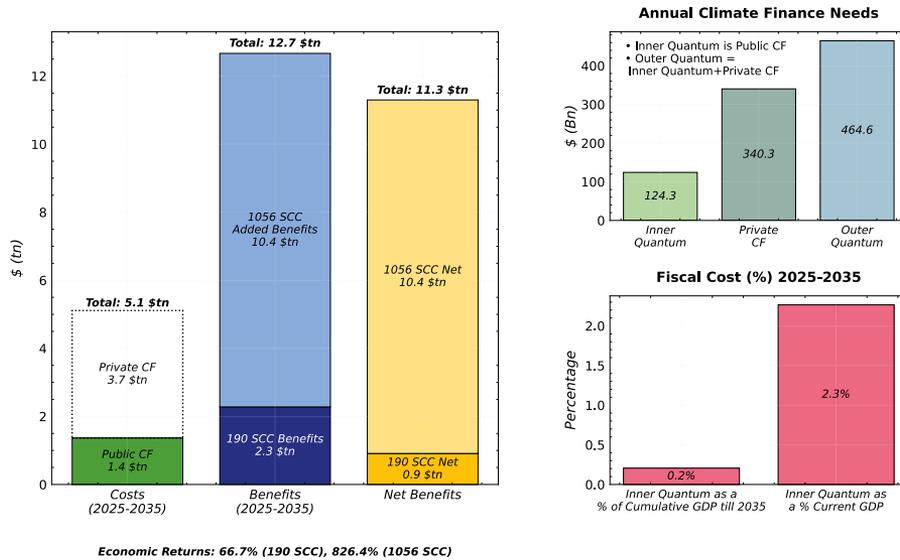
FIGURE 2 COSTS AND BENEFITS FOR FINANCIER COALITION (CONSISTING OF G7 EXCL. US, EU, SOUTH KOREA, NORWAY, SWITZERLAND, AND AUSTRALIA) OF FINANCING 1.5°C-ALIGNED TRANSITIONS IN DEVELOPING COUNTRIES (EXCLUDING CHINA, PETRO-RICH STATES, AND SOUTH KOREA)



Note: See note to Figure 1.
 Source: Bolton and Kleijnjehuis (2025).

The final variation of the financier coalition we consider is one where China joins the European Union and allies in the provision of climate finance. China is well positioned to support developing countries in their decarbonisation efforts. By joining the climate finance financier coalition, it stands to also benefit from exporting its renewables to countries in the Global South, as they receive climate finance to install these as part of their phase-in pipeline. In Figure 3, we show that if China joins the financier coalition, the total climate finance *need* for all developing countries remains, logically, unchanged. What does change is that the fiscal cost to the financier coalition falls from 0.3% of their annual GDP to 0.2% of their annual GDP. In addition, the gross and net benefits to the financiers increase by about \$800 billion, assuming a low SCC of \$190/tCO₂, and by about \$4.4 trillion if a high SCC of \$1056/tCO₂ is assumed, as the economic benefits to China – whose SCC share is approximately as large as that of the European Union, at 11.3% according to Ricke et al. (2018) – are now included.

FIGURE 3 COSTS AND BENEFITS TO FINANCIER COALITION (CONSISTING OF G7 EXCL. US, EU, CHINA, SOUTH KOREA, NORWAY, SWITZERLAND, AUSTRALIA) OF FINANCING 1.5°C-ALIGNED TRANSITIONS IN DEVELOPING COUNTRIES (EXCL. CHINA, PETRO-RICH STATES, AND SOUTH KOREA)



Note: See note to Figure 1.

Source: Bolton and Kleinnijenhuis (2025).

3.2 Net benefits of funding the energy transition of individual developing countries

Figure 2 shows that the net benefits of funding the energy transition of developing countries are positive, and likely large, even for a relatively small financier coalition. However, this result might be hiding large differences in the economic returns to power sector decarbonisation across recipient countries. Given constraints to fiscal and implementation capacity, it makes sense to prioritise the recipients with the highest benefits.

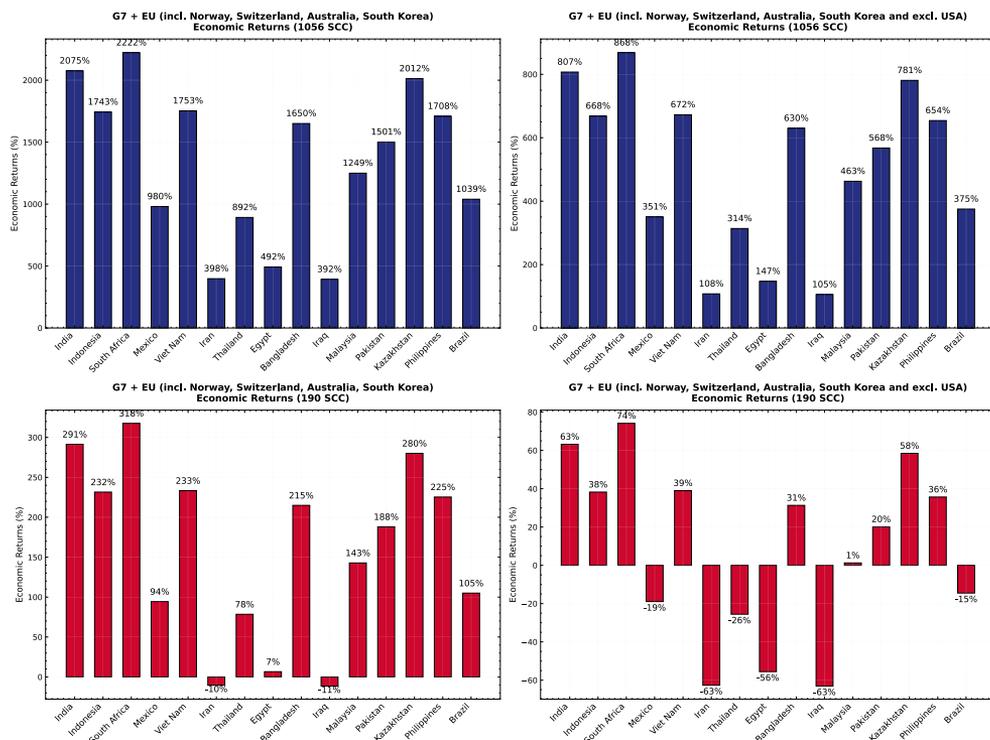
To see whether this is the case, Figure 4 reports country-level estimates of net returns (benefits minus costs, divided by costs) for the 15 largest developing country power sector emitters. The results cover two assumed financing coalitions: the G7 including the United States, the European Union, China, South Korea, Norway, Switzerland and Australia (left column); and the same coalition, but excluding the United States (right column). The upper row reports results for an assumed global SCC of \$1056/tCO₂, while the lower row assumes an SCC of \$190/tCO₂.

The main finding is that there are large differences in economic returns arising from power sector decarbonisation across the 15 countries, with Iran, Iraq, and Egypt showing the lowest returns, and India, South Africa, and Kazakhstan the highest. While all returns are positive for the high assumed SCC of \$1056/tCO₂, returns for Iraq and Iran

turn negative when the SCC of \$190/tCO₂ is assumed, even if the United States is part of the climate finance coalition (bottom-left plot). If the United States does not contribute and an SCC of \$190/tCO₂ is assumed, the economic returns for the finance coalition for Mexico, Egypt, Iraq, and Iran turn negative.

The main reason why the economic return of decarbonising the power sector of countries such as Mexico, Egypt, Iraq, and Iran is lower than that of countries such as India, Indonesia, and South Africa is that the latter rely on coal, the most CO₂-intensive fuel. That said, the global economic return to decarbonising even the oil- and gas-based power sectors remains high, and a large financial contribution to their decarbonisation would make sense even for the narrower climate finance club, if it can be complemented by additional donors or by a domestic public or private effort (including through greater use of carbon pricing).

FIGURE 4 ECONOMIC RETURN TO FINANCIER COALITIONS (CONSISTING OF G7, EU, SOUTH KOREA, NORWAY, SWITZERLAND, AND AUSTRALIA) FROM FINANCING 1.5°C-ALIGNED MITIGATION IN TOP 15 DEVELOPING COUNTRY POWER SECTOR EMITTERS (IN PERCENT)



Note: Economic return is defined as mitigation benefits to the financier coalition minus fiscal costs of decarbonisation in percent of fiscal costs. Left plots include the United States in the finance coalition, right plots exclude it. Top plots assume SCC of \$1056/tCO₂; bottom plots assume \$190/tCO₂.

Source: Bolton and Kleijnjehuis (2025).

Table 2 reports the average annual climate finance costs of decarbonising the power sectors of the top 15 developing country power sector emitters over 2025-2035. Total costs are broken down into what the public sector must cover (fiscal costs) and what the crowded-in private sector can cover (annual private climate finance). We again assume that developed countries cover 25% of investment costs in renewables (and complementary technologies) and 100% of fossil fuel early closure costs. The fiscal cost to the financier coalition (irrespective of whether the United States contributes) is very small and would be even smaller as a percentage of their annual GDP. Financing decarbonisation of individual developing countries is thus fiscally affordable to developed countries, while generating a large economic return in most cases (see Figure 4).

TABLE 2 COSTS OF MEETING 1.5°C-ALIGNED MITIGATION NEEDS IN TOP 15 DEVELOPING COUNTRIES BY POWER SECTOR EMISSIONS

Country	Climate finance costs		Annual fiscal costs (percent of 2024 GDP)	
	Annual fiscal costs (\$ billion)	Annual private climate finance (\$ billion)	G7 + EU (incl. Norway, Switzerland, Australia, South Korea)	G7 + EU (incl. Norway, Switzerland, Australia, South Korea and excl. USA)
India	27.7	76.0	0.04	0.07
Indonesia	8.2	23.1	0.01	0.02
South Africa	5.3	14.5	0.01	0.01
Mexico	6.0	16.2	0.01	0.01
Viet Nam	5.5	15.1	0.01	0.01
Iran	9.9	27.9	0.01	0.02
Thailand	4.5	13.1	0.01	0.01
Egypt	9.2	27.6	0.01	0.02
Bangladesh	3.2	78.0	0.00	0.01
Iraq	7.4	20.3	0.01	0.02
Malaysia	3.4	9.4	0.00	0.01
Pakistan	2.0	5.2	0.00	0.00
Kazakhstan	1.8	5.1	0.00	0.00
Philippines	1.8	4.7	0.00	0.00
Brazil	4.9	10.5	0.01	0.01

4 POLICY CONSIDERATIONS

It is important to keep in mind that the public funding is likely to come from a subset of high- and middle-income countries that benefit from EMDE decarbonisation and that are volunteering to cooperate in channelling climate finance at scale to EMDEs. Some countries that have the financial wherewithal may not participate, most notably the United States, and these countries therefore should not have any control rights over how this funding is allocated. Accordingly, a legal entity or vehicle separate from existing international financial institutions – we will call it the International Climate Fund (ICF) – will have to be set up, which will be governed by the funding countries joining the EMDE climate finance coalition.

As even the most willing countries joining this coalition will only be able to contribute limited funds (and revenues from carbon levies in one form or another, or raising sovereign debt, will also be limited), a fundamental objective ought to be to maximise the amount of EMDE decarbonisation that can be funded per dollar available of public funds channelled to the ICF. This means that financing the decarbonisation of EMDEs must rely on multiple funding sources – public, non-profit, and for-profit – with the objective of maximising the fraction of private funding from capital markets that can be attracted.

Maximising the quantity of decarbonisation per dollar, in turn, requires that the governance of phased-in renewable energy investment and the phase-out of fossil fuel operations offers the strongest possible protections to investors and the lowest costs. This is best achieved through a jurisdiction-level approach (rather than project-level), where the recipient country commits to a joint phase-in and phase-out pipeline of projects (through country platforms or other mechanisms).⁹ Another key advantage of a jurisdiction-level approach is that it ensures that there will be no carbon leakage. Indeed, a key weakness of a project-level approach is that there is no guarantee that the early closure of a fossil fuel power plant will not be followed by, or accompanied by, another fossil fuel-based facility. In effect, the ICF would enter into a climate finance programme with a recipient country, whereby funding for the next period – from both public and private sources – is conditional on meeting pre-agreed decarbonisation milestones along the jurisdiction-

9 A jurisdiction-level approach is essential to enable a speed and scale transition. No fossil fuel power plant will be closed unless there is a concrete plan for what renewable capacity to build in its place – otherwise, the country risks energy insecurity. Likewise, no renewable plant can be added unless there is a coordinated plan for how to connect it to the grid and supply it with sufficient storage. A jurisdiction-level approach is also critical for advance planning. When a country needs to close dozens – or, in the case of large emitters like China or India, even over a hundred – fossil fuel power plants each year to remain aligned with a net-zero carbon budget, this can only be achieved through detailed, forward-looking coordination. Renewable projects must be planned in advance to come online at the right time as replacements. This approach is also necessary to obtain permitting rights for the phase-in pipeline in advance, and to set enabling legislation (such as the German Coal Phase-Out Act of 2020) that clears legal and institutional bottlenecks. Any supporting infrastructure or grid upgrades likewise require synchronised planning. Finally, a jurisdiction-level strategy is essential to mobilize funding at the scale truly required for a country's transition to net zero. In short, only the jurisdiction-level approach allows for cohesive, advance planning at the speed and scale required to heed the climate science and timely resolve the climate crisis.

wide decarbonisation pathway. These funds would support the next phase-in pipeline of renewables and the phase-out pipeline of fossil fuels. For example, continued funding could depend on the country having achieved the previous period's *avoided emissions* target necessary to stay aligned with a 1.5°C-compatible decarbonisation pathway.

A major constraint that both the ICF and EMDE countries are likely to face is expertise in infrastructure investment and renewable energy investments. This expertise often resides in development banks. Accordingly, the creation of the ICF is best structured in partnership with a consortium of MDBs (and possibly national development banks). There are obviously different ways this partnership could be structured, and there are several leading MDB candidates that could partner with the ICF.

Note that the funding towards the decarbonisation of EMDEs would not be channelled directly to MDBs for two basic reasons. First, most MDBs are restricted in the types of investments they can make (for example, they cannot make equity investments) and their mission is primarily development finance, which is much broader than financing the energy transition. Second, the shareholder base of most MDBs is much larger than the group of countries that are likely to be willing to join a climate finance coalition.

Another important practical consideration is that private investor participation will not be forthcoming unless the risks and the transaction costs are sufficiently low. Two important implications follow from this observation.

First, to sufficiently de-risk renewable energy investments for private investors, the public funding (from the ICF and possibly other sources) would take the form of a first-loss (equity) tranche, set at a level sufficient to attract private capital. De-risking can also be achieved through other blended finance instruments, such as power purchase agreements (PPAs) and guarantees. However, because these instruments offer no upside to the guarantor by design, they can be more costly from a public finance perspective. The risk exposure of the public (first-loss) tranche can be further reduced by granting property and commercial development rights as collateral, thereby allowing public investors to capture some of the spillover value created by the renewable energy investments. Another way of derisking EMDE debt issuance to fund renewable energy investments could be to set up a credit default swap (CDS) insurance platform, where sovereign wealth funds and other long-term investors would be sellers of CDS protection.

Second, to sufficiently lower the transaction costs for private sector investors, who are likely to be mostly 'plug and play' investors, the project preparation and permitting would be done by the ICF and the relevant (MDB) partners, in cooperation with government entities in the jurisdictions receiving funding from the ICF (and possibly also infrastructure development companies). There could also be implementation partners.

5 CONCLUSION

This chapter provides granular estimates of the costs and benefits of 1.5°C-compatible decarbonisation of the power sectors in developing countries. These estimates inform the negotiations finalising the new climate finance agreement at COP30, as well as ongoing negotiations among coalitions of disposed developed and developing countries outside the COP framework. Indeed, a key insight of our analysis is that the absence of a global consensus, which has led to watered-down COP agreements on climate finance in the past, and in the face of retreat by the United States from climate mitigation, meaningful climate action and climate finance is not only possible, but also in the interest of a smaller coalition of disposed developed countries (which could also include China) and of those recipient developing countries that commit to a 1.5°C-compatible decarbonisation pathway. Our analysis shows that a coalition of disposed, self-interested developed countries – including, potentially, China – can economically justify and fiscally support the timely provision of climate finance at the scale needed to decarbonise the power sectors of all developing countries.

On the recipient side, developing countries that commit to decarbonisation plans – jurisdiction-wide pipelines of fossil fuel phase-outs and renewable phase-ins – can position themselves to access the necessary external climate finance to implement transitions aligned with a 1.5°C-consistent trajectory. This is a win for developing countries: it enhances their sustainable development prospects, reduces air pollution, lowers adaptation costs, and helps avert escalating climate disasters. It enables them to transition to clean energy at reasonable cost, while safeguarding national habitability.

On the financier side, we show that it is in the direct economic interest of sufficiently large coalitions of disposed developed countries to provide at scale climate finance in grant-equivalent terms when this climate finance is explicitly tied to measurable emissions reductions in the developing countries committing to decarbonisation. This is a win for developed countries: financing the cheapest mitigation opportunities abroad lowers the overall costs of abatement and reduces their exposure to escalating climate damages and adaptation costs at home, with returns that far exceed the investment. There is no plausible path to a global net-zero target without supporting decarbonisation in developing countries, which are otherwise projected to emit the majority of 21st-century GHGs.

The climate financing approach we propose – jurisdiction-wide, conditional, and coalition-based – is a coherent climate finance solution. Conceptually, the climate finance coalition (“climate finance club”) we outline parallels the “climate [carbon] club” idea of Nordhaus: a (non-global) coalition of self-interested, disposed countries leading decarbonisation. Unlike carbon clubs, the climate finance coalition works through carrots rather than sticks – which may have greater appeal in the developing world. Yet, a combination of carbon club and climate finance coalition – a combination of carrots

and sticks – is likely to deliver the most effective way forward for the decarbonisation of developing economies. In a world where carbon pricing remains sparse and insufficient, international climate finance provides the complementary mechanism needed to deliver decarbonisation at speed and scale.

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TABLE A1 COSTS AND CLIMATE FINANCE NEED ASSOCIATED WITH 1.5°C-ALIGNED DECARBONISATION OF THE POWER SECTOR IN DEVELOPING COUNTRIES, 2024-2035 (US\$ BILLION)

Country	Total climate finance need	Renewables investment costs (RC)						Opportunity costs (OC)			
		Total RC	Renewable energy sources	Short-term storage	Long-term storage	Renewables to power electrolyzers	Grid extension	Total OC	Owners	Workers 5 year wages	Workers retraining
Total including China	9712.994	9489.871	7440.669	1063.453	140.197	166.574	678.974	223.086	35.16	184.314	3.608
Total excluding China	5110.794	4991.171	3950.269	547.753	72.797	73.974	346.374	119.617	35.16	82.839	1.615
China	4602.200	4498.700	3490.400	515.700	67.400	92.600	332.600	103.469	0.000	101.475	1.993
India	1141.254	1115.553	835.864	144.964	19.245	21.953	93.527	25.7	1.061	24.165	0.475
Iran	416.406	409.659	365.095	25.174	3.405	0.873	15.111	6.748	2.617	4.05	0.08
Egypt	404.967	404.574	344.463	27.601	3.603	12.238	16.668	0.393	0.155	0.233	0.005
Indonesia	344.055	338.706	268.173	39.359	5.164	0.746	25.264	5.349	2.255	3.034	0.06
Iraq	305.303	298.252	268.333	16.613	2.133	0	11.173	7.051	1.767	5.184	0.1
Mexico	244.692	237.804	189.833	24.926	3.271	4.731	15.042	6.888	5.55	1.312	0.026
Viet Nam	226.342	220.812	166.343	27.593	3.552	5.153	18.17	5.53	0.451	4.981	0.098
South Africa	217.984	212.729	158.112	28.464	3.786	3.623	18.743	5.256	0.016	5.138	0.101
Thailand	194.155	192.432	160.175	17.355	2.32	2.589	9.994	1.723	0.026	1.664	0.033
Brazil	169.05	153.437	115.503	20.436	2.676	2.214	12.608	15.613	12.474	3.078	0.061
Malaysia	140.565	138.259	108.714	15.567	2.044	1.716	10.218	2.307	0.953	1.328	0.026
Bangladesh	122.6	116.61	82.748	17.642	2.311	2.429	11.481	5.99	0.902	4.991	0.097
Nigeria	79.428	78.794	67.058	6.937	0.938	0.075	3.786	0.633	0.036	0.585	0.012
Pakistan	78.507	75.705	54.836	11.11	1.539	0.734	7.487	2.802	0.271	2.483	0.048
Algeria	76.662	76.218	62.804	6.897	0.904	1.26	4.352	0.443	0.04	0.396	0.008
Kazakhstan	75.961	74.842	57.277	8.847	1.178	1.634	5.906	1.119	0.194	0.908	0.018
Argentina	72.688	72.171	54.918	9.245	1.198	1.04	5.77	0.517	0.03	0.477	0.009
Philippines	71.12	68.39	51.238	8.747	1.406	1.172	5.827	2.73	0.252	2.43	0.047
Syrian Arab Republic	54.216	52.794	45.058	4.302	0.544	0.091	2.799	1.422	0.455	0.949	0.018
Uzbekistan	49.407	48.263	36.304	6.36	0.909	0.432	4.257	1.144	0.526	0.607	0.012
Ghana	43.228	43.088	32.582	5.701	0.745	0.556	3.504	0.14	0.038	0.1	0.002
Morocco	42.551	42.233	34.812	3.869	0.508	0.488	2.555	0.319	0.035	0.279	0.006

Country	Total climate finance need	Renewables investment costs (RC)					Opportunity costs (OC)				
		Total RC	Renewable energy sources	Short-term storage	Long-term storage	Renewables to power electrolyzers	Grid extension	Total OC	Owners	Workers 5 year wages	Workers retraining
Chile	41.461	40.38	28.927	6.191	0.823	0.701	3.737	1.081	0.176	0.888	0.017
Turkmenistan	41.081	40.442	31.768	4.563	0.608	0.778	2.725	0.639	0.474	0.162	0.003
Israel	38.893	38.007	26.511	5.986	0.778	0.765	3.968	0.886	0.017	0.852	0.017
Colombia	30.619	29.581	22.434	3.706	0.485	0.643	2.312	1.039	0.751	0.281	0.006
Libya	27.83	27.121	18.466	4.671	0.614	0.567	2.803	0.709	0.028	0.668	0.013
Azerbaijan	25.284	24.818	20.841	2.056	0.286	0.228	1.407	0.466	0.231	0.231	0.005
Oman	25.134	24.26	17.843	3.893	0.494	0.574	1.456	0.875	0.042	0.817	0.016
Peru	21.281	21.039	15.74	2.904	0.396	0.38	1.618	0.242	0.155	0.085	0.002
Serbia	19.491	19.186	13.695	2.708	0.374	0.495	1.914	0.305	0.04	0.26	0.005
Venezuela, Bolivarian Republic of	19.485	18.367	13.792	2.633	0.343	0	1.599	1.118	0.726	0.384	0.008
Singapore	17.458	16.716	11.132	2.943	0.416	0.349	1.876	0.741	0.328	0.405	0.008
Dominican Republic	15.293	14.674	10.857	2.025	0.275	0.273	1.243	0.62	0.348	0.267	0.005
Tunisia	15.159	15.029	10.262	2.527	0.327	0.328	1.586	0.129	0.015	0.113	0.002
Lebanon	13.062	12.428	10.776	0.97	0.134	0	0.548	0.633	0.068	0.555	0.011
Zimbabwe	11.242	9.829	7.112	1.431	0.186	0.218	0.882	1.413	0	1.386	0.027
Jordan	10.272	9.782	6.257	1.844	0.242	0.203	1.236	0.49	0.181	0.303	0.006
Yemen	10.105	9.847	7.849	1.072	0.149	0.182	0.595	0.259	0.094	0.161	0.003
South Sudan	9.378	8.681	6.959	0.975	0.131	0.003	0.613	0.696	0.011	0.673	0.012
Democratic People's Republic of Korea	8.929	8.814	7.372	0.809	0.105	0	0.529	0.115	0.006	0.108	0.002
Trinidad and Tobago	7.888	7.577	5.84	0.898	0.117	0.152	0.569	0.311	0.257	0.054	0.001
Bosnia and Herzegovina	7.601	7.383	6.207	0.81	0.133	0.013	0.22	0.219	0	0.214	0.004
Sri Lanka	7.275	6.901	5.596	0.693	0.101	0.078	0.432	0.374	0.041	0.327	0.006
Lao People's Democratic Republic	7.206	6.864	5.151	0.961	0.125	0	0.628	0.342	0.007	0.329	0.006
Myanmar	6.714	5.587	4.32	0.701	0.096	0.021	0.449	1.126	0.001	1.104	0.021

Country	Total climate finance need	Renewables investment costs (RC)						Opportunity costs (OC)			
		Total RC	Renewable energy sources	Short-term storage	Long-term storage	Renewables to power electrolyzers	Grid extension	Total OC	Owners	Workers 5 year wages	Workers retraining
Cambodia	6.217	5.903	4.584	0.658	0.118	0.097	0.446	0.315	0.007	0.302	0.006
El Salvador	6.142	6.08	4.73	0.716	0.095	0.117	0.423	0.062	0.015	0.046	0.001
Cuba	5.948	5.815	4.12	0.879	0.12	0.131	0.564	0.133	0	0	0
United Republic of Tanzania	5.736	5.728	4.758	0.589	0.082	0	0.298	0.008	0.006	0.002	0
Bolivia (Plurinational State of)	5.232	4.953	3.508	0.754	0.103	0.092	0.496	0.278	0.219	0.058	0.001
Panama	4.771	4.596	3.457	0.598	0.079	0.09	0.372	0.174	0.095	0.078	0.001
Honduras	4.613	4.449	3.313	0.618	0.081	0.055	0.382	0.163	0.077	0.085	0.001
Montenegro	4.308	4.237	3.485	0.386	0.048	0.068	0.25	0.07	0	0.069	0.001
Republic of Moldova	4.048	3.89	2.565	0.722	0.101	0.078	0.424	0.158	0.117	0.04	0.001
Senegal	3.942	3.898	2.827	0.588	0.084	0.084	0.315	0.045	0.003	0.041	0.001
Angola	3.805	3.794	3.099	0.411	0.058	0.017	0.209	0.011	0.003	0.008	0
Jamaica	3.644	3.595	2.806	0.386	0.05	0.091	0.262	0.049	0.01	0.039	0
Botswana	3.523	2.945	2.227	0.381	0.048	0.06	0.229	0.578	0	0.566	0.011
Ecuador	3.282	3.224	2.571	0.379	0.052	0.003	0.219	0.058	0.054	0.004	0
Guatemala	3.029	2.958	2.273	0.377	0.051	0.036	0.222	0.07	0.019	0.05	0.001
Uruguay	2.971	2.889	2.278	0.338	0.052	0.062	0.159	0.082	0.068	0.014	0
Kyrgyzstan	2.889	2.83	2.205	0.357	0.045	0	0.223	0.06	0.002	0.056	0.001
Cameroon	2.419	2.408	1.834	0.338	0.046	0	0.19	0.011	0.003	0.008	0
North Macedonia	2.272	2.185	1.956	0.148	0.022	0.014	0.045	0.087	0.012	0.073	0.001
Mongolia	1.849	1.479	1.479	0	0	0	0	0.37	0.002	0.361	0.007
Zambia	1.83	1.668	1.288	0.225	0.032	0.006	0.117	0.162	0.001	0.158	0.003
Gabon	1.772	1.759	1.309	0.251	0.032	0	0.168	0.013	0.001	0.011	0
Armenia	1.67	1.58	1.58	0	0	0	0	0.09	0.016	0.073	0.001
Georgia	1.555	1.48	1.199	0.153	0.025	0.001	0.101	0.075	0.017	0.057	0.001
Kenya	1.442	0.998	0.65	0.182	0.026	0.018	0.122	0.444	0.001	0.434	0.008
Mauritania	1.331	1.112	0.728	0.205	0.028	0.023	0.129	0.218	0.113	0.104	0.002

Country	Total climate finance need	Renewables investment costs (RC)						Opportunity costs (OC)			
		Total RC	Renewable energy sources	Short-term storage	Long-term storage	Renewables to power electrolyzers	Grid extension	Total OC	Owners	Workers 5 year wages	Workers retraining
Nicaragua	1.19	1.124	0.82	0.162	0.022	0.014	0.105	0.066	0.019	0.047	0.001
Bahamas	1.06	0.986	0.77	0.113	0.015	0.019	0.069	0.074	0.013	0.06	0.001
Mauritius	0.744	0.709	0.481	0.137	0.021	0.015	0.054	0.035	0	0.034	0.001
Mozambique	0.716	0.666	0.491	0.099	0.015	0.008	0.053	0.05	0.001	0.048	0.001
Tajikistan	0.69	0.62	0.477	0.079	0.01	0	0.053	0.069	0.005	0.063	0.001
Madagascar	0.676	0.594	0.41	0.1	0.013	0.009	0.063	0.082	0.001	0.079	0.001
Mali	0.56	0.559	0.446	0.062	0.008	0.007	0.036	0.001	0.001	0	0
Congo	0.512	0.49	0.378	0.076	0.011	0	0.024	0.022	0	0.021	0
Equatorial Guinea	0.481	0.435	0.349	0.048	0.007	0	0.031	0.046	0	0.045	0.001
Burkina Faso	0.46	0.388	0.266	0.066	0.009	0.008	0.04	0.071	0.001	0.069	0.001
Djibouti	0.44	0.372	0.291	0.043	0.006	0.007	0.026	0.068	0.001	0.066	0.001
Chad	0.393	0.329	0.257	0.038	0.005	0.006	0.023	0.064	0.001	0.062	0.001
Sierra Leone	0.388	0.318	0.209	0.059	0.008	0.006	0.036	0.07	0.001	0.067	0.001
Uganda	0.383	0.27	0.193	0.042	0.006	0.001	0.028	0.112	0.001	0.11	0.002
Somalia	0.268	0.24	0.157	0.045	0.006	0.005	0.027	0.028	0.001	0.027	0.001
Niger	0.26	0.115	0.115	0	0	0	0	0.145	0	0.142	0.003
Barbados	0.244	0.226	0.148	0.042	0.006	0.005	0.026	0.018	0.005	0.013	0
Papua New Guinea	0.218	0.218	0.159	0.033	0.005	0	0.022	0	0	0	0
Antigua and Barbuda	0.207	0.199	0.149	0.025	0.004	0.004	0.017	0.008	0.007	0.001	0
Benin	0.199	0.193	0.154	0.02	0.003	0.005	0.011	0.006	0	0.005	0
Seychelles	0.194	0.169	0.111	0.031	0.004	0.003	0.019	0.025	0	0.024	0
Afghanistan	0.18	0.174	0.146	0.015	0.002	0.001	0.01	0.006	0.002	0.004	0
Maldives	0.142	0.139	0.104	0.018	0.002	0.003	0.012	0.003	0.002	0.001	0
Suriname	0.127	0.11	0.08	0.023	0.005	0	0.002	0.017	0.002	0.015	0
Eritrea	0.116	0.049	0.049	0	0	0	0	0.067	0	0.066	0.001
Togo	0.112	0.112	0.087	0.015	0.002	0.002	0.006	0	0	0	0
Rwanda	0.107	0.105	0.066	0.02	0.003	0.002	0.014	0.002	0	0.002	0

Country	Total climate finance need	Renewables investment costs (RC)					Opportunity costs (OC)				
		Total RC	Renewable energy sources	Short-term storage	Long-term storage	Renewables to power electrolyzers	Grid extension	Total OC	Owners	Workers 5 year wages	Workers retraining
Costa Rica	0.092	0.08	0.06	0.011	0.002	0.001	0.007	0.012	0.001	0.011	0
Central African Republic	0.061	0.039	0.026	0.007	0.001	0.001	0.004	0.021	0	0.021	0
Namibia	0.052	0.052	0.041	0.006	0.001	0.001	0.004	0	0	0	0

Notes: Column 3 reports the climate finance needs for each developing country as defined by UNFCCC 1992 non-Annex I, excluding Bahrain, Brunei Darussalam, Kuwait, Qatar, Saudi Arabia, South Korea and United Arab Emirates, to implement 1.5°C-aligned NDCs over 2025-2035. Renewable investment costs consist of replacing fossil fuels and keeping up with growth in energy demand, short-term energy storage via lithium-ion batteries (in line with Way et al. (2022)), we conservatively assume that 20 percent of daily generated renewable energy must be able to be stored short-term); long-term energy storage via green hydrogen produced with electrolyzers (in line with Way et al. (2022)) we conservatively assume that one month worth of annual generated renewable energy must be able to be stored long-term; renewables to power electrolyzers so that the hydrogen produced is green; and grid extension. The opportunity costs consist of the opportunity costs of: the expected discounted missed free cash flow from early closure, i.e. the stranded asset value for owners; fossil fuel worker lost wages for the duration of 5 years; and fossil fuel worker retraining for employment elsewhere, particularly in the renewable industry. For 45 countries, estimates are not available due to data limitations. Detailed methodology is presented in Section 9.5 of Bolton and Kleinmijenhuis (2024).

Source: Bolton and Kleinmijenhuis (2025).