

# NATIONAL FAIR SHARES

## THE MITIGATION GAP - DOMESTIC ACTION AND INTERNATIONAL SUPPORT

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## THE MITIGATION GAP - DOMESTIC ACTION AND INTERNATIONAL SUPPORT

*This report is motivated by a striking truth – an equitable international agreement is necessary if we are to preserve a stable climate system. This is because equity is the key to cooperation, and cooperation is indispensable in solving any commons problem. And the climate crisis is notably the most pressing commons problem of all time. As is stressed in the IPCC’s Fifth Assessment Report Summary for Policy Makers, “Outcomes seen as equitable can lead to more effective cooperation.” Or, as it is often and more straightforwardly said, “Equity is the pathway to ambition.”*

*In this report, we systematically apply a generalized and transparent equity reference framework (see Appendix 2), with the goal of quantitatively examining the problem of national fair shares in a global effort to rapidly reduce greenhouse gas emissions. This framework is based upon an effort-sharing approach, uses flexibly-defined national “responsibility and capacity indicators,” and is explicitly designed to reflect the UNFCCC’s core equity principles. It can be applied using a range of possible assumptions, and whatever values are chosen, they are applied to all countries, in a dynamic fashion that reflects the changing global economy.*

*In this report, we present results for twelve representative countries and a selected set of illustrative “cases.” Each case begins with the selection of a reference mitigation pathway; this choice corresponds to a certain level of ambition and level of risk of exceeding 2°C. The mitigation pathway also implies an annual global mitigation effort, which drives society to diverge rapidly from business-as-usual emissions growth. Each country’s share of global responsibility and capacity determines its fair share of the global mitigation effort.*

*The quantitative analysis in this report is based upon the Climate Equity Reference Calculator, an online tool and database that allows the user to select “equity settings” relating to key equity-related parameters, including responsibility, capacity, and development need. These settings are then used, together with standard demographic and macroeconomic indicators (e.g., national population, GDP and carbon-intensity) to calculate implied national fair shares of the global mitigation effort. Importantly, this fair share is expressed as a sum of domestically- and internationally-supported mitigation.*

*We provide illustrative results for various alternative levels of ambition, for various equity settings, and for various estimates of national emissions reductions. We also show that the differences between the cases are much less significant than the similarities, and that a great deal of the detail can therefore be set aside in favor of an “equity band” that is bound by “High Equity Settings” on one side and “Low Equity Settings” on the other. We have defined this equity band to span a wide range of perspectives on fairness, but of course more work remains to be done on this front. In particular, as we explain below, it is easier to argue that the “Low Equity Settings” are “too low” than it is that the “High Equity Settings” are “too high.”*

*In the course of this analysis, a notable pattern emerges. In general, a nation’s fair share of the global mitigation effort can be quite different from its domestic mitigation potential.<sup>1</sup>*

- Countries with relatively high capacity and responsibility are generally found to have fair shares that greatly exceed their own domestic mitigation potential; therefore, if they are to fulfill their entire fair share, they are required to contribute financial and technological support to other countries. For these countries – “Support Contributors” – national fair shares are presented as a combination of domestic and internationally-supported mitigation.*
- Conversely, countries with relatively low capacity and responsibility are able to act entirely within their own borders. It is assumed that they use international support to undertake mitigation in excess of their own fair shares of the global mitigation effort, and by so doing exploit their full national mitigation potentials. For these countries – “Support Recipients” – the national fair share is reported along with the additional mitigation that could be undertaken, assuming sufficient international support.*

*Note that nations are not taken to be “Support Contributors” or “Support Recipients” in any static or absolute sense. The category within which a given nation falls is determined by the user’s selected equity settings.*

*In all of this, this report aims to provide input to the review of the Intended Nationally Determined Contributions (INDCs) that are now being tabled under the UNFCCC. It derives a defensible range for each country’s fair share of a given global climate effort. This “equity*

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<sup>1</sup> By “mitigation potential,” we mean not only techno-economic potential (efficiency, low-carbon energy technology and so on) but also emissions reductions associated with consumption-related and lifestyle changes.

*band” provides a way to assess a given country’s position relative to the requirements of equity and science – that is, whether that country is a leader or a laggard.*

*One can also assess any country’s INDC by asking “what overall global ambition level can it plausibly claim to be pledging its fair share of”. One can derive this “ambition band” by assuming that all other countries make “comparable efforts” by doing their fair share according to the same equity assumptions. This approach is demonstrated by way of the EU’s 40% target for 2030. We show that the EU’s “ambition band,” unless it is supplemented by considerable amount of international mitigation support, is inconsistent with any plausible 2°C level of ambition.*

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## INTRODUCTION

This report presents illustrative national “fair shares,” as related to both domestic mitigation action and internationally-supported mitigation action. These fair shares are expressed as pairs of numbers, both of which are expressed in tons. We do not attempt to estimate the size of national fair shares on the adaptation / loss-and-damage side of the climate transition equation, as there are not yet any reliable, comprehensive estimates of the size of the total required global effort.

The analysis in this report is done within the [Climate Equity Reference Calculator](#).<sup>2</sup> This online tool and database allows the user to select specific equity-related settings and other key parameters, and then to calculate the implied national fair shares of the global mitigation effort. These calculations are available for all countries, though in this report we present results for only twelve, which taken together provide a good overview of the global situation. They are the developed economies of the US, EU28, Germany, and Japan, the BRICS (Brazil, Russia, India, China, and South Africa), the LDC Nepal, and the COP hosts Peru and France.

The *Climate Equity Reference Calculator* first asks the user to select a global mitigation pathway. This choice specifies a level of ambition, and determines the required level of global mitigation effort in each year, to be fairly shared among countries. Then, drawing on the core equity principles of the UNFCCC, the *Calculator* asks the user to specify a selection of “equity settings,” and thus a definition of capacity and responsibility, which can be calculated in a way that excludes the income and emissions of individuals below some specified threshold, such as a ‘development threshold’ that is set so as to exempt poor individuals. Drawing upon standard information sources for historic and projected data (GDP, population, emissions, etc.), each country’s share of the total global capacity and responsibility is then estimated. The resulting “Responsibility and Capacity Index” (RCI) in turn determines the country’s fair share, in percentage terms, of the global mitigation effort and (though it is not being treated here) of the global effort towards adaptation and loss and damage. (See *Appendix 2* for further detail.)

A nation’s fair share of the global mitigation effort may be quite different from its domestic mitigation potential (and here we mean both techno-economic potential and emission reductions associated with consumption and lifestyle changes). For wealthy and high emitting countries (i.e., those with high capacity and responsibility), the fair share generally *exceeds* the country’s domestic mitigation potential, and in some cases even its domestic emissions. For poor and low emitting countries (i.e., those with low capacity and responsibility), the domestic potential for curbing emissions may greatly exceed the country’s fair share of the global mitigation effort. For countries with middle-range incomes and emissions, domestic mitigation potential and fair share may be closely matched.

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<sup>2</sup> The *Calculator* can be access at <http://www.gdrights.org/calculator/> -- this website also provides further technical information and help for the user.

Therefore, fair shares must be seen in terms that include both domestic reductions and support for mitigation in other countries. Otherwise, the wealthier countries will be saddled with greater mitigation obligation than they can possibly discharge, and poorer countries will be left with a great mass of unexploited mitigation options, an untenable situation rendering impossible the pursuit of an ambitious global mitigation pathway. Consequently, this report explicitly presents fair shares in terms of the sum of 1) reductions achieved domestically and 2) reductions achieved through international support.

## HOW THIS REPORT IS ORGANIZED

Using clearly stated methods and assumptions, the *Climate Equity Reference Calculator* provides the user with a wide range of choices. These represent different possible technical, ambition and equity settings designed to reflect a variety of approaches to calculating fair shares, all of which are plausibly consistent with the Convention's core equity principles.<sup>3</sup> In this report, we present results for a selected subset of the settings available in the calculator, carefully chosen to allow an exploration of the most important and politically relevant parameters: three global mitigation pathways, three equity settings related to capacity, three equity settings related to historical responsibility, and three methods of estimating domestic reductions.

This itself is a very large subset of all the available settings, and in principle, it provides a total of 81 (= 3 x 3 x 3 x 3) cases. Of course, we don't present all of these cases in this report. Rather, we examine a set of example countries, presenting for each an "equity band" that is bracketed by "High Equity Settings" on the one side and "Low Equity Settings" on the other. The main report presents results for four example countries – the United States, the EU, China and India – along with general results at the global level. This presentation, we hope, suffices as an introduction to the overall approach. Then, in Appendix 1, we give results for many more cases, and the twelve representative countries that we've used as examples. Again, the full range of cases considered here (and many other selections of settings) can be examined interactively and in detail for all countries with the online *Climate Equity Reference Calculator*.<sup>4</sup>

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<sup>3</sup> See *The Core Convention-based Equity Principles*, a Climate Action Network position paper of September 2013. [http://climatenetwork.org/sites/default/files/can\\_convention-based\\_indicators\\_sept2013.pdf](http://climatenetwork.org/sites/default/files/can_convention-based_indicators_sept2013.pdf)

<sup>4</sup> The *Calculator* currently supports only the equal-proportional method for estimating country-level emissions reductions, whereas this report presents two alternative methods as well. These alternative methods will be available in the *Calculator* in a near-future release.

## AMBITION AND EQUITY SETTINGS

To summarize the choices involved in defining our illustrative cases, it's helpful to express them in terms of the following set of specific ambition and equity settings:

1. **Level of ambition:** Three mitigation pathways, corresponding to three global mitigation budgets, each representing a goal that is politically relevant in the current mitigation debate. Each of the pathways is referenced to the greenhouse gas budgets reported in the IPCC's Fifth Assessment Report for the purpose of estimating their likelihood of keeping warming below 2°C.
2. **Equity settings:** We present here three alternative settings related to *capacity*, and three alternative settings relating to *responsibility*.
  - The capacity settings differ in how progressively they calculate capacity from income: No Progressivity, Weak Progressivity, and Strong Progressivity.
  - The responsibility settings differ in only the initial date from which they account for historic emissions in the calculation of responsibility: since 1850, since 1950, since 1990.
3. **Domestic mitigation:** Three illustrative approaches are considered for estimating how the fair shares of the relatively wealthy countries might be divided into domestic mitigation and international support, and conversely how much international support the relatively poor countries would receive to enable mitigation actions that exceed their own fair shares of the global mitigation requirement.

These various ambition and equity settings are enumerated in the following schematic. Each "case" is defined by making a single choice from each row.

The ambition and equity settings			
Level of ambition	G8 pathway	Weak 2°C pathway	Strong 2°C pathway
Equity settings	Capacity: No Progressivity	Capacity: Weak Progressivity	Capacity: Strong Progressivity
	Responsibility: Since 1990	Responsibility: Since 1950	Responsibility: Since 1850
Domestic mitigation estimate	Intensity-adjusted	Equal-proportional	Income-adjusted



## LEVEL OF AMBITION

The *Climate Equity Reference Calculator* supports three global mitigation pathways, which we identify respectively as “Strong 2°C pathway,” “Weak 2°C pathway” and “G8 pathway.” For the purposes of this

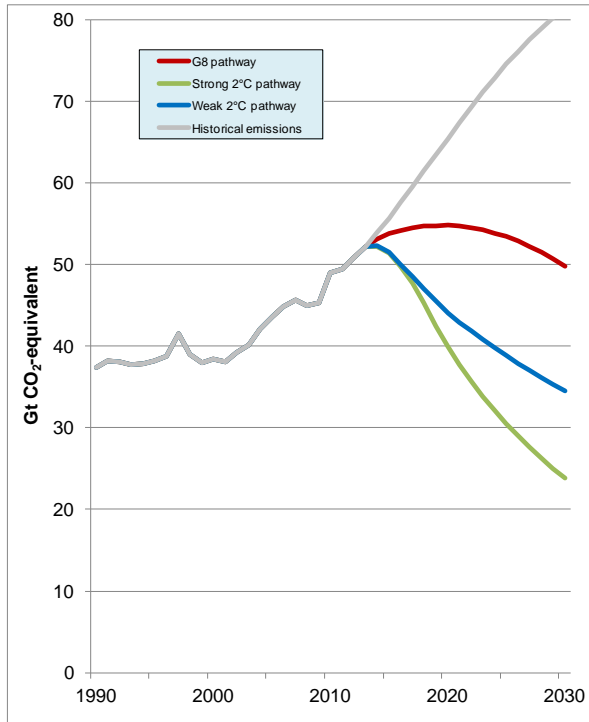


Figure 1: Three global mitigation pathways considered in this analysis – Strong 2°C pathway, a Weak 2°C pathway, and a G8 pathway, with a progressively greater risks of exceeding 2C.

analysis, the most relevant feature of each pathway are (1) its likelihood of exceeding 2°C, which reflects the risk associated with the pathway, and (2) the amount of mitigation required relative to business-as-usual (BAU) emissions growth<sup>5</sup>, which is the overall global effort to be divided into national fair shares.

Information regarding each pathway’s likelihood of exceeding 2°C can be derived by noting that each corresponds to a global emissions budget, which can be referenced to one of the budgets given in the IPCC’s Fifth Assessment Report (Working Group 1).

The chart below compares the CO<sub>2</sub> budgets of the three pathways to the budgets associated with a 67%, 50%, and 33% chance of keeping warming below 2°C, as presented by the IPCC<sup>6</sup>.

This comparison allows us to conclude, in rough terms, the following:

- The Strong 2°C pathway, with a budget well below the IPCC 67% budget, has considerably greater than 67% chance of keeping warming below 2°C.
- The Weak 2°C pathway would have between a 33% and a 50% probability of keeping warming below 2°C.
- The G8 pathway, with a budget well above the IPCC’s 33% budget, has a considerably less than 33% chance of keeping warming below 2°C.

<sup>5</sup> See Appendix 2, and particularly its footnotes, for more discussion of business-as-usual emission projections.

<sup>6</sup> For more detail see *Three salient global mitigation pathways, assessed in light of the IPCC carbon budgets*, at <http://gdrights.org/gdrs-scorecard-calculator-information/mitig-path-overview/>

The IPCC provides less explicit information on the likelihood of exceeding 1.5°C, but based on the information given, it is possible to conclude that the Strong 2°C path’s chance of keeping warming below 1.5°C is “more unlikely than likely” (less than 50%) and the Weak 2°C and G8 paths are both “unlikely” (less than 33%)<sup>7</sup>

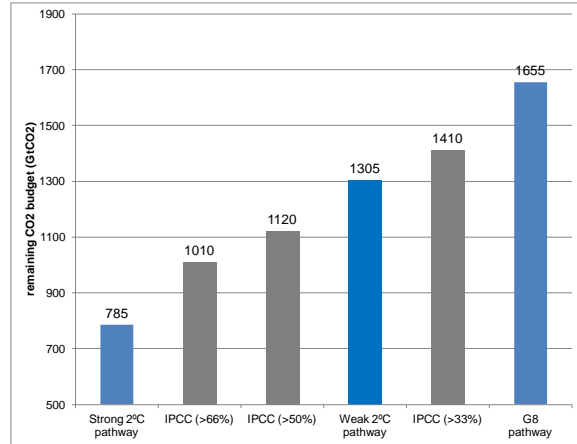


Figure 2: The remaining (post 2012, forward to exhaustion) CO<sub>2</sub> budgets associated with the three mitigation pathways (blue), as well as the IPCC’s three carbon budgets (grey), shown in the same terms.

## EQUITY SETTINGS

The *Climate Equity Reference Calculator* supports a range of settings and parameters, which it uses to calculate a Responsibility and Capacity Index for each country. There are many possible equity settings, but this analysis focuses on two key aspects of equity. The first is the overall income progressivity used in the definition of capacity. The second is start date from which historical emissions are reckoned in the definition of responsibility.

While various other equity-related settings are available in the *Calculator*, they are not explored in this report. They are held constant across the various cases presented here:

- **The relative weighting of responsibility and capacity.** The relative weighting of the Responsibility and Capacity Index is set at 50% / 50%. Other choices ranging from 0% / 100% (all responsibility) to 100% / 0% (all capacity) are available in the *Calculator*.
- **Choice of greenhouse gases.** The calculations in this report are based on emissions of fossil carbon dioxide and non-CO<sub>2</sub> “Kyoto basket” GHGs, and exclude land-use emissions. The *Calculator* gives the user the choice of including or excluding non-CO<sub>2</sub> GHGs and land-use emissions.
- **Choice of accounting for emissions on a production or consumption basis.** Here we use production-based accounting. The *Calculator* also offers the option to account for emissions on a consumption

<sup>7</sup> See table SPM1 in the Climate Change 2014: Mitigation of Climate Change – Summary for Policymakers, Contribution of Working Group III to the Intergovernmental Panel on Climate Change Fifth Assessment Report, Berlin, Germany. <http://www.mitigation2014.org>.

basis (whereby emissions generated in the production of goods are attributed to the country that consumes those goods).

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## PROGRESSIVITY

As is customary in discussions of equitable effort-sharing, the *Calculator* defines *capacity* in terms of a country's income. Income is typically considered in a progressive manner in national tax policy; analogously, it can be considered in a progressive manner for the purposes of defining capacity. Since the overall progressivity is a key defining characteristic of capacity, we consider three alternative settings here. (See *Appendix 2*, and in particular *Figure A2* and accompanying text for a further explanation.)

- The low case is a **“No Progressivity”** setting in which all income within a nation counts toward its capacity. There is no income threshold below which individual income is exempted from national capacity, either on the basis of a poverty exclusion or a development exclusion. Rather, when calculating capacity, each dollar of income – even for the poorest of the world's people – counts as much as each dollar of the world's richest. This setting is inconsistent with the conventional progressive approach that virtually all societies have adopted for the purpose of income taxation, and it is difficult (if not impossible) to justify in equity terms. Nonetheless we include it here as a lower bound.
- The medium case is a **“Weak Progressivity”** setting in which there is a low income threshold below which individual income is exempted from the calculation of national capacity.<sup>8</sup> In this report, this weak case is used to define “Medium Progressivity” cases, in which the “development threshold” is set at \$7,500 (approximately \$20/day). This level is just a bit above a global poverty line that reflects empirical observations, so it too should be taken as a low estimate of “medium” progressivity.
- The high case is a **“High Progressivity”** setting in which a lower income threshold is set at \$7,500 (as in the “Weak Progressivity” case), with income above this threshold counting toward national capacity at a steadily rising rate, until it reaches an upper income threshold (set for this analysis at \$50,000), above which all income is counted towards national capacity. Note that the figure of \$50,000 is set as the upper threshold because it falls within the income of the highest earning “one percent” of the global population. These settings increase the overall progressivity of the income calculation just as a graduated tax schedule raises the progressivity of an income tax.<sup>9</sup>

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<sup>8</sup> Correspondingly, emissions corresponding to income below the same threshold do not count toward Responsibility.

<sup>9</sup> The *Climate Equity Reference Calculator* allows the user to set the lower and upper thresholds at any income level. It refers to the lower income level as the “development threshold” and the higher income level as the “luxury threshold”. These terms are used because they are suggestive of a typical and ethically compelling interpretation, where the lower threshold is chosen to reflect an income level modestly above a global poverty line, and the upper threshold is chosen to reflect an income level above which all income is discretionary, and much of it is spent for consumption well beyond basic comforts.

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## HISTORICAL RESPONSIBILITY

The *Calculator* defines responsibility in terms of a country's cumulative emissions, as is generally done in discussions of equitable effort-sharing. A key setting then is the initial year from which historic emissions are included in the reckoning of a country's responsibility. We consider three alternative settings here.

- The low case is defined as **“Responsibility since 1990.”** This date corresponds roughly to the time when negotiations for an international legal agreement to limit GHGs began in earnest and the risks of rising GHGs were acknowledged by the IPCC. The 1990 date can be difficult to defend, given that the UN Framework Convention was itself being negotiated at that time, and its authors cannot reasonably be said to have had 1990 in mind when they inscribed the term “historical” into the text. Still, the 1990 case is arguably fair, but *only* in cases where the Responsibility and Capacity Index is set to include capacity (as it is in all the cases in this report). This is because historical responsibility before 1990 is highly correlated with national capacity.
- The medium case is defined as **“Responsibility since 1950.”** This date marks a useful middle setting. It defines a period in which responsibility is comprehensible in terms of human lifetimes, reflects roughly the useful lifetimes of much infrastructure, and avoids some of the historical discontinuities that occur when, for example, wars remake national boundaries.
- The high case is defined as **“Responsibility since 1850.”** This date defines responsibility as cumulative emissions since a date that roughly corresponds to the time at which carbon dioxide emissions from fossil fuel combustion reached significant levels. This is also the earliest date for which plausible emissions data exist.

There are nine possible combinations of the three capacity settings and three responsibility settings. However, in the main report, we group these into only three cases, which more simply capture the broad “equity band” spanned by the possible settings.

- *“Low Equity Settings”* case: No Progressivity and Historical Responsibility since 1990
- *“Medium Equity Settings”* case: Weak Progressivity and Historical Responsibility since 1950
- *“High Equity Settings”* case: Strong Progressivity and Historical Responsibility since 1850

While we refer to these combinations as Low, Medium, and High Equity Settings, these references do not imply that the High Equity Settings case is objectively “more equitable” than Low Equity Settings, as this is ultimately a normative judgment. Rather, these references simply refer to the fact that the High Equity Settings case is the most progressive and includes the most historical responsibility, while the Low Equity Settings case is the least progressive and includes the least historical responsibility. This range of settings

typically gives the widest range of results for each country, and reflects an instructively broad “equity band” for each country.<sup>10</sup>

We intend with this “equity band” approach to capture a meaningfully broad spectrum of perspectives on two hotly debated issues in climate equity – the level of progressivity that is appropriate to a definition of national capacity, and the appropriate time frame to account for historic responsibility. Using such a broad equity band leads inevitably to fair share results that can span a significant range, as is evident in the results section below.

However, the real virtue of the “equity band” approach is that it allows us to escape the debate between, on the one hand, the claim that equity is an entirely subjective matter, a mere battle of opinions, and, on the other hand, the claim that one or another equity approach is the precisely “right one.” Equity bands offer a quantitative framework within which explicit choices between well-specified approaches – e.g. more or less progressive responsibility and capacity indexes – can be assessed and compared in a common framework without being over-specified and reified. While this approach inevitably yields ranges instead of distinct numbers, it also yields higher confidence, as a consequence of having understandable results that transparently and traceably expresses a set of explicit ethical-political choices.

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## ILLUSTRATIVE DOMESTIC MITIGATION ESTIMATES

As noted above, a nation’s fair share of the global mitigation effort can be greatly different from its capacity for domestic emissions reductions. Depending on the particular choice of settings, each and every country will be found in one of two complementary situations:

- **Countries with high capacity and responsibility:** these are generally wealthier countries with fair shares (of the shared global mitigation effort) that are large enough to exceed their own domestic mitigation potential (and here we mean both techno-economic potential and emission reductions associated with consumption and lifestyle changes). These fair shares are best understood as comprising *a two-fold obligation*: domestic mitigation action and provision of international support (finance, technology support, capacity building) for mitigation in other countries. As there is no single definitive level of mitigation potential within each country at each level of aggregate global mitigation effort, we give three indicative methods for estimating it. Each of these provides an illustrative way to divide a national fair share into domestic mitigation and support for international mitigation.
- **Countries with relatively low capacity and responsibility:** these are generally developing countries whose fair shares of the shared global mitigation effort are smaller than their domestic mitigation potential. And yet, to achieve a given global mitigation pathway, this potential must be

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<sup>10</sup> This is true in general, but not always. For the EU28, for example, the Historical Responsibility band is bounded by the 1850 and 1990 cases, while the Progressivity band is bounded by the Low and Middle cases. This odd result is an artifact of the EU’s multiple national income distributions.

comprehensively exploited (e.g., highly-polluting power sources must be replaced in all countries, not just in wealthy countries). In this case, the three methods for estimating domestic mitigation potential, when taken together, provide a reasonable indication of how much additional mitigation, beyond a country's own fair share of the effort, requires international support.

It is inherent in the approach taken by the *Climate Equity Reference Calculator* that the combined total of mitigation that must be supported in countries with low capacity and responsibility will be precisely balanced by the amount of international support that is required of countries with high capacity and responsibility.

Note that countries with middle levels of capacity and responsibility will have fair shares that are closer to their estimated domestic mitigation potential. And because we provide three different approaches (as described below) to estimating domestic emissions reductions, such countries could have domestic emission reductions, for one estimate, that are larger than the fair share and, for another, are smaller.

We use three different approaches because no single 'objectively correct' method exists to determine how much domestic mitigation is appropriate for each country, in a given year and under a given mitigation pathway. If economic efficiency were the only relevant criterion, then one could in principle use country-specific marginal abatement cost curves to determine a globally cost-effective level of domestic emissions reductions in each country.<sup>11</sup> However, predicting such curves requires a large amount of (largely unavailable) data, along with a large number of (largely untestable) assumptions about a number of critical parameters such as future technology costs and performance. Moreover, there are relevant criteria other than cost-effectiveness. Institutional lock-in dynamics, energy security considerations, culture, behavior and other political and social factors all have key ramifications, with regard to estimating the physical domestic emissions reductions that a country can reasonably be expected to contribute to that global mitigation effort.

And, as always, equity considerations arise, and are indeed paramount. If the carbon budget is dwindling, and not all activities can be decarbonized, then some activities may need to be foregone – but which activities? Presumably, luxury consumption should be treated differently from basic needs. And is it fairer to allocate poor countries more emissions space than is “cost-effective?” Should they rather be enabled to leapfrog as rapidly as possible?

For this reason, this report uses three alternative estimation algorithms (all of them straightforward) that, when taken together, define a rough range that, we believe, reasonably spans the results that would follow from more involved methodologies. Each algorithm provides an estimate indicative of each

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<sup>11</sup> In the hypothetical world of pure economic efficiency, each country's marginal abatement cost curve (the cost of each additional ton of reductions) would be well known, and each country would make domestic emissions reductions until it reached the equilibrium global marginal cost, yielding a least-cost distribution of mitigation effort.

country's domestic emissions reductions, over time and depending on the stringency of the global mitigation pathway.

- **Equal-proportional domestic reductions.** This algorithm approximates each country's domestic emissions reductions by assuming that all countries' emissions drop at the same rate below national business-as-usual (BAU). Consequently, emissions in all countries drop by the same percent as the global emissions drops below the global BAU. The implication is that in 2025, all countries drop their domestic emissions to approximately 55% below BAU for the Strong 2°C pathway, 45% for the Weak 2°C pathway, and 25% for the G8 pathway; in 2030, domestic emissions are approximately 70% below BAU for the Strong 2°C pathway, 60% for the Weak 2°C pathway, and 40% for the G8 pathway.
- **Intensity-adjusted domestic reductions.** To reflect the assumption that more carbon-intensive economies have lower-cost mitigation options available to them (due to technological or other alternatives to existing economic activity), countries with carbon intensities *higher* than the global median reduce domestic emissions faster than the global average rate, while countries with carbon intensity *lower* than the global median reduce emissions slower than the global average rate.
- **Income-adjusted domestic reductions.** To reflect the assumption that wealthier countries have a variety of lower-cost mitigation options (lifestyle changes, policy or technology options) available to them, countries with per-capita income higher than a specified income threshold (defined as global mean per-capita income in 2012, or approximately US\$10,000 MER) reduce domestic emissions faster than the global average rate, and countries with lower incomes reduce their emissions slower than the global average rate.

We stress that the domestic emission pathways that result from these calculations are not explicitly cost optimized in any sense. They are merely estimates based on heuristic algorithms that can and should be revised and improved.

## NATIONAL RESULTS: FOUR EXAMPLES

In this section, we introduce the tables and figures by which we present key country-level results, and show how they vary across the equity band spanned by the Low, Medium, and High Equity Settings cases. In *Appendix 1*, we show how results vary as the other key settings are changed one-by-one: level of ambition, progressivity, historical responsibility, and domestic mitigation method.

In this section, we show results for the US, China, the EU28 and India. These four countries<sup>12</sup> represent instructively distinct cases. Appendix 1 includes the results for all twelve example countries.

The ambition and equity settings (simplified)			
Level of ambition	G8 pathway	Weak 2°C	Strong 2°C
Equity settings	Low Equity (No Progressivity, Responsibility since 1990)	Medium Equity (Weak Progressivity, Responsibility since 1950)	High Equity (Strong Progressivity, Responsibility since 1850)
Domestic mitigation estimate	Intensity-adjusted	Equal-proportional	Income-adjusted

The schematic above shows the set of three cases that we focus on in this report. Lighter orange indicates the settings that are held constant to define the set. Darker orange indicates the cases that are varied to give the three cases shown in the results:

- 1 Level of ambition (Strong 2°C pathway)
- x 3 Equity settings (Low, Medium, and High Equity Settings)
- x 1 Domestic Mitigation estimate (Equal-proportional)
- = 3 cases.

The key number, **Total Mitigation Fair Share**, is shown in bold in the result tables below. As discussed above, a country with relatively high capacity and responsibility will generally have a larger fair share of the global mitigation effort than makes sense to undertake domestically, requiring it to fulfill the remaining portion of their obligation by contributing financial and technological support to other countries. Conversely, countries with relatively low capacity and responsibility will use these contributions to undertake mitigation in excess of their own fair shares of the global mitigation effort. Countries of the former type are referred to here as **Support Contributors**, and their results are presented differently from results of the latter type of countries, the **Support Recipients**.<sup>13</sup> *Results Table 1* shows the United States as

<sup>12</sup> For simplicity, we refer to the EU28 as a country.

<sup>13</sup> Note that in a small number of cases a country's status as a contributor or recipient depends on the equity settings or the method used for estimating domestic mitigation, and thus so does the form in which its results are presented. Russia (see *Appendix 1*) is one such example, for in both the Low and Medium Progressivity cases it is a Contributor, but in the High Progressivity case it becomes a Recipient.



an example of a Support Contributor; *Results Table 2* shows China as an example of a Support Recipient; the EU28 (*Results Table 3*) is also a Support Contributor, and India (*Results Table 4*) is a Support Recipient.

The first results row in each table gives the country's projected Responsibility and Capacity Index (RCI) for 2025 (as a percentage of the global total). Relatively high-income countries will have a higher RCI in the "High Progressivity" case than in the "Low Progressivity" case, and the opposite will be true for low-income countries. Multiplying the RCI by the total global mitigation required in 2025 (about 35 GtCO<sub>2e</sub> below projected baseline emissions for the Strong 2°C pathway), yields each country's **Total Mitigation Fair Share**.

**In the case of a country with relatively high capacity and responsibility**, the fair share of the mitigation effort generally exceeds the estimated domestic emissions reductions, and the country is thus a **Support Contributor** with its **Total Mitigation Fair Share** divided into two indicative portions. As can be seen in *Results Tables 1* and *3* below, the **Total Mitigation Fair Share** equals **Domestic Mitigation** plus **Internationally-Supported Mitigation**. Note that, for the cases presented here, this fraction of the **Total Mitigation Fair Share** that is estimated to be **Domestic Mitigation** is made using the simple approach that assumes equal-proportional reductions below baseline for all countries; it does not depend on the equity settings in any way. Also note that all these figures are reported in MtCO<sub>2e</sub>, and also as percent changes relative to 1990 emissions, 2013 emissions, and projected 2025 emissions.

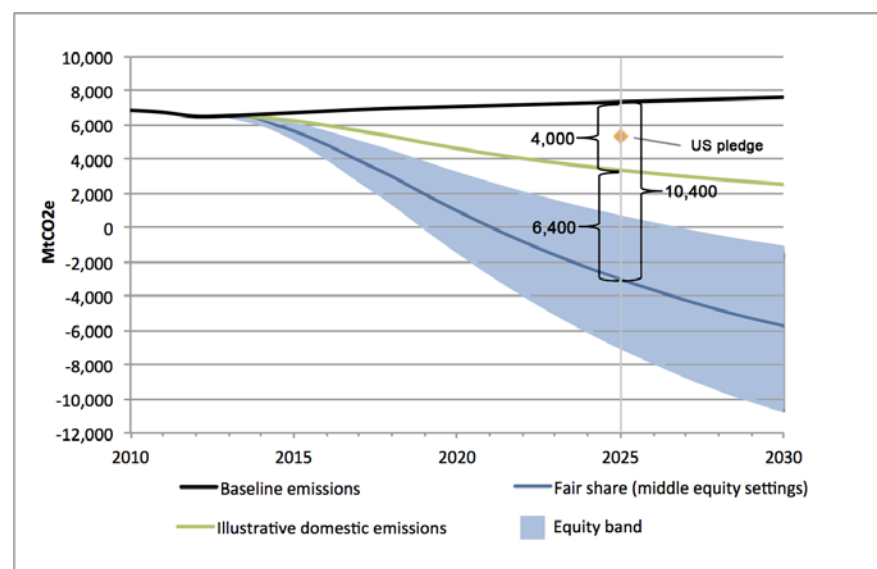
**In the case of a country with relatively low capacity and responsibility**, the fair share of the global mitigation effort is typically smaller, often much smaller, than the domestic emissions reductions that would be required if the country is to embark on a course consistent with the global mitigation pathway. The country is thus a **Support Recipient**, which enables it to augment its (self-funded) **Mitigation Fair Share** with **Internationally-Supported Mitigation**, and thus to reach its **Total Domestic Mitigation**. Again, **Mitigation Fair Share** is estimated using the simple approach that assumes equal-proportional reductions below baseline for all countries, and it does not depend on the equity settings in any way. See *Results Table 2* and *4* below for key examples.

## THE UNITED STATES

As with other high capacity and responsibility countries, the United States' *Total Mitigation Fair Share* is sufficiently large compared to its own emissions that fulfilling it entirely through domestic mitigation is implausible; even in the Low Equity Settings case, this would require a near complete elimination of emissions by 2025 (a 90% reduction relative to 1990 emissions), and in the High Equity Settings case it would require deeply negative emissions (a more than 200% reduction relative to 1990). For this reason, to fulfill its *Total Mitigation Fair Share*, the US must augment its *Domestic Mitigation* (estimated at 4,000 MtCO<sub>2</sub>e in 2025) with a considerable amount of *Internationally-Supported Mitigation* (ranging from 2,700 to 10,300 MtCO<sub>2</sub>e, as equity settings vary from Low to High). Clearly, irrespective of the choice of equity settings, international financial and technological support is as important as ambitious domestic mitigation action if the US is to do its fair share.

Country	Cell Definitions	Three Equity Settings												
		Low Equity Settings				Middle Equity Settings				High Equity Settings				
United States	Projected % of global RCI in 2025	19.3%				29.7%				41.0%				
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor				
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			
			1990	2013	2025		1990	2013	2025		1990	2013	2025	
		<b>Total Mitigation Fair Share</b>	6,700	-90%	-91%	-92%	10,400	-149%	-146%	-141%	14,300	-212%	-207%	-195%
		<b>Domestic Mitigation</b>	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%
	<b>Internationally-Supported Mitigation</b>	2,700	-44%	-42%	-37%	6,400	-102%	-98%	-87%	10,300	-166%	-158%	-141%	

Results Table 1: Equity band for the United States, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation estimate.



Results Figure 1 shows the “equity band” for the United States, defined as the range over which its *Total Mitigation Fair Share* varies as the equity settings are varied from the Low Equity Settings to the High Equity Settings. The brackets show the *Total Mitigation Fair Share* in 2025, divided into *Domestic Mitigation* and *Internationally-Supported Mitigation*, corresponding to the Middle Equity Settings as shown in Results Table 1. The equity band shows the *Total Mitigation Fair Share* varying in 2025 from 6,700 MtCO<sub>2</sub>e (Low Equity Settings) to 14,300 MtCO<sub>2</sub>e (High Equity Settings), implying the *Internationally-Supported Mitigation* would vary from 3,700 MtCO<sub>2</sub>e (Low Equity Settings) to 13,200 MtCO<sub>2</sub>e (High Equity Settings).

**Note, for reference, the orange icon spans the US’s announced pledge range of 26-28% reduction relative to 2005 emissions. (It assumes no internationally-supported mitigation.)**

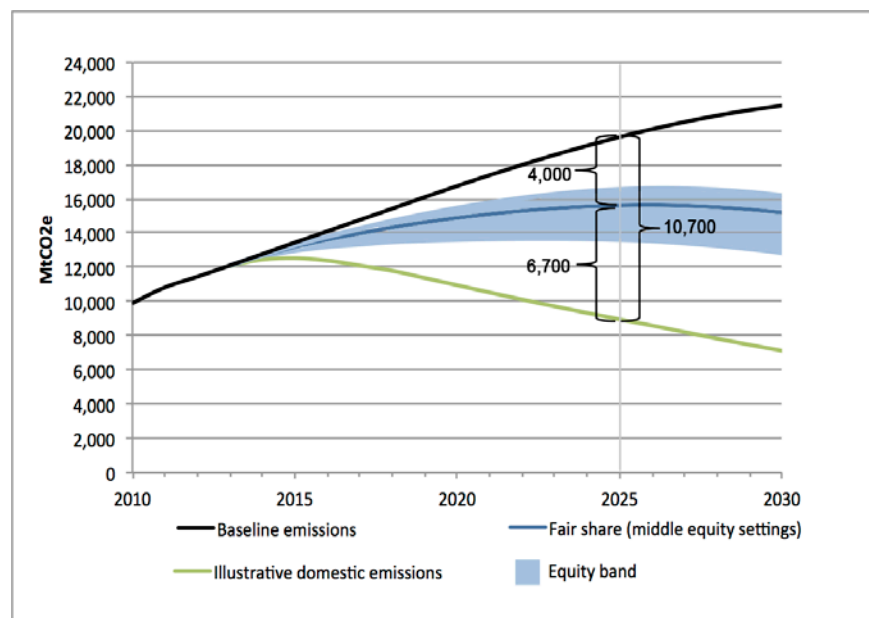
Results Figure 1. Equity band for the United States. The brackets correspond to the Middle Equity Settings shown in the table. (Strong 2°C pathway, Equal proportional Domestic Mitigation estimate).

## CHINA

In Results Table 2, we show China. Its *Mitigation Fair Share* is highest when the Low Equity Settings are applied, and lowest with the High Equity Settings. Not surprisingly, this is the opposite of the United States case, since China is projected to still be poor in comparison with the US in 2025, with a projected per capita income around one-third that of the United States' (on a Purchasing Power Parity basis). Across the entire equity band, China's *Mitigation Fair Share* is significantly smaller than its *Total Domestic Mitigation*, implying the need for significant international support to enable it to reach its *Total Domestic Mitigation*.

Country	Cell Definitions	Three Equity Settings											
		Low Equity Settings				Middle Equity Settings				High Equity Settings			
China	Projected % of global RCI in 2025	17.3%				11.5%				8.8%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	6,000	+319%	+12%	-31%	4,000	+382%	+29%	-20%	3,050	+410%	+37%	-16%
	Total Domestic Mitigation	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%
Internationally-Supported Mitigation	4,700	-143%	-38%	-24%	6,700	-206%	-55%	-34%	7,650	-234%	-63%	-39%	

Results Table 2. Equity band for China, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation estimate.



Results Figure 2 shows the “equity band” for China, defined as the range over which its *Mitigation Fair Share* varies as the equity settings are varied from Low to High. The brackets show for 2025 the *Mitigation Fair Share* (4,000 MtCO<sub>2</sub>e) and *Internationally-Supported Mitigation* (6,700 MtCO<sub>2</sub>e), corresponding to the Middle Equity Settings case as shown in Results Table 2, which together reach the *Total Domestic Mitigation* (10,700 MtCO<sub>2</sub>e). The equity band shows China's *Mitigation Fair Share* varying in 2025 from 3,050 MtCO<sub>2</sub>e (High Equity Settings) to 6,000 MtCO<sub>2</sub>e (Low Equity Settings), implying the *Internationally-Supported Mitigation* would vary from 7,650 MtCO<sub>2</sub>e (Low Equity Settings) to 4,700 MtCO<sub>2</sub>e (High Equity Settings) enabling it to reach the estimated *Total Domestic Mitigation* of 10,700 MtCO<sub>2</sub>e.

**Note, China's recently announced pledge to peak its CO<sub>2</sub> emissions by 2030 is not specific enough to be represented as an icon on this graph.**

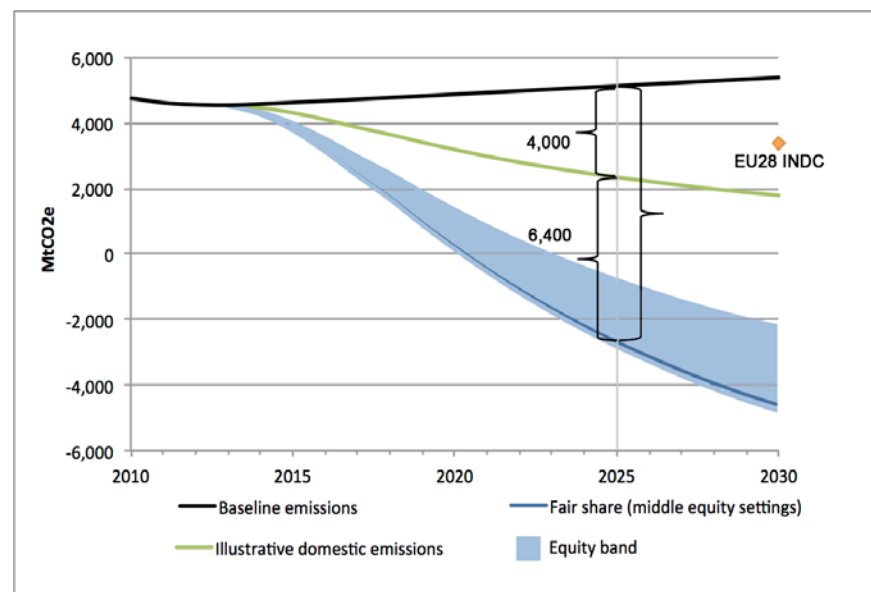
Results Figure 2. Equity band for China. The brackets correspond to the Middle Equity Settings shown in the table. (Strong 2°C pathway, Equal proportional Domestic Mitigation estimate.)

## THE EUROPEAN UNION

As with other high capacity and responsibility countries, the EU's *Total Mitigation Fair Share* is sufficiently large compared to its own emissions that fulfilling it through domestic mitigation is implausible, requiring more than 100% reduction relative to 1990 emissions by 2025 regardless of the equity case. Fulfilling its *Total Mitigation Fair Share* would require the EU to augment its *Domestic Mitigation* (estimated at 2,800 MtCO<sub>2</sub>e in 2025) with a considerable amount of support for *Internationally-Supported Mitigation* (ranging from 3,100 to 5,100 MtCO<sub>2</sub>e, as equity settings vary from Low to High). Clearly, irrespective of the equity settings, the international financial and technological support is as important as ambitious domestic mitigation action if the EU is to fulfill its equitable contribution to the global effort.

Country	Cell Definitions	Three Equity Settings											
		Low equity settings				Middle equity settings				High equity settings			
EU28	Projected % of global RCI in 2025	17.0%				22.4%				22.8%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	<b>Total Mitigation Fair Share</b>	5,900	-114%	-117%	-115%	7,800	-148%	-159%	-152%	7,900	-150%	-162%	-155%
	<b>Domestic Mitigation</b>	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%
<b>Internationally-Supported Mitigation</b>	3,100	-56%	-69%	-61%	5,000	-89%	-111%	-98%	5,100	-91%	-114%	-100%	

Results Table 3: Equity band for the EU28, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation estimate.



Results Figure 3 shows the “equity band” for the EU, the range over which its *Total Mitigation Fair Share* varies as the equity settings are varied from the Low to the High Equity Settings. The brackets show *Total Mitigation Fair Share* in 2025, divided into *Domestic Mitigation* and *Internationally-Supported Mitigation*, corresponding to the Middle Equity Settings shown in Results Table 3. The equity band shows *Total Mitigation Fair Share* varying in 2025 from 5,900 MtCO<sub>2</sub>e (Low Equity Settings) to 7,900 MtCO<sub>2</sub>e (High Equity Settings), implying the required *Internationally-Supported Mitigation* would vary from 3,100 MtCO<sub>2</sub>e (Low Equity Settings) to 5,100 MtCO<sub>2</sub>e (High Equity Settings).

**Note, for reference, the orange icon represents the EU28’s likely INDC of 40% reduction relative to 1990 emissions. (It assumes no internationally-supported mitigation.)**

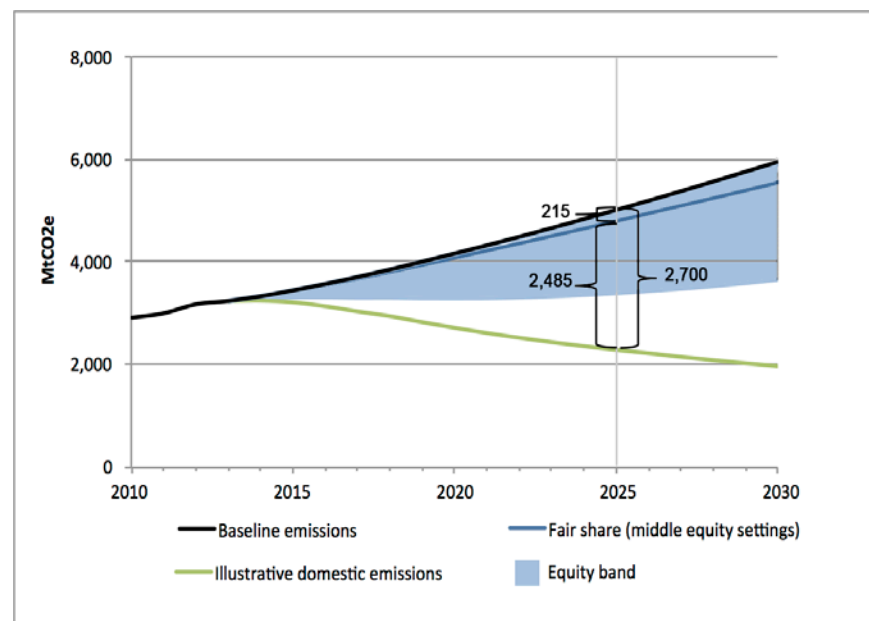
Results Figure 3. Equity Band for the EU28, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation.

## INDIA

In *Results Table 4* we show India. Its *Mitigation Fair Share* is much higher under the Low Equity Settings than with either the Middle or High Equity Settings. This is because India is projected to have a poor majority population in 2025, with very low incomes, and the Low Equity Settings case is by definition a No Progressivity case in which the income of even the very poorest individuals is included in the calculation of national capacity.

Country	Cell Definitions	Three Equity Settings											
		Low equity settings				Middle equity settings				High equity settings			
India	Projected % of global RCI in 2025	4.6%				0.6%				0.1%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	1,600	+212%	+5%	-32%	215	+341%	+48%	-4%	21	+359%	+54%	%
	Total Domestic Mitigation	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%
Internationally-Supported Mitigation	1,100	-101%	-34%	-22%	2,485	-231%	-77%	-50%	2,679	-249%	-83%	-54%	

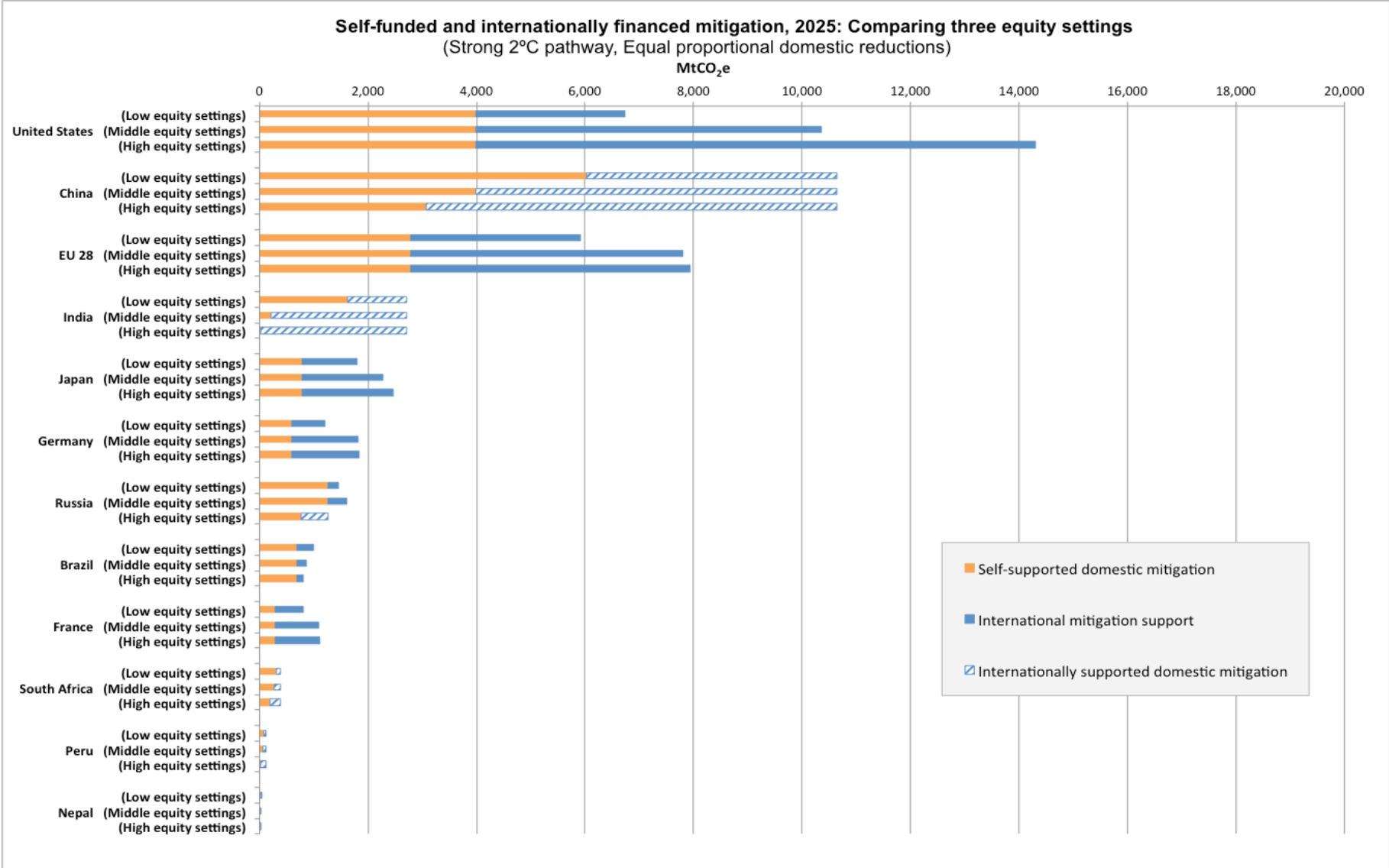
Results Table 4. Equity band for India, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation estimate.



*Results Figure 4* shows the “equity band” for India, defined as the range over which its *Mitigation Fair Share* varies as the equity settings are varied from the Low to High. The brackets show for 2025 the *Mitigation Fair Share* (215 MtCo<sub>2</sub>) and *Internationally-Supported Mitigation* (2,485 MtCo<sub>2</sub>e) that correspond to the Middle Equity Settings as shown in *Results Table 4*, which together reach the *Total Domestic Mitigation* (2,700 MtCo<sub>2</sub>e). The equity band shows India’s *Mitigation Fair Share* varying in 2025 from a barely perceptible 21 MtCo<sub>2</sub>e (High Equity Settings) to 1,600 MtCo<sub>2</sub>e (Low Equity Settings), implying the *Internationally-Supported Mitigation* would vary from 2,679 MtCo<sub>2</sub>e (Low Equity Settings) to 1,100 MtCo<sub>2</sub>e (High Equity Settings) enabling it to reach the estimated *Total Domestic Mitigation* of 2,700 MtCo<sub>2</sub>e.

Results Figure 4. Equity band for India, Strong 2°C pathway, Middle (Equal proportional) Domestic Mitigation estimate.

The following chart provides an overview for the entire set of example countries:



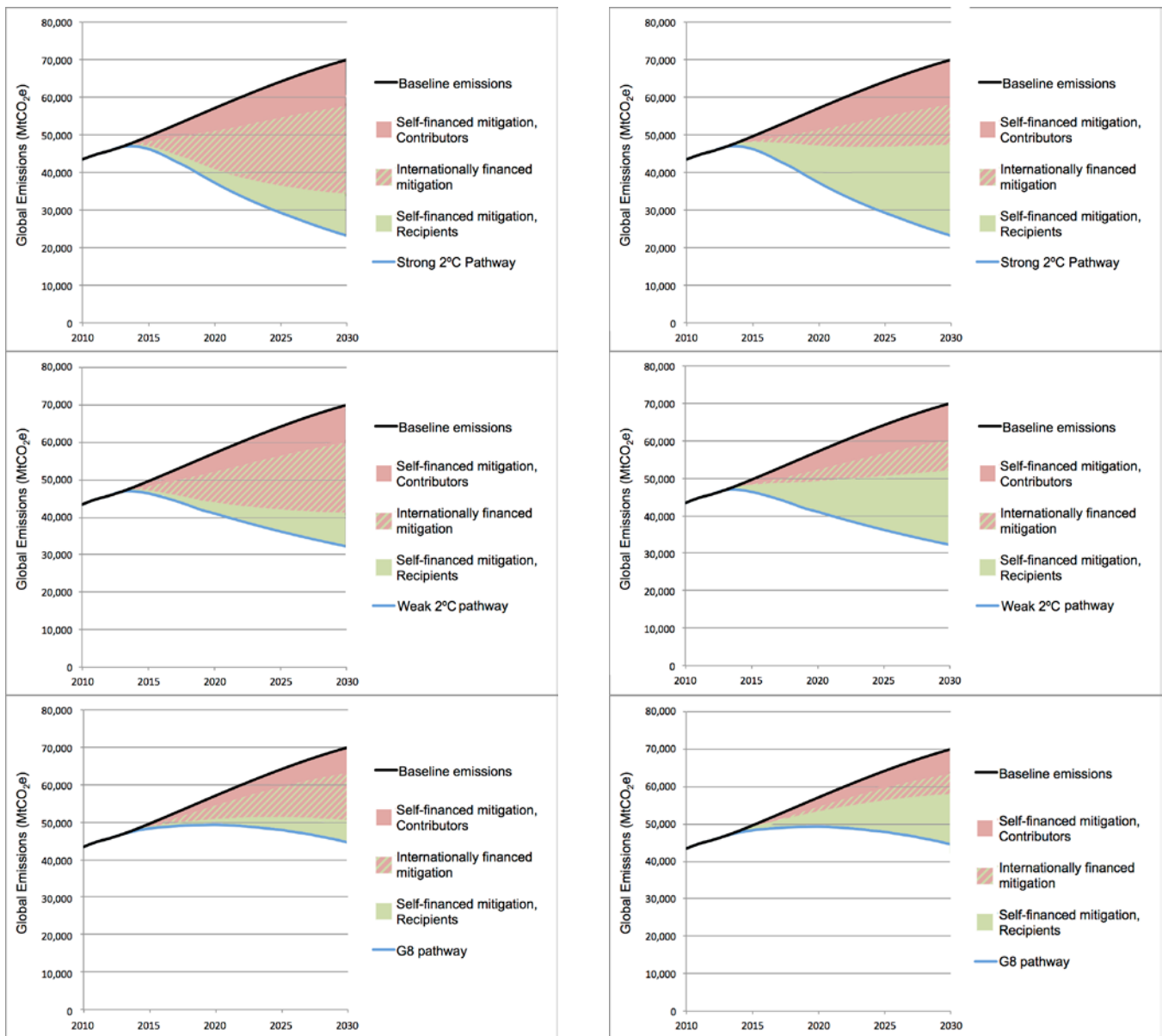
Results Figure 5. Self-funded and internationally-supported mitigation in 2025, comparing the three equity settings for all example countries. (Strong 2°C pathway, Middle ( Equal proportional) Domestic Mitigation estimate.)

## GLOBAL RESULTS: THREE MITIGATION PATHWAYS, HIGH AND LOW EQUITY SETTINGS

In our (above) discussion of results for the four individual example countries, we used the example of the Strong 2°C pathway and provided results for the three different equity cases (Low, Middle, High). Here we turn to the global level, and focus on the overall relationship between ambition and equity. This section considers the Strong 2°C, Weak 2°C and G8 pathways, together with the High and Low Equity Settings. (For the purposes of simplicity and clarity of exposition, we leave out the Middle Equity case.) Thus, in the following discussion, we show six global cases, consisting of three mitigation pathways and two equity settings. Throughout, *Domestic Mitigation* is estimated using the equal-proportional method.

Thus, the cases presented in this analysis are as follows:

<b>The ambition and equity settings (simplified)</b>			
<b>Level of ambition</b>	G8 pathway	Weak 2°C	Strong 2°C
<b>Equity settings</b>	Low Equity	Medium Equity	High Equity
<b>Domestic mitigation estimate</b>	Intensity-adjusted	Equal-proportional	Income-adjusted



Results Figure 5: The top two panels show the Strong 2°C pathway, the middle two show the Weak 2°C pathway, and the bottom two show the G8 pathway. In each case, the High Equity Settings case is shown on the left, and the Low Equity Settings case on the right.

Results Figure 5 shows as shaded areas the mitigation required to achieve each of the three mitigation pathways: the top two panels show Strong 2°C, the middle two panels show Weak 2°C, and the bottom two panels show G8. These shaded areas are divided into three segments: the green segment shows the reductions that are self-financed in countries that receive support, the green-red striped segment shows reductions that are internationally supported, and the red segment shows reductions (which are all self-financed) in countries that provide support<sup>14</sup>. The data for both 2025 and 2030 is given in Results Table 5 below.

<sup>14</sup> For the sake of clarity in the visual comparison of international finance under different equity settings, the grouping of countries as either support contributors or recipients in the Low Equity Settings is used in the High Equity Settings case as well. This is just a matter of presentation; the internationally-supported share of the total global mitigation does not depend on the particular categorization of countries between the Support Contributor and support recipient groups.



Domestic and Internationally-Supported Mitigation in 2025						
	Strong 2°C pathway		Weak 2°C pathway		G8 pathway	
	High Equity Settings	Low Equity Settings	High Equity Settings	Low Equity Settings	High Equity Settings	Low Equity Settings
<b>Baseline emissions</b> (MtCO <sub>2</sub> e)	64,000	64,000	64,000	64,000	64,000	64,000
<b>Mitigation required globally</b> (MtCo <sub>2</sub> e)	34,800	34,800	27,800	27,800	16,200	16,200
Self-financed Mitigation, Contributors (MtCO <sub>2</sub> e)	9,150	9,150	7,300	7,300	4,250	4,200
Self-financed Mitigation, Recipients (MtCO <sub>2</sub> e)	6,950	17,150	5,500	13,900	3,150	8,100
Internationally-Supported Mitigation (MtCO <sub>2</sub> e) (% of total)	18,700 (54%)	8,500 (24%)	15,000 (54%)	6,600 (24%)	8,800 (54%)	3,900 (24%)
<b>Mitigation gap</b> (MtCO <sub>2</sub> e)	29,200	29,200	36,200	36,200	47,800	47,800

Domestic and Internationally-Supported Mitigation in 2030						
	Strong 2°C pathway		Weak 2°C pathway		G8 pathway	
	High Equity Settings	Low Equity Settings	High Equity Settings	Low Equity Settings	High Equity Settings	Low Equity Settings
<b>Baseline emissions</b> (MtCO <sub>2</sub> e)	70,000	70,000	70,000	70,000	70,000	70,000
<b>Mitigation required globally</b> (MtCo <sub>2</sub> e)	46,800	46,800	37,700	37,700	25,400	25,400
Self-financed Mitigation, Contributors (MtCO <sub>2</sub> e)	11,800	11,800	9,450	9,450	6,400	6,400
Self-financed Mitigation, Recipients (MtCO <sub>2</sub> e)	10,800	23,700	8,700	19,400	5,650	13,050
Internationally-Supported Mitigation (MtCO <sub>2</sub> e) (% of total)	24,200 (52%)	11,300 (24%)	19,550 (52%)	8,850 (24%)	13,350 (52%)	5,950 (24%)
<b>Mitigation gap</b> (MtCO <sub>2</sub> e)	23,200	23,200	32,300	32,300	44,600	44,600

Results Table 5: Mitigation and mitigation support in 2025 and 2030 for the three global pathways, and for “High Equity” and “Low Equity” cases, as defined in the text. All mitigation figures are in MtCO<sub>2</sub>e except “Internationally-Supported Mitigation”, which is expressed as a percent of total mitigation.

The first point to observe is that, for all pathways, the great majority of reductions occur in the countries that are Support Recipients. While these developing countries have less capacity and responsibility, they are also the sites where most of the world’s emissions now arise, and where energy needs – and hence emissions – are growing fastest. Consequently, this is where most mitigation action must take place. In 2025, roughly three-quarters of the mitigation action will need to take place in these developing countries.

However, the fair share of the mitigation effort is distributed very differently. The countries that provide support – a group that overlaps very heavily with Annex 2 (the OECD Annex 1 countries) – have roughly half of the fair share of the effort in the Low Equity Settings case, and three-quarters in the High Equity Settings case.

The inevitable result of the stark discrepancy between the distribution of mitigation potential and the distribution of the fair-share obligation to act is that much of the mitigation will need to take place in developing countries, with financial support from developed countries. In 2025, between one-third (in the Low Equity Settings case) and two-thirds (in the High Equity Settings case) of the mitigation in developing countries is internationally financed.

Also, as suggested by the comments on India's 2025 *Mitigation Fair Share* above, it is easier to argue that the Low Equity Settings are "too low" than it is that the High Equity Settings are "too high." This is true on the historical responsibility side, for the Low Equity Settings case is defined in a manner that neglects emissions prior to 1990 (despite the reference to historic emissions in the UNFCCC itself, which was being drafted in 1990, as mentioned above). Even more importantly, this is true on the capacity side, for the Low Equity Settings assumes zero progressivity, with each dollar of income of the world's poorest counting just as much as each dollar of the world's richest. This contrasts markedly with how nations allocate tax burdens, and is extremely difficult to justify. On the High Equity Settings side, compelling arguments have been put forward that wealth, not income, should be used to define capacity, and that consumption emissions, rather than production emissions should be used to define responsibility. Each of these alternative interpretations of the capacity indicator would tend to allocate more of the responsibility to wealthier people and wealthier countries.

## COMPARABLE EFFORT IN A LOW AMBITION WORLD

This report has argued that when key equity choices related to the core equity principles of the UNFCCC are specified, it is possible to quantify national "fair shares" meaningfully. It has also argued that even a broad range of equity perspectives can be translated into a usefully bounded "equity band" for each country given a global mitigation pathway, and they yield useful insights into the necessary scale of both self-funded domestic mitigation and internationally-supported mitigation.

In this section we further argue that this "equity bands" approach can be used to assess individual national INDCs relative to overall global mitigation goals. Which is to say that it allows us, when evaluating an INDC, to answer the following straightforward question: "Of what overall global mitigation effort can this country claim to be pledging its fair share, assuming all other countries make "comparable efforts" by doing their fair shares?"

*Results Table 6, below*, illustrates this sort of assessment in the case of the EU's INDC of "at least 40% below 1990 emissions." In the High Equity Settings, the EU's fair share of global effort is 22% of the global total, with the rest of the world contributing the remaining 78%. (The assumption here is that each country makes comparable efforts by doing its fair share under the same equity settings.) The analogous shares for the Low Equity Settings case are 16% for the EU and 84% for the rest of the world, as shown in *Results Table 6*. Note that these shares are independent of the level of ambition; whatever global mitigation target was agreed, the EU's fair share would be 22% of that amount under the High Equity Settings, and 16% under the Low Equity Settings.

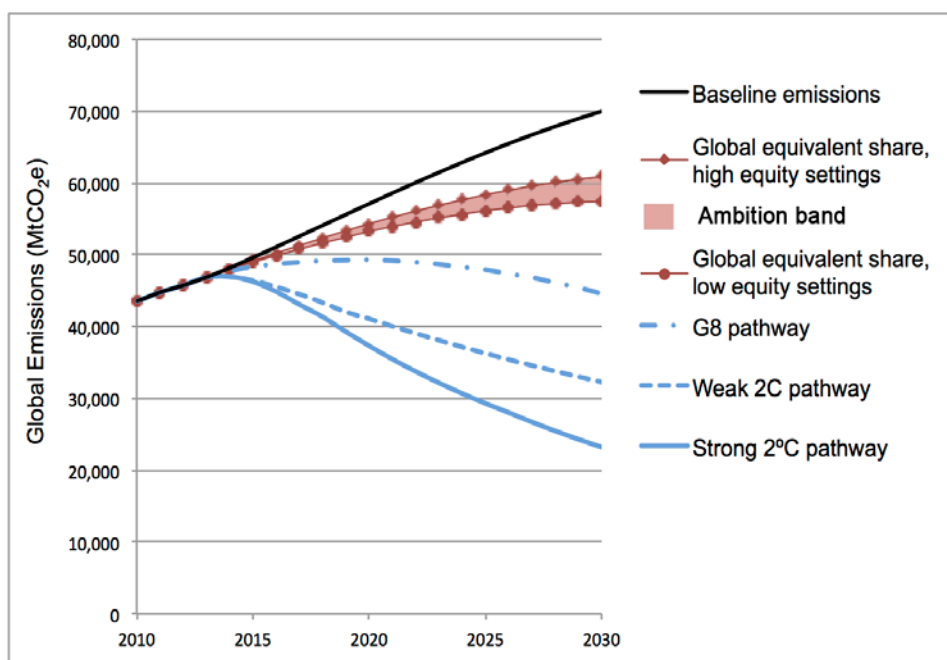
	High Equity Settings		Low Equity Settings	
	Fair share (%)	Mitigation (GtCO2e)	Fair share (%)	Mitigation (GtCO2e)
<b>EU's INDC</b>	22%	2.0	16%	2.0
<b>Rest of World</b>	<u>78%</u>	<u>7.1</u>	<u>84%</u>	<u>10.5</u>
<b>Total Mitigation</b>	100%	<b>9.1</b>	100%	<b>12.5</b>
<b>G8 pathway</b>				
				<b>25.3</b>
<b>Weak 2°C pathway</b>				
				<b>37.7</b>
<b>Strong 2°C pathway</b>				
				<b>46.7</b>

Results Table 6: Assessing the actions in the EU's INDC, by inferring the global mitigation effort of which it is the EU's fair share, assuming all other countries made comparable efforts by doing their fair share under the same equity settings. In both cases, the implied global effort falls far short of closing the global mitigation gap, even for the G8 pathway. (All figures are for 2030 and are rounded.)

We estimate that the EU's INDC requires roughly 2.0 GtCO<sub>2</sub>e of mitigation effort below the EU's projected 2030 baseline. Given this, we can use the above figures to calculate<sup>15</sup> straightforwardly the amount of mitigation to which other countries' comparable efforts would amount. If other countries' made comparable efforts in accordance with the High Equity Settings, their mitigation would amount to 7.1 GtCO<sub>2</sub>e, and 10.5 GtCO<sub>2</sub>e assuming the Low Equity Settings. Adding this to the EU's pledged 2.0 GtCO<sub>2</sub>e, the total global ambition would amount to 9.1 to 12.5 GtCO<sub>2</sub>e in 2030. Needless to say, this implies a large mitigation shortfall in comparison to all three pathways considered here, which require between 25 and 47 GtCO<sub>2</sub>e.

This concept is demonstrated in graphic form in *Results Figure 6*, below. The EU's "ambition band," shown in light red, represents the range of global mitigation that would be achieved if all countries matched the EU's pledged mitigation with comparable efforts under the same equity settings. The total mitigation achieved still leaves a large shortfall, even if one takes the lower edge of the ambition band, and even in comparison to the least ambitious (G8) of the three pathways considered here. This is true for the simple reason that EU's 2.0 GtCO<sub>2</sub>e pledge is only a small portion of its fair share of the required global mitigation, even under the Low Equity Settings, and even assuming the lower scale of mitigation required by the G8 pathway. (The EU's 2.0 GtCO<sub>2</sub>e amounts to less than 8% of the 25.3 GtCO<sub>2</sub>e of mitigation required to reach the G8 pathway.)

<sup>15</sup> Using the shares given above,  $78\%/22\% \times 2.0 \text{ GtCO}_2\text{e} = 7.1 \text{ GtCO}_2\text{e}$ ; and  $84\%/16\% \times 2.0 \text{ GtCO}_2\text{e} = 10.5 \text{ GtCO}_2\text{e}$ .



Results Figure 6: The red band represents the range of global emissions that would be achieved if the EU28 INDC were to be matched by comparable efforts by all other countries. The top of the band assumes the High Equity Settings case (where the EU’s INDC amounts to 22% of the global effort) and the bottom of the band assumes the Low Equity Settings case (where the EU’s INDC amounts to 16% of the global effort). The three blue lines show the G8, Weak 2°C, and Strong 2°C pathways, for comparison.

For the EU’s INDC to define a mitigation contribution that, when matched by comparable efforts by all other countries, would define a global effort that is more ambitious than the red “ambition band” shown here, one of the following two situations would need to apply:

First, the EU’s fair share of the global effort, as calculated by some means other than the one we have demonstrated here, would somehow have to be found to be smaller than the 16% that we have calculated in the Low Equity Setting case. However, since the Low Equity Setting case assumes that capacity is defined with zero progressivity (no development threshold that excludes the income of even the very poor from the calculation of a country’s capacity) this would effectively require a “fair shares” arrangement that is actually *regressive*, in essence requiring poor countries to contribute more per dollar of income to the global effort than do the richer countries.

Second, and far more plausibly, the EU’s pledged domestic mitigation could be accompanied by a second commitment, one to provide a significant level of international mitigation support. Given the small size of the EU’s pledged domestic reductions, its pledged international support would need to be quite large – roughly two times larger in terms of tons of mitigation supported for Low Equity Settings under the Weak 2°C pathway and increasing to four times larger for High Equity Settings under the Strong 2°C pathway.

## FINAL COMMENTS

As the climate negotiations approach their Paris reckoning, it's necessary to remember that the climate crisis is fundamentally a global commons crisis, and to appreciate exactly what this means. Simply stated, commons problems can be solved, but only when each party sees the other parties to be doing their fair shares, or more precisely to be doing their best to do their fair shares.

Our goal in this paper is to show that the fair-shares discussion can be more than a sterile and frustrating battle of opinions. To that end, we have charted out a charitably broad range of fair-share perspectives – all of them arguably consistent with the UNFCCC's equity principles, and all of them expressed in terms of transparent indicators of capacity and responsibility. With these indicators, we have derived a plausible *range* of fair shares for countries. And while these "equity bands" are in some ways quite broad, they are narrow enough to yield clear conclusions about countries' pledged efforts. In particular, they are narrow enough to tell us if a given nation's contribution is even remotely consistent with the demands of science and equity, and whether it marks that nation as a leader or a laggard.

The equity bands also show us that many countries' fair shares are much larger than their plausible domestic mitigation, and thus that their contributions will inevitably be judged on the basis of both their domestic mitigation and international support. Countries must be as transparent about their international support as they are about their domestic targets. Those who are not will not be trusted to be doing their fair share.

Finally, they tell us if a country's contribution is even consistent with its own stated global goal, such as 2°C. When a country tables a national contribution (including its financial contribution, whether as part of its INDC or not), it is participating in a kind of ad hoc negotiation in which that contribution is read as an open declaration, and as an invitation to work toward an overall level of ambition. Equipped with a range of plausible fair shares – an equity band – any national pledge can be translated into an "ambition band" that reveals that country's *de facto* global goal; it's necessary only to add the assumption that other countries will act in rough proportion. And in a commons, this is all we can expect. Which is why, when a country tables a contribution, it is implicitly voting for a particular future.

National contributions matter, and they must be reviewed.

## APPENDIX 1 – SOME SETS OF ILLUSTRATIVE RESULTS

This Appendix contains four sets of comparisons, designed to show the sensitivity of our results to modifications in each of the four settings: level of ambition, level of progressivity, level of responsibility, and level of domestic mitigation. In each comparison, the settings that are not being examined are held at their middle setting, except for level of ambition, which is held at the Strong 2°C setting. The four comparisons are thus:

- The 1<sup>st</sup> set compares the **three levels of Ambition**. (Progressivity, Responsibility, and Domestic Mitigation are held at their middle settings.)
- The 2<sup>nd</sup> set compares the **three levels of Progressivity**. (Ambition is set to Strong 2°C, Responsibility and Domestic Mitigation are held at their middle settings.)
- The 3<sup>rd</sup> set compares the **three levels of Responsibility**. (Ambition is set to Strong 2°C, Progressivity and Domestic Mitigation are held at their middle settings.)
- The 4<sup>th</sup> set compares the **three levels of Domestic Mitigation**. (Ambition is set to Strong 2°C, Progressivity and Responsibility are held at their middle settings.)

Many more cases can be constructed based on other equity settings that are supported by the *Climate Equity Reference Calculator*. However, taken together, the comparisons presented here provide a systematic exploration of the broad space of equity and ambition settings.

### THREE LEVELS OF AMBITION (PATHWAYS) COMPARED

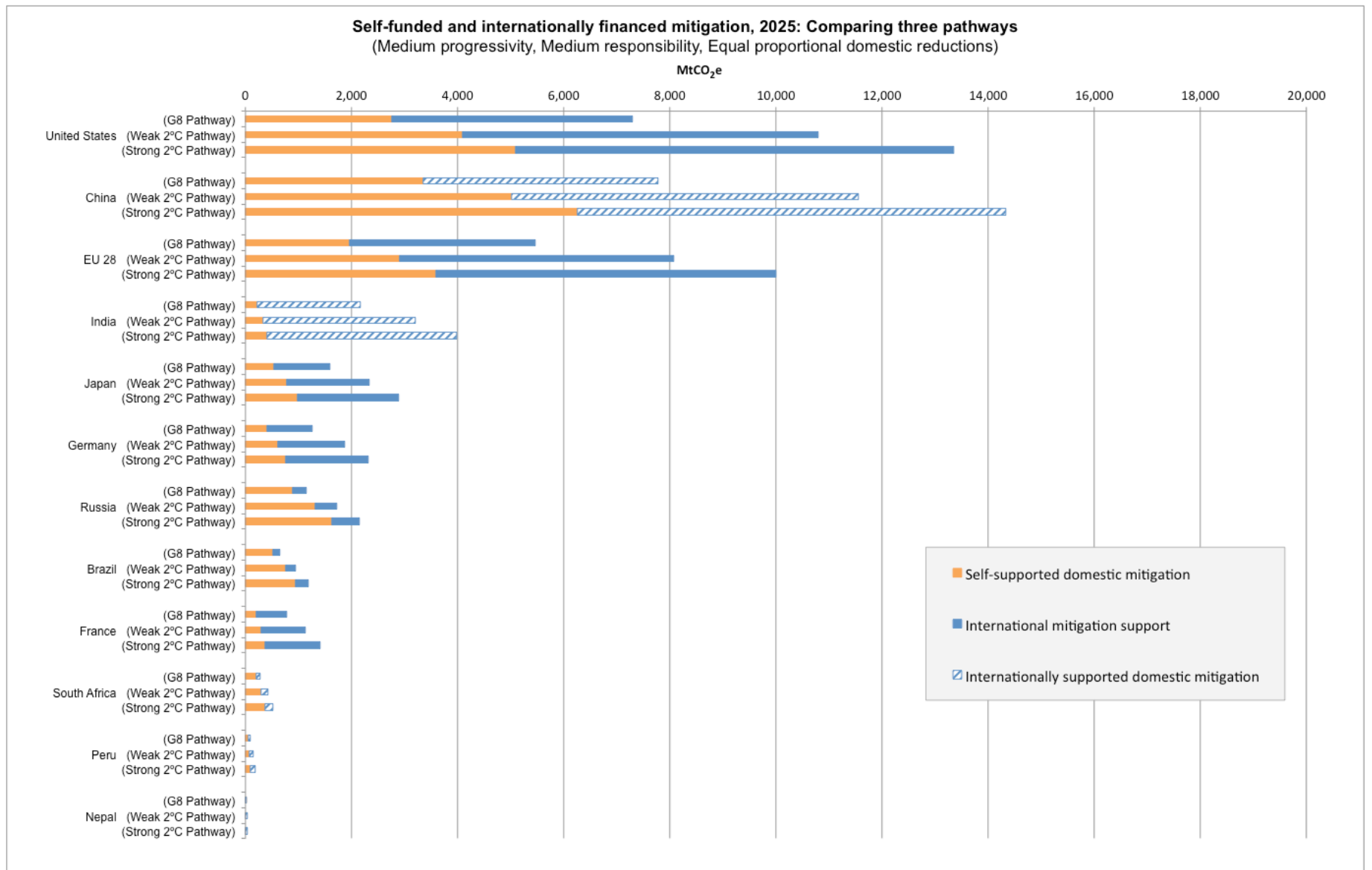
Three levels of ambition (pathways) compared (Middle-case progressivity, responsibility, and domestic mitigation estimate)			
Level of ambition	G8	Weak 2°C	Strong 2°C
Equity settings	No Progressivity	Weak Progressivity	Strong Progressivity
	Responsibility since 1990	Responsibility since 1950	Responsibility since 1850
Domestic mitigation estimate	Intensity-adjusted	Equal-proportional	Income-adjusted

The first set of results demonstrates the sensitivity of the results to variations in ambition; all other parameters are held at their middle settings: Weak Progressivity (\$7500 development threshold), Medium responsibility (1950 responsibility start date), and equal-proportional domestic emissions reductions. Recall that the domestic emissions reductions are estimated using highly simplified algorithms. For countries that are contributors of international support, the division into domestic mitigation and support for international mitigation is illustrative and is not intended to prescribe exactly how countries should meet their fair share obligations.

Because the equity settings are held the same across all three pathways, each country's RCI is essentially the same in each case, and thus the relative size of fair shares compared to estimated domestic reductions stays the same in all three pathways; that is, fair share obligations and domestic reductions increase proportionately as the global target becomes more stringent.

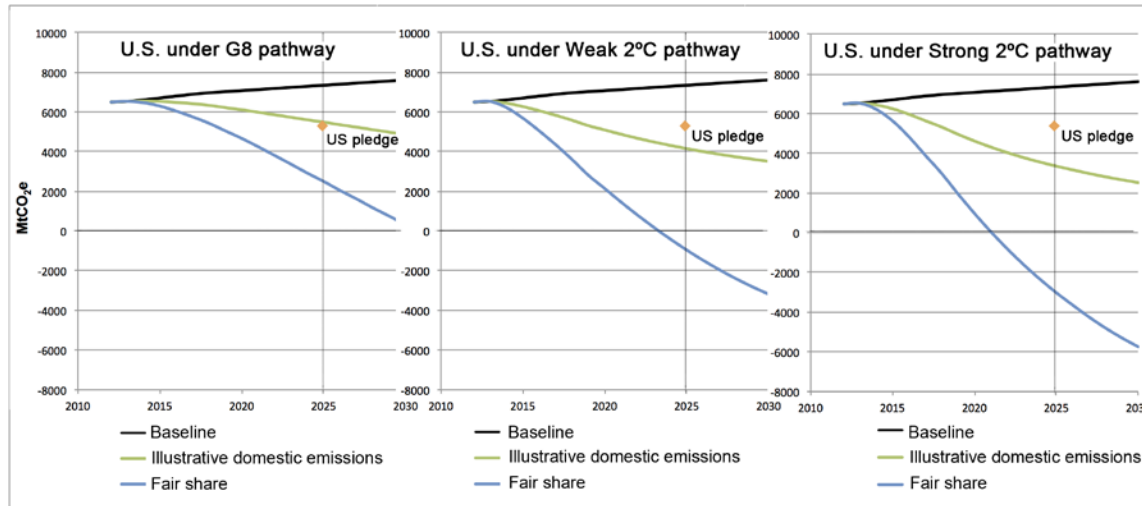
The bar chart at the beginning of this section compares our twelve example countries to each other, with a separate bar for each of the three levels of ambition. The bars are divided into self-funded domestic mitigation and international mitigation. For the contributor countries, international mitigation means support provided for international mitigation; for recipient countries, it means domestic mitigation funded by international sources.

In the individual country pages, per capita income is reported in \$2010 (MER), and per capita emissions include non-CO<sub>2</sub> gases but exclude CO<sub>2</sub> from land use.





Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
United States	Projected % of global RCI in 2025	29.8%				29.7%				29.7%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	4,850	-60%	-62%	-66%	8,300	-115%	-115%	-113%	10,400	-149%	-146%	-141%
	Domestic Mitigation	1,850	-12%	-16%	-25%	3,200	-33%	-36%	-43%	4,000	-46%	-49%	-54%
	Internationally-Supported Mitigation	3,000	-48%	-46%	-41%	5,100	-82%	-78%	-70%	6,400	-102%	-98%	-87%

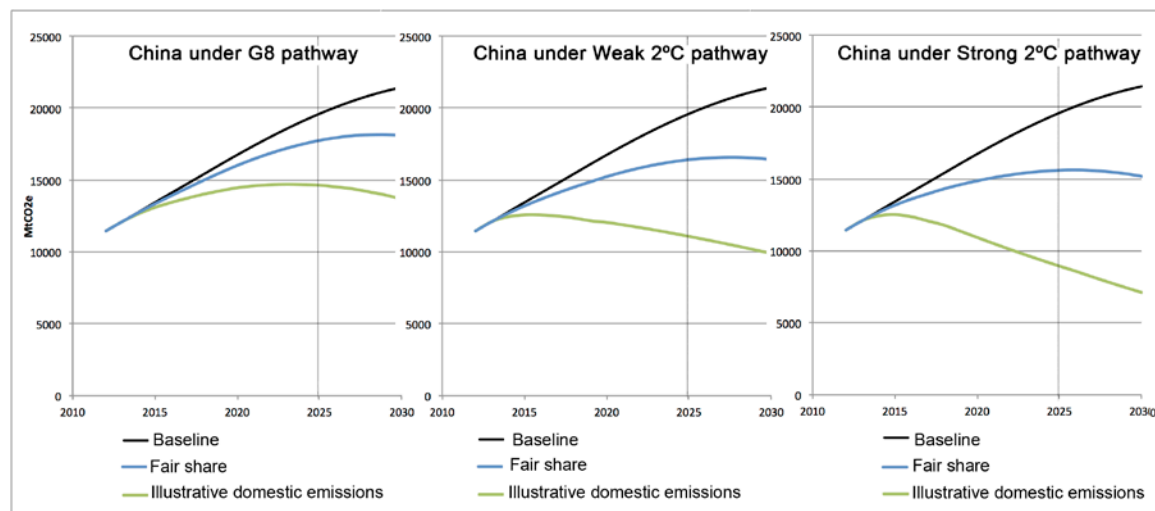


The United States’ projected 2025 per capita income is \$61,400. Its projected 2025 per capita baseline emissions are 21 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, the US is a contributor of international support.

Somewhat more than one-third of its mitigation obligation in 2025 would be met domestically and somewhat less than two-thirds by providing international support.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
China	Projected % of global RCI in 2025	11.4%				11.4%				11.5%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	1,850	+448%	+47%	-9%	3,200	+407%	+36%	-16%	4,000	+382%	+29%	-20%
	Total Domestic Mitigation	4,950	+352%	+21%	-25%	8,500	+242%	-8%	-43%	10,700	+176%	-26%	-54%
Internationally-Supported Mitigation	3,100	-96%	-26%	-16%	5,300	-165%	-44%	-27%	6,700	-206%	-55%	-34%	

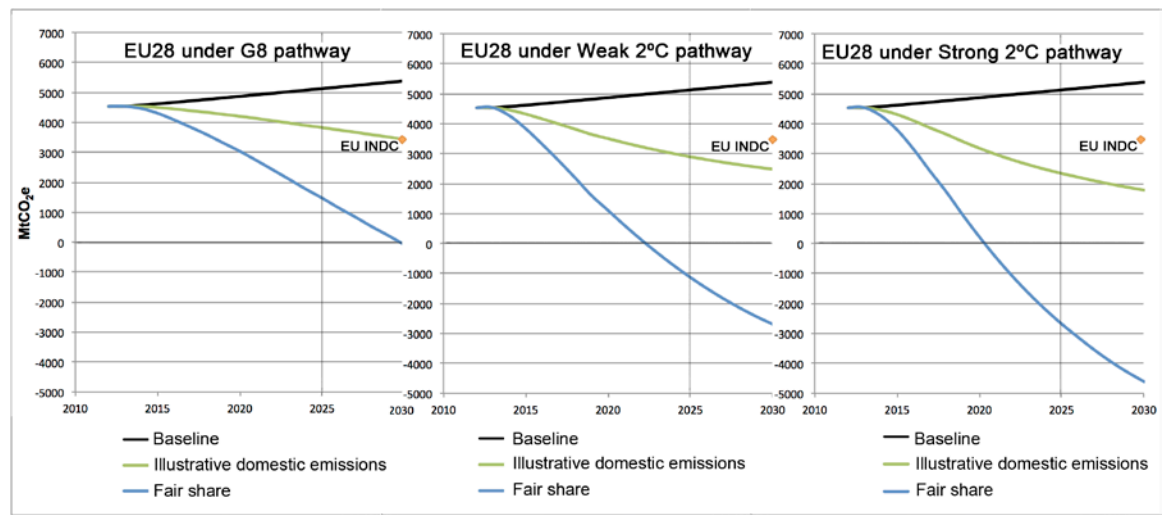


China’s projected per capita income in 2025 is \$12,700, and projected 2025 per capita baseline emissions are 13.5 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, China is a recipient of international support.

Somewhat more than one-third of China’s domestic mitigation obligation in 2025 would be self funded and somewhat less than two-thirds would be supported by international finance.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
EU28	Projected % of global RCI in 2025	22.5%				22.4%				22.4%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	3,650	-74%	-67%	-71%	6,300	-120%	-125%	-122%	7,800	-148%	-159%	-152%
	Domestic Mitigation	1,300	-32%	-16%	-25%	2,250	-49%	-36%	-43%	2,800	-58%	-48%	-54%
Internationally-Supported Mitigation	2,350	-42%	-52%	-46%	4,050	-71%	-89%	-78%	5,000	-89%	-111%	-98%	

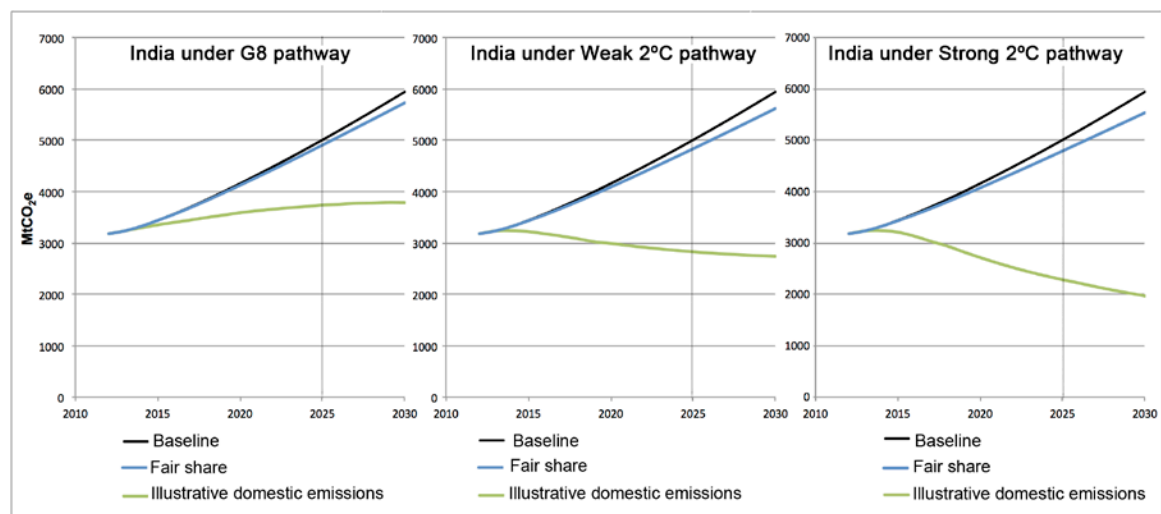


The EU28’s projected per capita income in 2025 is \$39,300, and projected 2025 per capita baseline emissions are 10 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, the EU28 is a contributor of international support.

About one-third of its mitigation obligation in 2025 would be met domestically and about two-thirds by providing international support.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
India	Projected % of global RCI in 2025	0.6%				0.6%				0.6%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	99	+352%	+52%	-2%	170	+345%	+49%	-3%	215	+341%	+48%	-4%
	Total Domestic Mitigation	1,250	+244%	+15%	-25%	2,200	+161%	-13%	-43%	2,700	+111%	-29%	-54%
Internationally-Supported Mitigation	1,151	-108%	-36%	-23%	2,030	-185%	-62%	-40%	2,485	-231%	-77%	-50%	

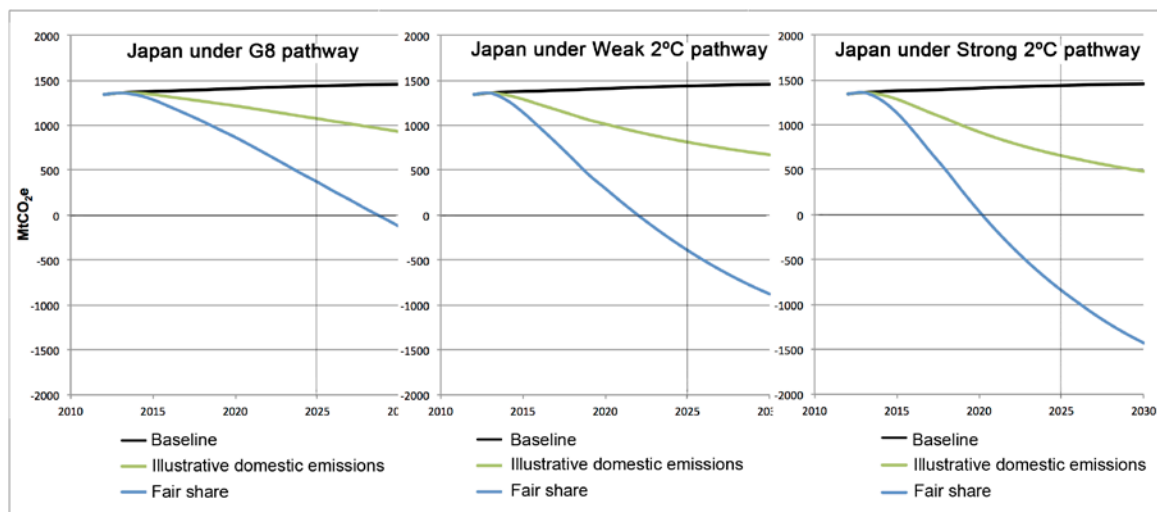


India’s projected per capita income in 2025 is \$3,000; and projected 2025 per capita baseline emissions are 3.5 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, India is a recipient of international support.

About 10% of India’s domestic mitigation obligation in 2025 would be self funded and 90% would be supported by international finance.

Country	Cell Definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Japan	Projected % of global RCI in 2025	6.6%				6.6%				6.5%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,050	-70%	-73%	-74%	1,850	-132%	-129%	-127%	2,300	-168%	-162%	-159%
	Domestic Mitigation	365	-13%	-21%	-25%	630	-34%	-40%	-43%	780	-47%	-52%	-54%
Internationally-Supported Mitigation	685	-57%	-52%	-49%	1,220	-97%	-89%	-84%	1,520	-121%	-110%	-104%	



Japan’s projected per capita income in 2025 is \$52,600, and projected 2025 per capita baseline emissions are 12 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, Japan is a contributor of international support.

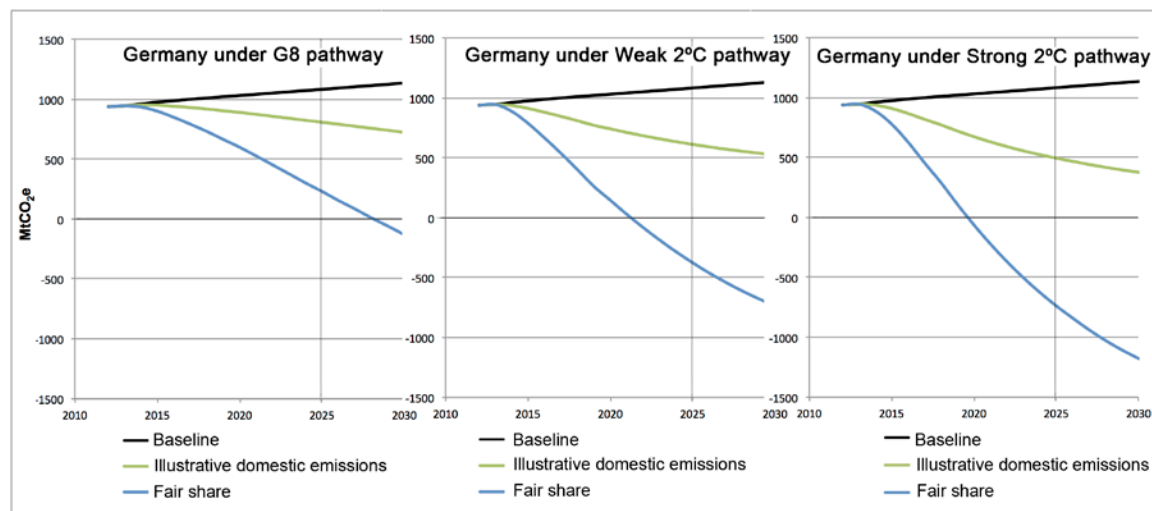
About one-third of Japan’s mitigation obligation in 2025 would be met domestically and about two-thirds by providing international support.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Germany	Projected % of global RCI in 2025	5.2%				5.2%				5.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	850	-81%	-76%	-79%	1,450	-130%	-140%	-135%	1,800	-159%	-178%	-168%
	Domestic Mitigation	275	-35%	-14%	-25%	470	-51%	-35%	-43%	590	-60%	-48%	-54%
Internationally-Supported Mitigation	575	-46%	-61%	-53%	980	-79%	-105%	-91%	1,210	-99%	-130%	-114%	

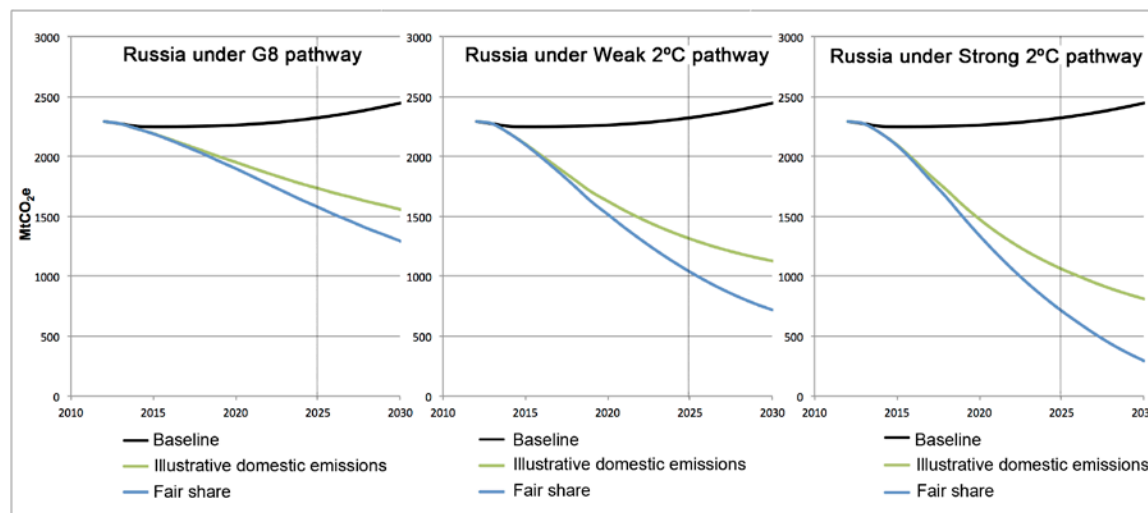
Germany’s projected per capita income in 2025 is \$50,100, and projected 2025 per capita baseline emissions are 13 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, Germany is a contributor of international support.

About one-third of Germany’s mitigation obligation in 2025 would be met domestically and two-thirds by providing international support.



Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Russia	Projected % of global RCI in 2025	4.6%				4.6%				4.6%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	750	-53%	-31%	-32%	1,300	-69%	-54%	-55%	1,600	-79%	-69%	-69%
	Domestic Mitigation	590	-48%	-24%	-25%	1,000	-61%	-42%	-43%	1,250	-68%	-53%	-54%
Internationally-Supported Mitigation	160	-5%	-7%	-7%	300	-8%	-12%	-12%	350	-10%	-15%	-15%	

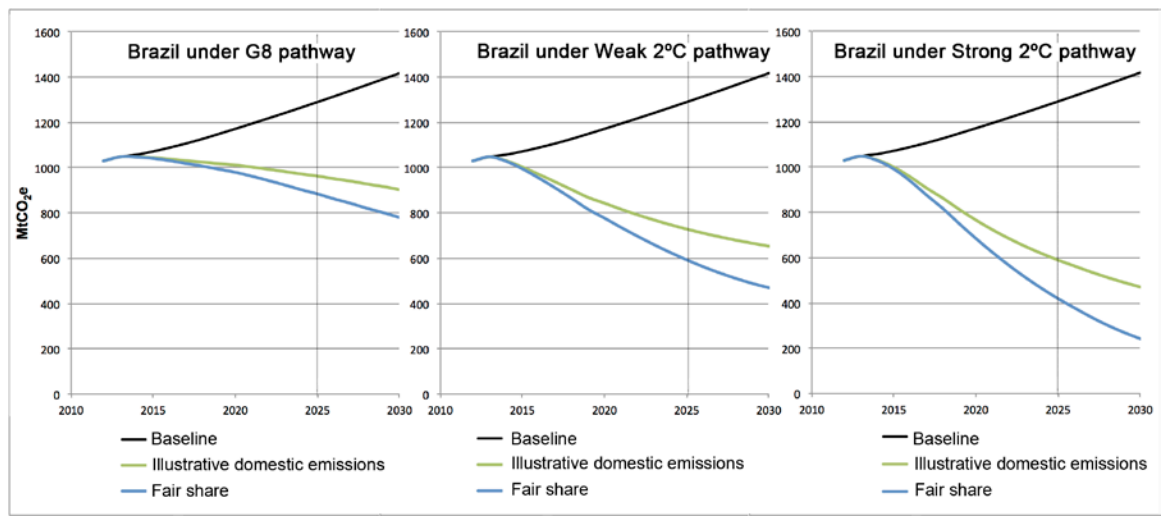


Russia’s projected per capita income in 2025 is \$18,500, and projected 2025 per capita baseline emissions are 17 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, Russia is a contributor of international support.

About three-quarters of Russia’s mitigation obligation in 2025 would be met domestically and one-quarter by providing international support.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Brazil	Projected % of global RCI in 2025	2.5%				2.5%				2.5%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	405	+20%	-16%	-31%	700	-19%	-43%	-54%	870	-43%	-60%	-68%
	Domestic Mitigation	325	+31%	-8%	-25%	560	-1%	-30%	-43%	700	-20%	-44%	-54%
Internationally-Supported Mitigation	80	-11%	-8%	-6%	140	-18%	-13%	-11%	170	-23%	-16%	-13%	



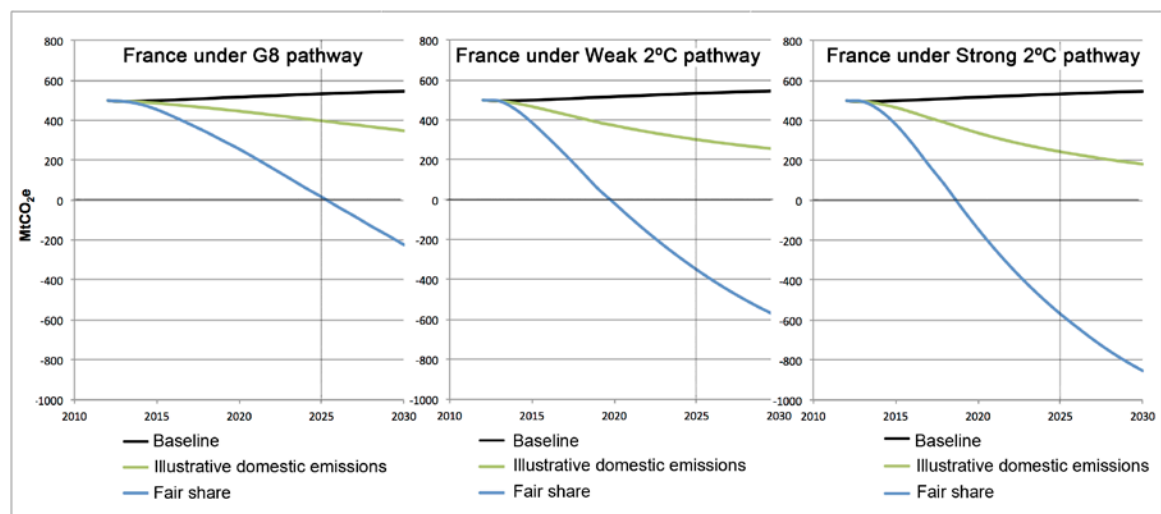
Brazil's projected per capita income in 2025 is \$16,400, and projected 2025 per capita baseline emissions are 6 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, Brazil is a contributor of international support.

About 80% of Brazil's mitigation obligation in 2025 would be met domestically and about 20% by providing international support.



Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
France	Projected % of global RCI in 2025	3.2%				3.2%				3.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	520	-97%	-97%	-97%	880	-163%	-171%	-166%	1,100	-202%	-215%	-207%
	Domestic Mitigation	135	-29%	-20%	-25%	230	-46%	-39%	-43%	290	-57%	-51%	-54%
Internationally-Supported Mitigation	385	-68%	-77%	-72%	650	-116%	-132%	-122%	810	-145%	-164%	-153%	

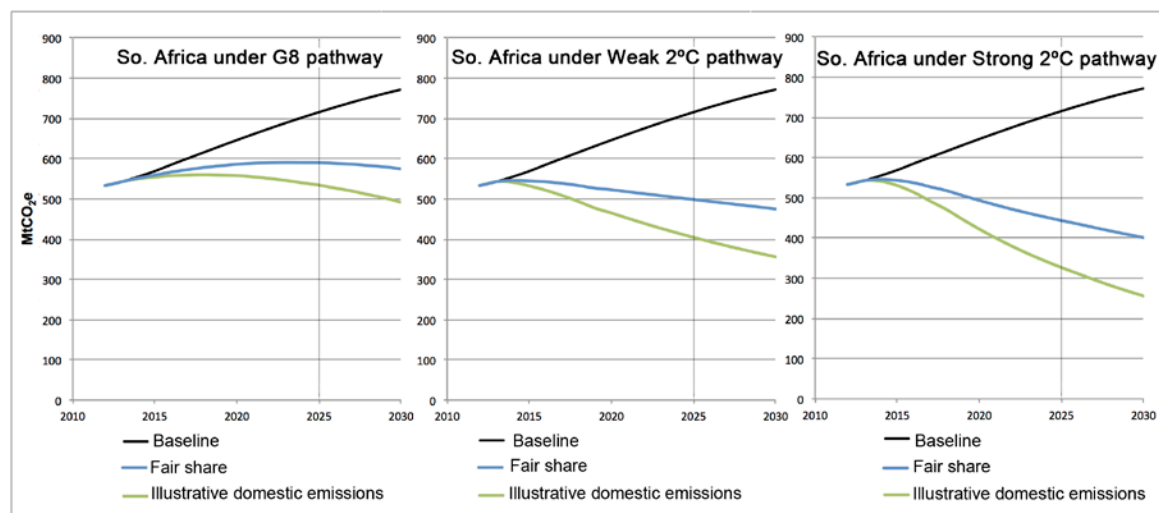


France’s projected per capita income in 2025 is \$47,000, and projected 2025 per capita baseline emissions are 8 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, France is a contributor of international support.

About one-quarter of France’s mitigation obligation in 2025 would be met domestically and three-quarters by providing international support

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
South Africa	Projected % of global RCI in 2025	0.77%				0.78%				0.78%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	125	+58%	+9%	-18%	215	+34%	-8%	-30%	270	+19%	-18%	-38%
	Total Domestic Mitigation	180	+43%	-2%	-25%	310	+8%	-25%	-43%	390	-12%	-40%	-54%
Internationally-Supported Mitigation	55	-15%	-10%	-8%	95	-25%	-17%	-13%	120	-31%	-22%	-16%	

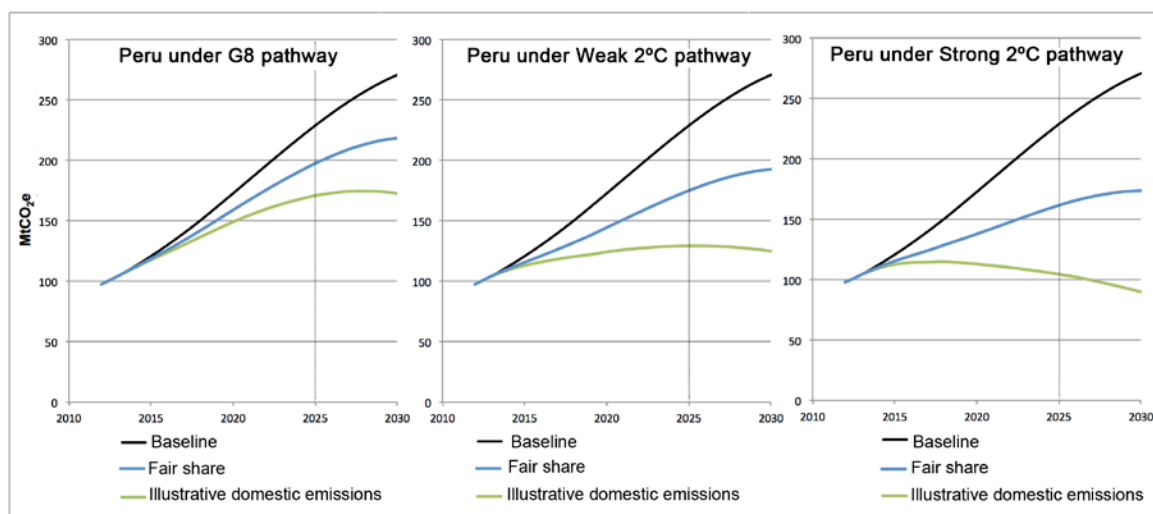


South Africa’s projected per capita income in 2025 is \$10,100, and projected 2025 per capita baseline emissions are 13 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility), and domestic mitigation estimated by the equal-proportional method, South Africa is a recipient of international support.

About two-thirds of South Africa’s domestic mitigation obligation in 2025 would be self funded and about one-third would be supported by international finance.

Country	Cell Definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Peru	Projected % of global RCI in 2025	0.19%				0.19%				0.19%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	31	+297%	+89%	-14%	54	+252%	+68%	-24%	67	+225%	+55%	-29%
	Total Domestic Mitigation	58	+243%	+64%	-25%	100	+160%	+24%	-43%	125	+110%	+	-54%
Internationally-Supported Mitigation	27	-54%	-26%	-12%	46	-92%	-44%	-20%	58	-115%	-55%	-25%	

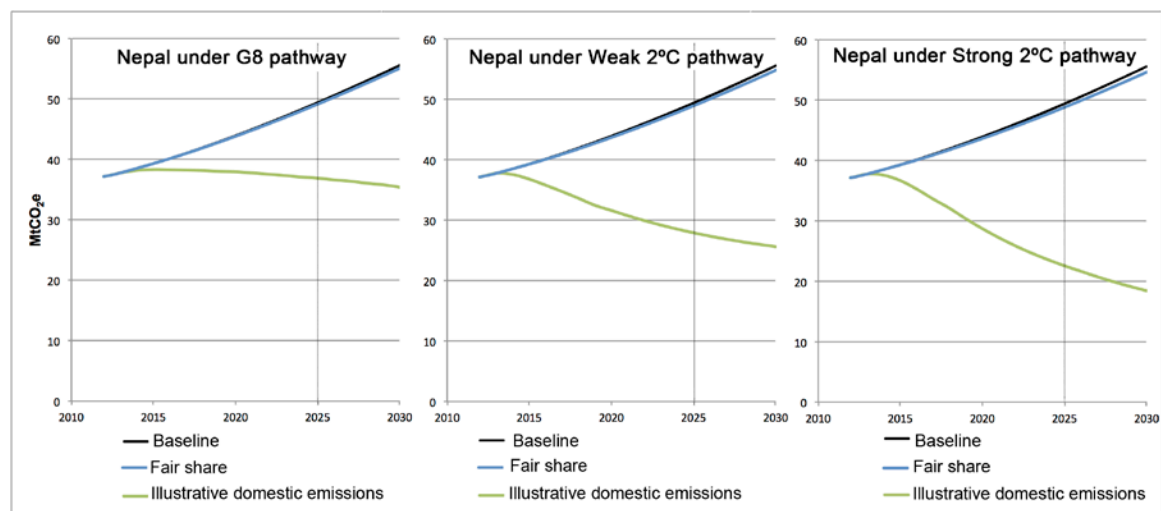


Peru’s projected per capita income in 2025 is \$9,900. Its projected 2025 per capita baseline emissions are 6.6 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility and equal-proportional domestic mitigation, Peru is a recipient of international support.

About half of Peru’s domestic mitigation obligation in 2025 would be self-funded and about half would be supported by international finance.

Country	Cell definitions	Three pathways											
		G8 pathway				Weak 2°C pathway				Strong 2°C pathway			
Nepal	Projected % of global RCI in 2025	0.002%				0.002%				0.002%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	0	+105%	+30%	-1%	1	+104%	+30%	-1%	1	+103%	+29%	-1%
	Total Domestic Mitigation	13	+54%	-2%	-25%	21	+16%	-26%	-43%	27	-6%	-40%	-54%
Internationally-Supported Mitigation	13	-51%	-32%	-25%	21	-88%	-56%	-43%	26	-109%	-70%	-53%	



Nepal’s projected per capita income in 2025 is \$900, and projected 2025 per capita baseline emissions are 1.6 tCO<sub>2</sub>e.

With these equity settings (Middle Progressivity and Responsibility and equal-proportional domestic mitigation, Nepal is a recipient of international support.

Virtually none (2%) of Nepal’s domestic mitigation obligation in 2025 would be self funded, for almost all of it would be supported by international finance.

**THREE LEVELS OF PROGRESSIVITY COMPARED**

<b>Three levels of progressivity compared</b> (Strong 2°C pathway, middle-case responsibility and domestic-mitigation estimate)			
<b>Level of ambition</b>	G8	Weak 2°C	Strong 2°C
<b>Equity settings</b>	No Progressivity	Weak Progressivity	High progressivity
	Responsibility since 1990	Responsibility since 1950	Responsibility since 1850
<b>Domestic mitigation estimate</b>	Intensity-adjusted	Equal-proportional	Income-adjusted

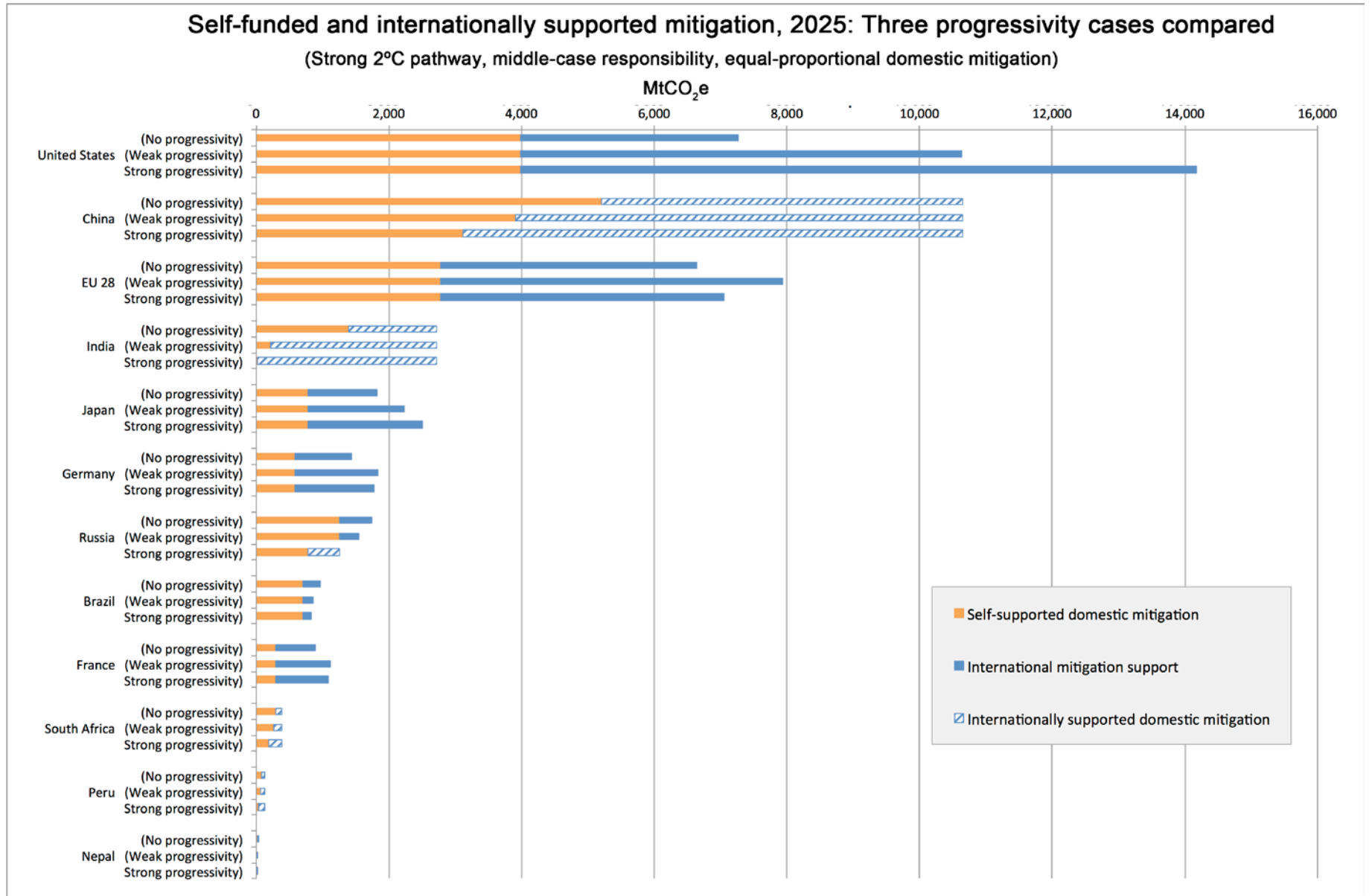
This comparison varies the level of Progressivity, while holding the other settings constant. The three progressivity settings are:

a) No Progressivity: development threshold set to zero, no luxury threshold.

b) Weak Progressivity: development threshold set to \$7,500 (Purchasing Power Parity basis), no luxury threshold.

c) High progressivity: development threshold set to \$7,500 (Purchasing Power Parity basis), luxury threshold set to \$50,000.

In all cases, the pathway is Strong 2°C pathway, responsibility is set to 1950 start-date, and domestic mitigation is estimated with the equal-proportional method.



Country	Cell definitions	Three progressivity cases											
		No Progressivity				Weak Progressivity				Strong Progressivity			
United States	Projected % of global RCI in 2025	20.8%				29.7%				40.6%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	7,300	-99%	-99%	-99%	10,400	-149%	-146%	-141%	14,200	-210%	-205%	-193%
	Domestic Mitigation	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%
Internationally-Supported Mitigation	3,300	-53%	-50%	-45%	6,400	-102%	-98%	-87%	10,200	-164%	-156%	-139%	
China	Projected % of global RCI in 2025	15.0%				11.5%				8.9%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	5,200	+344%	+19%	-27%	4,000	+382%	+29%	-20%	3,100	+409%	+36%	-16%
	Total Domestic Mitigation	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%
Internationally-Supported Mitigation	5,500	-168%	-45%	-28%	6,700	-206%	-55%	-34%	7,600	-233%	-62%	-38%	
EU28	Projected % of global RCI in 2025	19.0%				22.4%				20.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	6,600	-127%	-133%	-129%	7,800	-148%	-159%	-152%	7,000	-134%	-142%	-137%
	Domestic Mitigation	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%
Internationally-Supported Mitigation	3,800	-68%	-85%	-75%	5,000	-89%	-111%	-98%	4,200	-76%	-94%	-83%	

Country	Cell definitions	Three progressivity cases											
		No Progressivity				Weak Progressivity				Strong Progressivity			
India	Projected % of global RCI in 2025	4.0%				0.6%				0.1%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	1,400	+233%	+12%	-28%	215	+341%	+48%	-4%	21	+359%	+54%	%
	Total Domestic Mitigation	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%
Internationally-Supported Mitigation	1,300	-122%	-41%	-26%	2,485	-231%	-77%	-50%	2,679	-249%	-83%	-54%	
Japan	Projected % of global RCI in 2025	5.2%				6.5%				7.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,850	-131%	-129%	-127%	2,300	-168%	-162%	-159%	2,500	-187%	-179%	-174%
	Domestic Mitigation	780	-47%	-52%	-54%	780	-47%	-52%	-54%	780	-47%	-52%	-54%
Internationally-Supported Mitigation	1,070	-85%	-77%	-73%	1,520	-121%	-110%	-104%	1,720	-140%	-127%	-120%	
Germany	Projected % of global RCI in 2025	4.1%				5.2%				5.1%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,450	-128%	-137%	-132%	1,800	-159%	-178%	-168%	1,800	-155%	-173%	-164%
	Domestic Mitigation	590	-60%	-48%	-54%	590	-60%	-48%	-54%	590	-60%	-48%	-54%
Internationally-Supported Mitigation	860	-68%	-89%	-78%	1,210	-99%	-130%	-114%	1,210	-95%	-126%	-110%	



Country	Cell definitions	Three progressivity cases											
		No Progressivity				Weak Progressivity				Strong Progressivity			
Russia	Projected % of global RCI in 2025	5.0%				4.6%				2.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,750	-83%	-74%	-75%	1,600	-79%	-69%	-69%	780	-54%	-32%	-34%
	Domestic Mitigation	1,250	-68%	-53%	-54%	1,250	-68%	-53%	-54%	1,250	-68%	-53%	-54%
Internationally-Supported Mitigation	500	-14%	-21%	-21%	350	-10%	-15%	-15%	470	-14%	-21%	-21%	
France	Projected % of global RCI in 2025	2.6%				3.2%				3.1%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	900	-165%	-173%	-168%	1,100	-202%	-215%	-207%	1,100	-200%	-213%	-205%
	Domestic Mitigation	290	-57%	-51%	-54%	290	-57%	-51%	-54%	290	-57%	-51%	-54%
Internationally-Supported Mitigation	610	-108%	-123%	-114%	810	-145%	-164%	-153%	810	-143%	-163%	-151%	
Brazil	Projected % of global RCI in 2025	2.8%				2.5%				2.4%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	960	-55%	-69%	-74%	870	-43%	-60%	-68%	830	-37%	-56%	-64%
	Domestic Mitigation	700	-20%	-44%	-54%	700	-20%	-44%	-54%	700	-20%	-44%	-54%
Internationally-Supported Mitigation	260	-35%	-25%	-20%	170	-23%	-16%	-13%	130	-17%	-12%	-10%	

Country	Cell definitions:	Three progressivity cases											
		No Progressivity				Weak Progressivity				Strong Progressivity			
South Africa	Projected % of global RCI in 2025	0.86%				0.78%				0.55%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	300	+11%	-23%	-42%	270	+19%	-18%	-38%	190	+41%	-3%	-27%
	Total Domestic Mitigation	390	-12%	-40%	-54%	390	-12%	-40%	-54%	390	-12%	-40%	-54%
Internationally-Supported Mitigation	90	-24%	-16%	-12%	120	-31%	-22%	-16%	200	-53%	-36%	-28%	
Peru	Projected % of global RCI in 2025	0.25%				0.19%				0.09%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	86	+187%	+37%	-38%	67	+225%	+55%	-29%	30	+299%	+90%	-13%
	Total Domestic Mitigation	125	+110%	+	-54%	125	+110%	+	-54%	125	+110%	+	-54%
Internationally-Supported Mitigation	39	-77%	-37%	-17%	58	-115%	-55%	-25%	95	-189%	-90%	-41%	
Nepal	Projected % of global RCI in 2025	0.052%				0.0017%				0.0002%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	18	+31%	-17%	-36%	1	+103%	+29%	-1%	0	+105%	+31%	%
	Total Domestic Mitigation	27	-6%	-40%	-54%	27	-6%	-40%	-54%	27	-6%	-40%	-54%
Internationally-Supported Mitigation	9	-37%	-23%	-18%	26	-109%	-70%	-53%	27	-112%	-71%	-54%	

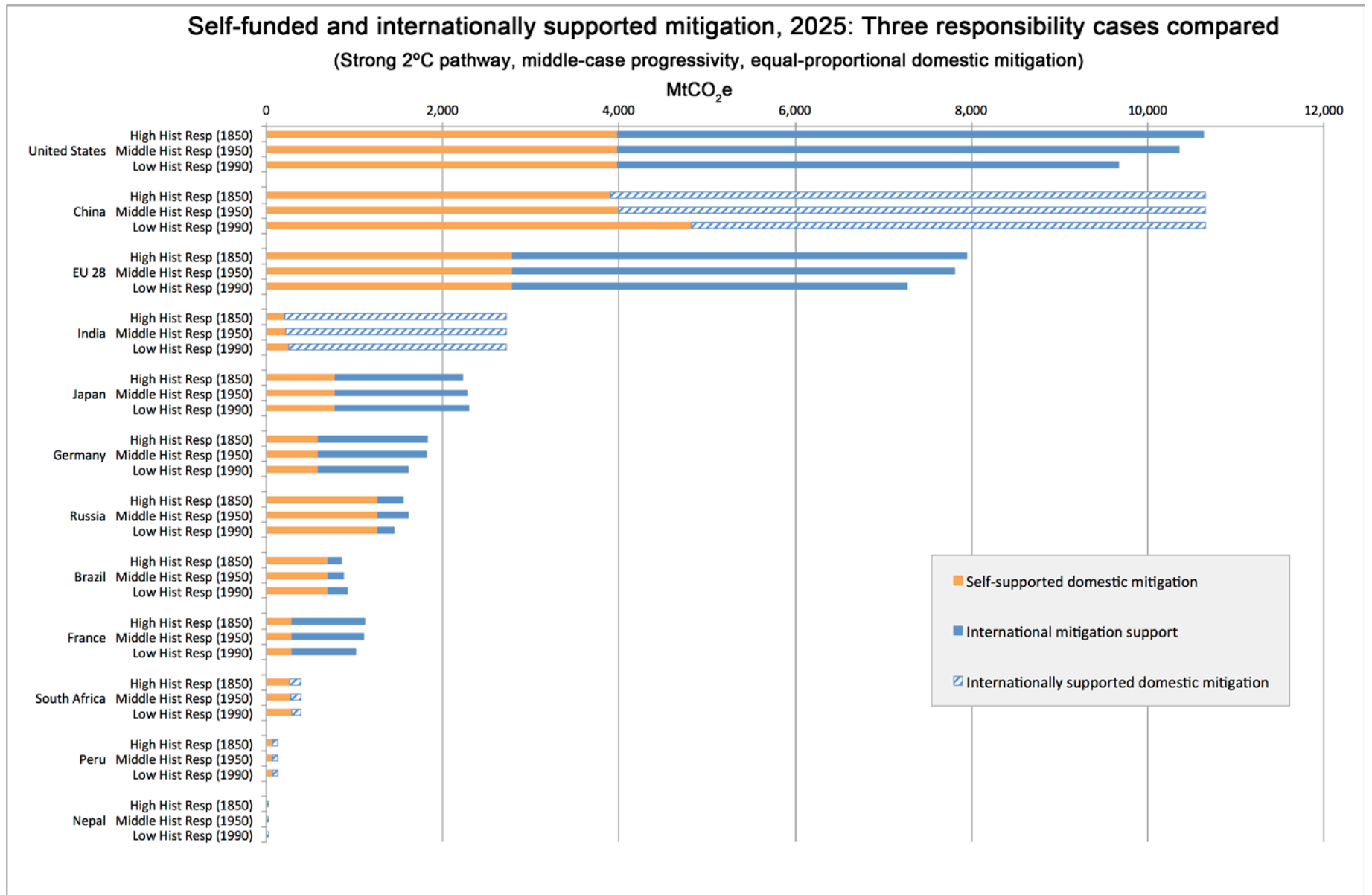
**THREE LEVELS OF RESPONSIBILITY COMPARED**

<b>Three levels of responsibility compared</b> (Strong 2°C pathway, middle-case progressivity and domestic-mitigation estimate)			
<b>Level of ambition</b>	G8	Weak 2°C	Strong 2°C
<b>Equity settings</b>	No Progressivity	Weak Progressivity	Strong Progressivity
	Responsibility since 1990	Responsibility since 1950	Responsibility since 1850
<b>Domestic mitigation estimate</b>	Intensity-adjusted	Equal-proportional	Income-adjusted

This comparison varies the level of responsibility, while holding the other settings constant. The three responsibility settings are:

- a) Low responsibility: Cumulative emissions since 1990 (for CO<sub>2</sub>, excluding land use) and 1950 (for non-CO<sub>2</sub> gases).
- b) Middle responsibility: Cumulative emissions since 1950 (for CO<sub>2</sub>, excluding land use, and non-CO<sub>2</sub> gases).
- c) High responsibility: Cumulative emissions since 1850 (for CO<sub>2</sub>, excluding land use, and non-CO<sub>2</sub> gases).

In all cases, the pathway is the Strong 2°C pathway, progressivity is set to Weak Progressivity (\$7500 development threshold, no luxury threshold), and domestic mitigation is estimated with the equal-proportional method.



Country	Cell definitions	Three responsibility cases											
		Low Responsibility (1990)				Middle Responsibility (1950)				High Responsibility (1850)			
United States	Projected % of global RCI in 2025	27.7%				29.7%				30.5%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	9,700	-137%	-136%	-132%	10,400	-149%	-146%	-141%	10,600	-153%	-151%	-145%
	Domestic Mitigation	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%	4,000	-46%	-49%	-54%
	Internationally-Supported Mitigation	5,700	-91%	-87%	-77%	6,400	-102%	-98%	-87%	6,600	-107%	-102%	-91%
<hr/>													
China	Projected % of global RCI in 2025	13.8%				11.5%				11.2%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	4,800	+356%	+22%	-25%	4,000	+382%	+29%	-20%	3,900	+385%	+30%	-20%
	Total Domestic Mitigation	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%	10,700	+176%	-26%	-54%
	Internationally-Supported Mitigation	5,900	-180%	-48%	-30%	6,700	-206%	-55%	-34%	6,800	-208%	-56%	-34%
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EU28	Projected % of global RCI in 2025	20.9%				22.4%				22.8%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	7,300	-138%	-147%	-142%	7,800	-148%	-159%	-152%	7,900	-150%	-162%	-155%
	Domestic Mitigation	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%	2,800	-58%	-48%	-54%
	Internationally-Supported Mitigation	4,500	-80%	-99%	-87%	5,000	-89%	-111%	-98%	5,100	-91%	-114%	-100%

Country	Cell definitions	Three responsibility cases											
		Low Responsibility (1990)				Middle Responsibility (1950)				High Responsibility (1850)			
India	Projected % of global RCI in 2025	0.73%				0.62%				0.60%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	255	+338%	+47%	-5%	215	+341%	+48%	-4%	210	+342%	+48%	-4%
	Total Domestic Mitigation	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%	2,700	+111%	-29%	-54%
Internationally-Supported Mitigation	2,445	-227%	-76%	-49%	2,485	-231%	-77%	-50%	2,490	-231%	-78%	-50%	
Japan	Projected % of global RCI in 2025	6.6%				6.5%				6.4%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	2,300	-170%	-163%	-160%	2,300	-168%	-162%	-159%	2,250	-164%	-159%	-155%
	Domestic Mitigation	780	-47%	-52%	-54%	780	-47%	-52%	-54%	780	-47%	-52%	-54%
Internationally-Supported Mitigation	1,520	-123%	-112%	-106%	1,520	-121%	-110%	-104%	1,470	-118%	-107%	-101%	
Germany	Projected % of global RCI in 2025	4.6%				5.2%				5.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,600	-142%	-155%	-148%	1,800	-159%	-178%	-168%	1,850	-160%	-179%	-169%
	Domestic Mitigation	590	-60%	-48%	-54%	590	-60%	-48%	-54%	590	-60%	-48%	-54%
Internationally-Supported Mitigation	1,010	-82%	-108%	-94%	1,210	-99%	-130%	-114%	1,260	-99%	-131%	-115%	

Country	Cell definitions	Three responsibility cases											
		Low Responsibility (1990)				Middle Responsibility (1950)				High Responsibility (1850)			
Russia	Projected % of global RCI in 2025	4.2%				4.6%				4.4%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,450	-74%	-62%	-62%	1,600	-79%	-69%	-69%	1,550	-77%	-66%	-67%
	Domestic Mitigation	1,250	-68%	-53%	-54%	1,250	-68%	-53%	-54%	1,250	-68%	-53%	-54%
Internationally-Supported Mitigation	200	-6%	-8%	-8%	350	-10%	-15%	-15%	300	-8%	-12%	-12%	
France	Projected % of global RCI in 2025	2.9%				3.2%				3.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,000	-186%	-197%	-190%	1,100	-202%	-215%	-207%	1,100	-204%	-218%	-210%
	Domestic Mitigation	290	-57%	-51%	-54%	290	-57%	-51%	-54%	290	-57%	-51%	-54%
Internationally-Supported Mitigation	710	-129%	-146%	-136%	810	-145%	-164%	-153%	810	-148%	-168%	-156%	
Brazil	Projected % of global RCI in 2025	2.6%				2.5%				2.4%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:			MtCO <sub>2</sub> e	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	910	-49%	-64%	-71%	870	-43%	-60%	-68%	850	-40%	-58%	-66%
	Domestic Mitigation	700	-20%	-44%	-54%	700	-20%	-44%	-54%	700	-20%	-44%	-54%
Internationally-Supported Mitigation	210	-29%	-20%	-17%	170	-23%	-16%	-13%	150	-20%	-14%	-12%	

Country	Cell definitions:	Three responsibility cases											
		Low Responsibility (1990)			Middle Responsibility (1950)			High Responsibility (1850)					
South Africa	Projected % of global RCI in 2025	0.83%			0.78%			0.76%					
	Support Contributor or Recipient	Support Recipient			Support Recipient			Support Recipient					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	290	+14%	-22%	-40%	270	+19%	-18%	-38%	265	+21%	-17%	-37%
	Total Domestic Mitigation	390	-12%	-40%	-54%	390	-12%	-40%	-54%	390	-12%	-40%	-54%
Internationally-Supported Mitigation	100	-27%	-18%	-14%	120	-31%	-22%	-16%	125	-33%	-23%	-17%	
Peru	Projected % of global RCI in 2025	0.20%			0.19%			0.19%					
	Support Contributor or Recipient	Support Recipient			Support Recipient			Support Recipient					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	70	+219%	+52%	-31%	67	+225%	+55%	-29%	66	+227%	+56%	-29%
	Total Domestic Mitigation	125	+110%	+	-54%	125	+110%	+	-54%	125	+110%	+	-54%
Internationally-Supported Mitigation	55	-109%	-52%	-24%	58	-115%	-55%	-25%	59	-117%	-56%	-25%	
Nepal	Projected % of global RCI in 2025	0.002%			0.002%			0.002%					
	Support Contributor or Recipient	Support Recipient			Support Recipient			Support Recipient					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	1	+103%	+29%	-1%	1	+103%	+29%	-1%	1	+103%	+29%	-1%
	Total Domestic Mitigation	27	-6%	-40%	-54%	27	-6%	-40%	-54%	27	-6%	-40%	-54%
Internationally-Supported Mitigation	26	-109%	-69%	-53%	26	-109%	-70%	-53%	26	-109%	-70%	-53%	



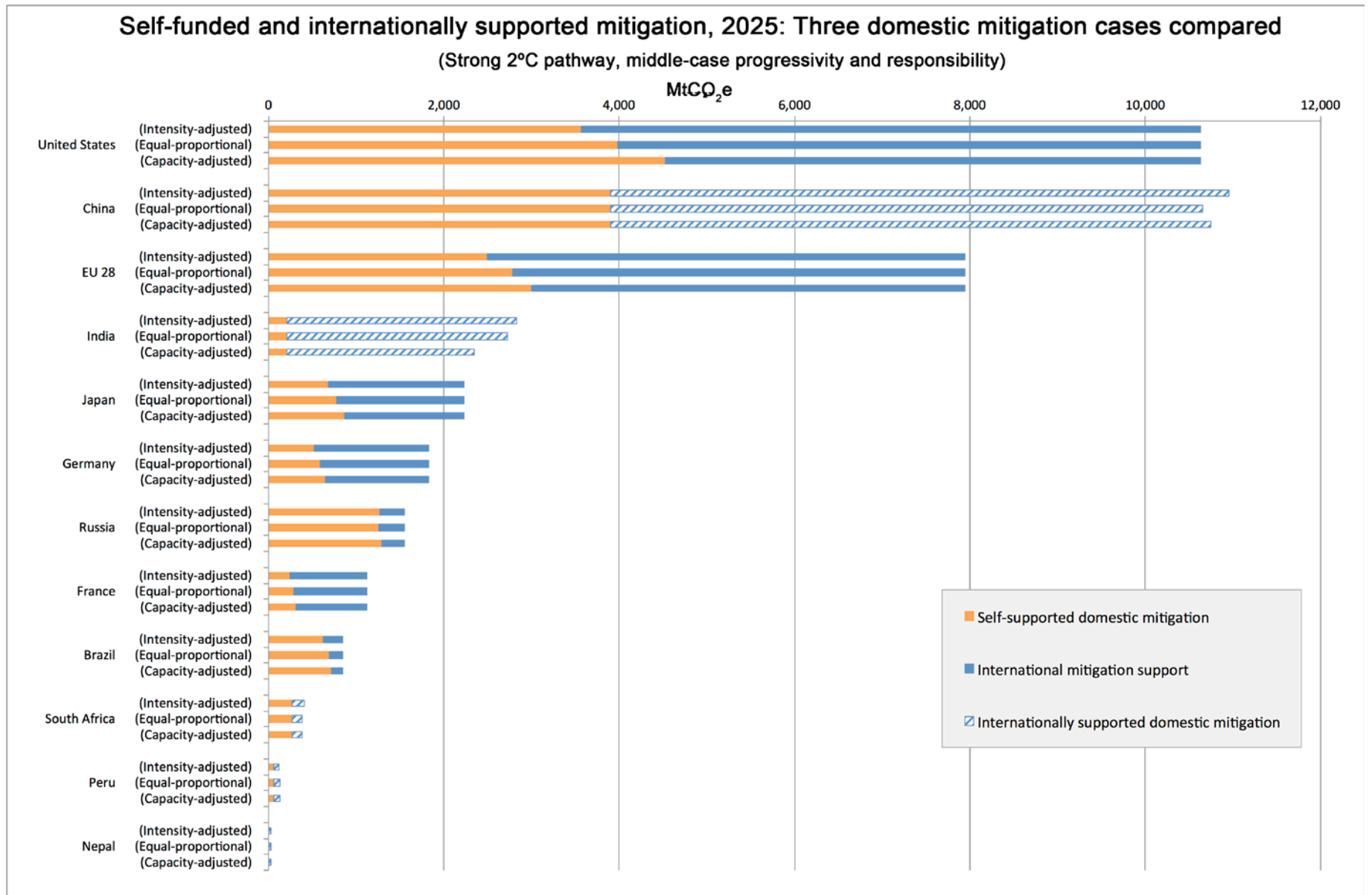
**THREE DOMESTIC-MITIGATION ESTIMATES, COMPARED**

<b>Three domestic-mitigation estimates</b> (Strong 2°C pathway, middle-case progressivity and responsibility)			
<b>Level of ambition</b>	G8	Weak 2°C	Strong 2°C
<b>Equity settings</b>	No Progressivity	Weak Progressivity	Strong Progressivity
	Responsibility since 1990	Responsibility since 1950	Responsibility since 1850
<b>Domestic mitigation estimate</b>	Intensity-adjusted	Equal-proportional	Income-adjusted

This comparison varies the method for estimating domestic mitigation, while holding the other settings constant. The three methods for estimating domestic mitigation are:

- a) Intensity-adjusted: Countries with higher emissions intensities make larger percentage reductions below the baseline than countries with lower emissions intensities.
- b) Equal-proportional: All countries reduce the same percentage amount below their baseline (the same percentage as the global reduction below the global baseline).
- c) Income-adjusted: Countries with higher per capita income make larger percentage reductions below the baseline than countries with lower per capita income.

In all cases, the pathway is the Strong 2°C pathway, progressivity is set to Weak Progressivity (\$7500 development threshold, no luxury threshold), and responsibility is set to historical responsibility since 1950.



Country	Cell definitions	Three domestic-reduction estimates											
		Intensity-adjusted			Equal-proportional			Income-adjusted					
United States	Projected % of global RCI in 2025	29.7%			29.7%			29.7%					
	Support Contributor or Recipient	Support Contributor			Support Contributor			Support Contributor					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	10,400	-149%	-146%	-141%	10,400	-149%	-146%	-141%	10,400	-149%	-146%	-141%
	Domestic Mitigation	3,550	-39%	-42%	-49%	4,000	-46%	-49%	-54%	4,550	-55%	-57%	-62%
Internationally-Supported Mitigation	6,850	-109%	-104%	-93%	6,400	-102%	-98%	-87%	5,850	-94%	-89%	-80%	
China	Projected % of global RCI in 2025	11.5%			11.5%			11.5%					
	Support Contributor or Recipient	Support Recipient			Support Recipient			Support Recipient					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	4,000	+382%	+29%	-20%	4,000	+382%	+29%	-20%	4,000	+382%	+29%	-20%
	Domestic Mitigation	11,000	+167%	-28%	-56%	10,650	+176%	-26%	-54%	10,750	+174%	-27%	-55%
Internationally-Supported Mitigation	7,000	-215%	-58%	-35%	6,650	-206%	-55%	-34%	6,750	-208%	-56%	-34%	
EU28	Projected % of global RCI in 2025	22.4%			22.4%			22.4%					
	Support Contributor or Recipient	Support Contributor			Support Contributor			Support Contributor					
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	7,800	-148%	-159%	-152%	7,800	-148%	-159%	-152%	7,800	-148%	-159%	-152%
	Domestic Mitigation	2,500	-53%	-42%	-48%	2,800	-58%	-48%	-54%	3,000	-62%	-53%	-59%
Internationally-Supported Mitigation	5,300	-95%	-117%	-104%	5,000	-89%	-111%	-98%	4,800	-85%	-106%	-94%	

Country	Cell definitions	Three domestic-reduction estimates											
		Intensity-adjusted				Equal-proportional				Income-adjusted			
India	Projected % of global RCI in 2025	0.6%				0.6%				0.6%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	215	+341%	+48%	-4%	215	+341%	+48%	-4%	215	+341%	+48%	-4%
	Total Domestic Mitigation	2,850	+100%	-33%	-57%	2,700	+111%	-29%	-54%	2,350	+145%	-18%	-47%
Internationally-Supported Mitigation	2,635	-241%	-81%	-52%	2,485	-231%	-77%	-50%	2,135	-197%	-66%	-43%	
Japan	Projected % of global RCI in 2025	6.5%				6.5%				6.5%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	2,300	-168%	-162%	-159%	2,300	-168%	-162%	-159%	2,300	-168%	-162%	-159%
	Domestic Mitigation	680	-39%	-44%	-47%	780	-47%	-52%	-54%	870	-54%	-58%	-60%
Internationally-Supported Mitigation	1,620	-130%	-118%	-111%	1,520	-121%	-110%	-104%	1,430	-114%	-104%	-98%	
Germany	Projected % of global RCI in 2025	5.2%				5.2%				5.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,800	-159%	-178%	-168%	1,800	-159%	-178%	-168%	1,800	-159%	-178%	-168%
	Domestic Mitigation	520	-55%	-40%	-48%	590	-60%	-48%	-54%	650	-65%	-54%	-60%
Internationally-Supported Mitigation	1,280	-104%	-138%	-120%	1,210	-99%	-130%	-114%	1,150	-94%	-124%	-108%	

Country	Cell definitions	Three domestic-reduction estimates											
		Intensity-adjusted				Equal-proportional				Income-adjusted			
Russia	Projected % of global RCI in 2025	4.6%				4.6%				4.6%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,600	-79%	-69%	-69%	1,600	-79%	-69%	-69%	1,600	-79%	-69%	-69%
	Domestic Mitigation	1,250	-69%	-54%	-55%	1,250	-68%	-53%	-54%	1,300	-69%	-55%	-56%
Internationally-Supported Mitigation	350	-10%	-15%	-14%	350	-10%	-15%	-15%	300	-10%	-14%	-14%	
France	Projected % of global RCI in 2025	3.2%				3.2%				3.2%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	1,100	-202%	-215%	-207%	1,100	-202%	-215%	-207%	1,100	-202%	-215%	-207%
	Domestic Mitigation	250	-49%	-43%	-47%	290	-57%	-51%	-54%	315	-62%	-57%	-60%
Internationally-Supported Mitigation	850	-152%	-172%	-160%	810	-145%	-164%	-153%	785	-140%	-159%	-147%	
Brazil	Projected % of global RCI in 2025	2.5%				2.5%				2.5%			
	Support Contributor or Recipient	Support Contributor				Support Contributor				Support Contributor			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Total Mitigation Fair Share	870	-43%	-60%	-68%	870	-43%	-60%	-68%	870	-43%	-60%	-68%
	Domestic Mitigation	630	-11%	-37%	-49%	700	-20%	-44%	-54%	710	-22%	-45%	-55%
Internationally-Supported Mitigation	240	-33%	-23%	-19%	170	-23%	-16%	-13%	160	-21%	-15%	-12%	

Country	Cell definitions	Three domestic-reduction estimates											
		Intensity-adjusted				Equal-proportional				Income-adjusted			
South Africa	Projected % of global RCI in 2025	0.8%				0.8%				0.8%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	270	+19%	-18%	-38%	270	+19%	-18%	-38%	270	+19%	-18%	-38%
	Total Domestic Mitigation	410	-18%	-44%	-57%	390	-12%	-40%	-54%	390	-13%	-40%	-54%
Internationally-Supported Mitigation	140	-37%	-25%	-19%	120	-31%	-22%	-16%	120	-31%	-22%	-16%	
Peru	Projected % of global RCI in 2025	0.19%				0.19%				0.19%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	67	+225%	+55%	-29%	67	+225%	+55%	-29%	67	+225%	+55%	-29%
	Total Domestic Mitigation	120	+119%	+4%	-52%	125	+110%	+	-54%	125	+110%	+	-54%
Internationally-Supported Mitigation	53	-106%	-50%	-23%	58	-115%	-55%	-25%	58	-115%	-55%	-25%	
Nepal	Projected % of global RCI in 2025	0.002%				0.002%				0.002%			
	Support Contributor or Recipient	Support Recipient				Support Recipient				Support Recipient			
		MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:			MtCO <sub>2e</sub>	% reduction relative to:		
			1990	2013	2025		1990	2013	2025		1990	2013	2025
	Mitigation Fair Share	1	+103%	+29%	-1%	1	+103%	+29%	-1%	1	+103%	+29%	-1%
	Total Domestic Mitigation	30	-18%	-48%	-60%	27	-6%	-40%	-54%	22	+14%	-27%	-45%
Internationally-Supported Mitigation	29	-121%	-77%	-59%	26	-109%	-70%	-53%	21	-89%	-57%	-43%	

## APPENDIX 2 – THE EFFORT-SHARING APPROACH USED IN THIS REPORT

This report approaches fair shares in a manner that draws directly from the core equity principles of the UNFCCC. These principles have been nicely summarized<sup>16</sup> as follows:

1. **A precautionary approach to adequacy**, referring to the collective obligations of countries to undertake and support urgent and adequate global action to prevent dangerous impacts of climate change and provide effective adaptation to unavoidable impacts, without which there can be no justice. (Article 3.3: “The Parties should take precautionary measures to anticipate, prevent and minimize the causes of climate change and mitigate its adverse effects.”)
2. **Common but differentiated responsibility and respective capability (CBDR+RC)**, in which obligations to take action and provide support, and rights to receive such support, are accepted as functions of both historical and current emissions, and of capability to act. (Article 3.1: “The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.”)
3. **The right to sustainable development**, which we understand as the right of all countries to not just lift their people out of poverty, but also to provide their citizens with sustainable and universalizable living standards. By sustainable we mean “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” By universalizable, we mean living standards that could be made available to the citizens of all countries. (Article 3.4: “The Parties have a right to, and should, promote sustainable development.”)

The [Climate Equity Reference Calculator](#), within which the calculations in this report were done, is an online tool and database that allows the user to select a global mitigation pathway of a specified level of ambition, thereby determining the amount of required global mitigation effort – a mitigation gap – to be fairly shared among countries according to the UNFCCC principles of equity.<sup>17</sup> The user then selects specific equity-related settings relating to responsibility and capacity, and other key parameters, which are used to calculate the implied national fair shares of the global mitigation effort for all countries. In particular, each country’s fair share of the global mitigation effort in each year is determined by its share of global responsibility and capacity, which are calculated in a manner that can exclude the income and emissions of individuals below some specified threshold.

<sup>16</sup> This summary was done by the Equity / Effort-sharing Working Group of the Climate Action Network. See footnote 2 for the link, which contains much more information of how CAN has defined the Convention’s core equity principles, and what kinds of indicators it sees as appropriate to their measurement. Note also that this analysis is hardly the last word. A great deal of work remains to be done on Convention-compliant effort sharing.

<sup>17</sup> This mitigation gap is defined relative to a global business-as-usual emissions path. Effort-sharing frameworks (unlike resource-sharing frameworks that divide up, say, a fixed emissions budget) require emissions baselines, because a “effort” must be measured against a business-as-usual pathway that reflects “no effort” or “no policies”. In this report, the calculations are based on a set of national no-effort baselines that, in turn, rely as heavily as possible on existing, widely known and well vetted national projections for all key indicators (i.e. population projections, GDP projections, carbon intensity projections) updated for recent history. For much more on all this, see [Definition, sourcing, and updating of the emissions baselines](#). Also, note that, as with global mitigation pathways, the *Calculator* can be adapted to support any set of national business-as-usual pathways, if fully specified as described above for mitigation pathways. Please contact us if you are interested in exploring alternative mitigation pathways or business-as-usual pathways.

Appendix 2

Figure A1, below, illustrates the general effort-sharing approach of this analysis, for it shows how a mitigation gap is partitioned into mitigation fair shares that are assigned to individual countries on the basis of their responsibility and capacity.

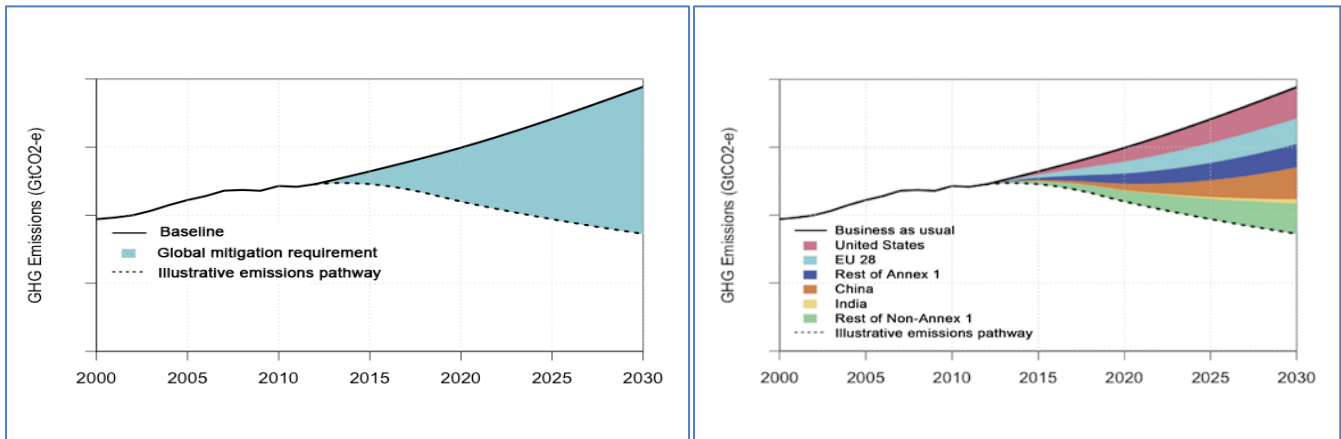


Figure A1: Total globally required mitigation (blue area) divided among countries in proportion to their share of global responsibility and capacity.

As has become customary in discussions of equitable effort-sharing, capacity is represented in financial terms. This is not necessarily because financial income is the only important type of capacity for dealing with climate change, though it is very highly correlated with the other various types of capacity that are also important (technological capacity, institutional capacity, etc.). Just as income is typically considered in a progressive manner in national tax policy, it can analogously be defined in a progressive manner for the purposes of defining capacity. A straightforward method for doing this is to define an income level below which income does not count toward capacity, similar to a “0% tax bracket” that exists in most national tax schedules. Extending the comparison to a tax schedule, a higher income level can also be set at which income counts fully toward national capacity, analogous to the maximum tax bracket. Between the two income levels, income

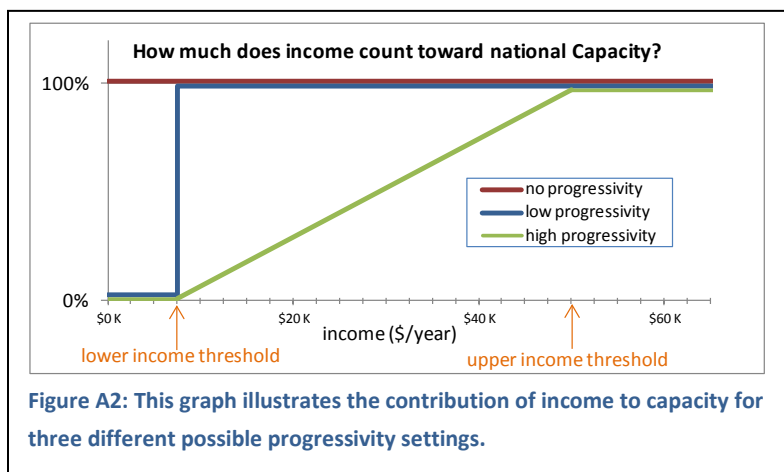


Figure A2: This graph illustrates the contribution of income to capacity for three different possible progressivity settings.

increasingly counts toward the calculation of a country’s capacity. The *Climate Equity Reference Calculator* refers to the lower income level as the “development threshold” and the higher income level as the “luxury threshold”.

While setting this lower threshold to reflect a ‘development threshold’ allows one to exempt the emissions and income of poor individuals, it is far from being a guarantee of equitable access to sustainable development. In particular, it does not assert a positive right to development, or

even a positive right to energy services. That said, an exclusion set to reflect a development threshold does make a significant difference in the calculation of fair shares for countries (e.g. LDCs, India) with mostly poor people.



Appendix 2

Figure A2 illustrates the three different progressivity cases presented in this report. In the “No progressivity” case, every dollar of income earned by every person in the country, regardless of their total income, would count 100% toward the calculation of a country’s capacity (red line). In the “Weak progressivity” case, income earned below a lower income threshold (here shown at \$7,500/year) does not count toward national capacity, and income above counts 100% (blue line). In the “High progressivity” case, income below the lower income threshold does not count, income above a higher threshold counts 100%, and between the two thresholds income counts to an extent that gradually rises from 0% to 100% (the green line). These calculations are done using income distributions (see Figure A3) based on data from the World Bank World Development Indicators and the World Income Inequality Database.

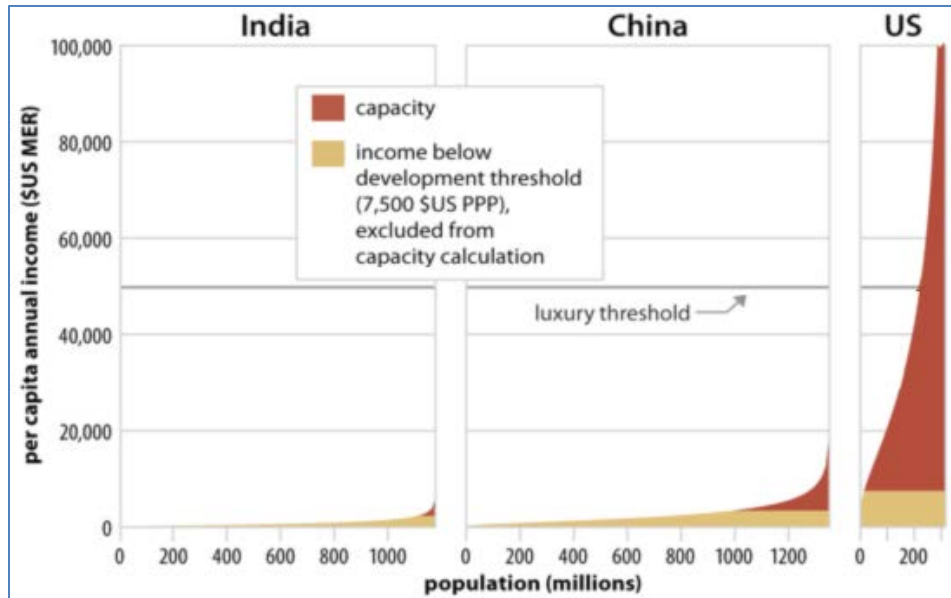


Figure A3: Income distributions for three countries in the year 2010, showing the same lower income threshold (here set at a level reflecting a “development threshold” of \$US 7,500, adjusted for purchase power parity) and upper income threshold (here set to reflect a “luxury threshold” of \$US 50,000) as shown in Figure A2. (Because the development threshold is defined on a Purchasing Power Parity basis, it appears at different market exchange rate (MER) level for each country.)

Responsibility is represented by cumulative GHG emissions from some user-specified initial year, which directly reflects a nation’s contribution to climate change. Similar to the definition of capacity, responsibility is defined in a manner that excludes emissions corresponding to consumption below the specified lower income threshold.

Using these definitions, responsibility and capacity can be calculated for each country over time, and used to create a combined Responsibility and Capacity indicator (RCI). The simplest way to create an RCI is to weight responsibility and capacity equally (simply averaging them together), reflecting the perspective that the two should count equally toward determining a country’s fair share. Alternatively, the *Calculator* allows users to weight the two unequally, giving greater priority to either capacity or responsibility (including weighting either factor at 100% and excluding the other).

For several representative countries (or groups), Table A1 below shows the share of global capacity and responsibility in 2010, and averaging them, the RCI in 2010. The RCI in 2020 and 2030 is shown as well. As the countries’ economies and emissions are projected to grow at different rates over time, their share of global capacity and responsibility

correspondingly varies. For each country, this RCI can then be used to determine its fair share of the globally required mitigation effort, as illustrated in *Figure A1*, above.

	2010					2020	2030
	Population (% global)	GDP per capita (\$US PPP)	Responsibility (% global)	Capacity (% global)	RCI (% global)	RCI (% global)	RCI (% global)
EU 28	7%	\$27,644	24%	30%	27%	23%	21.4%
EU 15	6%	\$30,688	21%	28%	24%	21%	19.1%
EU +13	1.6%	\$16,411	2.9%	1.8%	2.4%	2.3%	2.3%
US	5%	\$41,773	37%	29%	33%	31%	29%
China	20%	\$6,713	2%	6%	4%	9%	13%
Japan	1.8%	\$30,729	5%	10%	8%	7%	6%
Russia	2.1%	\$13,998	7%	2%	5%	5%	5%
India	17%	\$3,171	0.10%	0.20%	0.15%	0.42%	0.87%
LDCs	11%	\$1,498	0.27%	0.09%	0.18%	0.21%	0.25%
Annex 1	19%	\$28,596	82%	79%	81%	74%	68%
Non-Annex 1	81%	\$5,445	18%	21%	19%	26%	32%
World	100%	\$9,777	100%	100%	100%	100%	100%

**Table A1: For a representative set of countries (and groupings), population, income, capacity and responsibility (for 2010), and combined Responsibility and Capacity Indicator – RCI (for 2010, 2020, and 2030). These results are based on “medium equity settings” as defined in this report, i.e., medium progressivity (a development threshold set at \$7,500 (Purchasing Power Parity dollars and no luxury threshold) and medium responsibility (a historical emissions start date of 1950). Responsibility and capacity are equally weighted, as they are in all the results given in this report.**

A nation’s fair share of the global mitigation effort may be quite different from its domestic mitigation potential. For wealthy and high emitting countries (i.e., those with higher capacity and responsibility, like the U.S.), the fair share generally greatly exceeds the country’s domestic mitigation potential (and perhaps even its domestic emissions, like Switzerland). This is especially true in countries where capacity is greater than responsibility, (i.e., wealthy countries where carbon intensity is relatively low). For poor and low emitting countries (i.e., those with lower capacity and responsibility, like India) – the domestic potential for curbing emissions may greatly exceed the country’s fair share of the global mitigation effort. This is the fundamental reason that fair shares must be seen not only in terms of domestic reductions obligations, but also in terms of required support for mitigation in other countries. Otherwise, the wealthier countries would be saddled with greater mitigation obligation than they can possibly discharge, and poorer countries would be left with great deal of unexploited mitigation options, an untenable situation rendering impossible the pursuit of any ambitious global mitigation pathway. Consequently, this report explicitly presents fair shares in terms of the sum of reductions achieved domestically and reductions achieved through the transfer of international support.