KHAZANAH RESEARCH INSTITUTE

VIEWS 25/23 | 18 DECEMBER 2023

Climate Equity: A Primer

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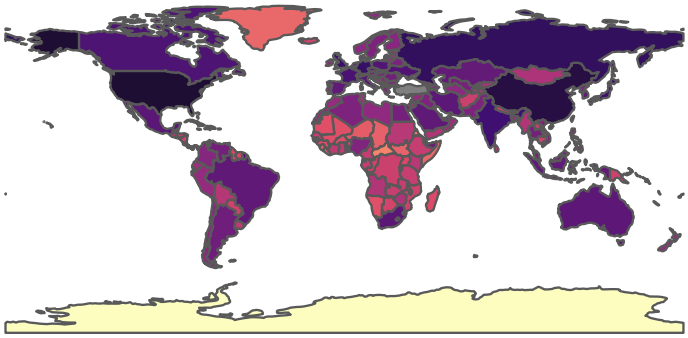

Source: Friedlingstein et al. (2023), Author's visualisation
Note: The choropleth map shows cumulative CO_2 emissions by country. Darker tones indicate higher emissions. Value is log-transformed.

Introduction

Climate change needs an equitable solution. Historically, human development across the world has been uneven. Until 2022, developing and emerging countries still house a large share of extremely poor individuals [1]. Improvement of socioeconomic well-being through development is needed in these countries. Climate change, which inflicts damage and disrupts livelihoods, raises the risk of entrenching global inequities, making development more challenging. However, policies ostensibly dedicated to addressing climate change can themselves engender new inequities that adversely impact some groups and benefit others.

Global climate-resilient development, therefore, entails a global collaborative effort that is fair towards subjects with different levels of responsibility and capability. National climate policies also need to consider equity, both in terms of the national contribution to a global effort and intra-national redistribution of costs and benefits.

[1] Chancel et al. (2022)

This view was prepared by Khoo Wei Yang, a researcher from the Khazanah Research Institute (KRI). The author is grateful for the valuable comments from Prof. Dr Jomo Kwame Sundaram, Yin Shao Loong, and Shazrul Ariff Suhaimi.

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Climate change as a distributive problem

Climate change is a problem with many dimensions. At the physical level, a polluted atmosphere leads to global warming, whereby excessive heat is stored in the climate system, amplifying climate extremes. Consequently, we are pushing hard on the upper limit of the planetary boundary conducive to life on Earth. At the societal level, humanity faces significant risks of unmanageable damage from cascading climate impacts. This is problematic when our socioeconomic system heavily relies on the use of fossil fuels, which is the main source of greenhouse gas (GHG) pollution.

The material exchanges and flows within the global economic system, powered mostly by fossil fuels, have driven both socioeconomic development and climate change. However, the global economic system that produces material wealth of such scale has done poorly in equitably distributing the benefits it has generated.

Human well-being, in terms of life expectancy, health, education, and poverty, has improved unevenly worldwide over the past two decades[2]. In many least-developed countries, basic living standards are far from being met, whereas developed countries enjoy material wealth that is not well deployed to uplift the welfare of those in need. For example, the agreed target of official development assistance (ODA) is 0.7% of gross national income (GNI), but the size of the delivered ODA stood at 0.36% of development assistance committee (DAC) countries' GNI in 2022[3]. In developing countries, climate change threatens impacts that thwart development progress, which is needed to alleviate sub-national inequities, while the urgent need to mitigate global warming constrains developing countries' options.

There is a need to anchor climate change policymaking on an equity principle. As enshrined in international treaties such as the United Nations Framework Convention for Climate Change and its corollary protocols and agreements, any global pursuit to solve climate change should be made on the principle of equity and "common but differentiated responsibilities and respective capabilities" (CBDR-RC). CBDR-RC endorses "asymmetrical commitments of different states to ensure universal participation and effective implementation."[4] This means that country parties are held to different levels of obligation in mitigating climate change according to their respective responsibilities in causing the problem and respective capabilities in solving the problem.

The CBDR-RC principle guides countries to divide appropriate burdens for addressing climate change among themselves. What is an equitable way of distributing the burdens of addressing climate change?

[2] United Nations Development Program (2019)
[3] OECD (n.d.); (2023)
[4] Dipa Patel (2020)

What do we mean by climate equity?

Many climate solutions proposed now are market-based, such as carbon pricing, emissions trading schemes, and voluntary carbon markets. According to the view of the market-based approach, carbon is an externality that is not correctly priced to represent its damage to society[5]. Market instruments allow carbon emissions to be valued to impute the cost of carbon pollution, and like commodities, their abatement cost can be traded in the market to achieve cost efficiency. This idea is based on the principle of Pareto efficiency, which states that the benefit (cost) of one's emission (abatement) should not come at the expense of the cost (benefit) of another[6].

This principle is problematic, for it does not consider history. The current benefit that developed countries enjoy came as the result of the deep damage inflicted by imperialism and industrialisation on the colonised countries. Past emissions also have effects on current climate impacts, as GHGs accumulated in the atmosphere raises global surface temperatures that intensify climate change.

As opposed to welfare theorems like Pareto efficiency, which require benefits to be allocated not at the detriment of others, an equity principle calls for redistribution of the benefits from places of glut to places of need, as well as redistribution of cost to the responsible and/or capable. Climate equity, or climate justice, requires the consideration of this past cost. The principle requires those who have benefited in the past to compensate for the cost they have incurred.

The current international governance of climate change is centred on the Paris Agreement, which builds upon the UNFCCC as a treaty for international collaboration on addressing climate change. The treaty does this by asking country parties to independently communicate and commit to Nationally Determined Contributions (NDC), outlined in Article 4. This mechanism allows a country to set an individual contribution according to national circumstances. The implementation of NDCs is reviewed every five years in a Global Stocktake, the first of which concluded in 2023.

The differentiation of contributions among countries is to observe the CBDR-RC principle. Besides, developed countries are also asked to lead by pursuing "economy-wide emission reduction" and transferring resources such as finance, technology, and capacity building to developing countries through provisions in Articles 6, 9, and 10.

The voluntary nature of the pledge-and-review of the NDC mechanism makes it difficult to impose a top-down redistribution among countries, much less an equity-informed one. Countries are tasked with implementing climate solutions to achieve voluntary targets. Developing countries face the double challenge of achieving development under mounting constraints while being pressured to take on mitigation burdens equal to that of developing countries. Unfortunately, developed countries are not aiming proportionate to their fair share.

[5] Stern (2007)
[6] Grasso (2007); Manne and Stephan (2005)

Carbon budget and the bathtub analogy

An equitable global climate effort involves the foundational problem of sharing the common atmospheric resource. To arrive there, we first need to understand the physical processes of global warming and how human interference has led to climate change.

The carbon cycle is one of many Earth processes that regulate the energy flows of the planet. The balance of carbon in the atmosphere, land, and ocean has sustained the energy throughput required for life to exist for millennia. This equilibrium is no longer stable as it has been disturbed by human activities through the burning of hydrocarbon fuels that release GHGs, the major one being carbon dioxide (CO_2), often referred to simply as carbon. Humanity is a significant disturbance to the climate system due to the exceptionally large amount of GHGs released and the amount of global warming we have caused in a short period. The spike in GHG emissions can be primarily attributed to industrialisation.

Excessive GHGs in the atmosphere trap solar radiation, a process called radiative forcing, which heats the ocean surface, leading to evaporation. 50% of the atmospheric heat energy is stored in water vapour in the atmosphere. Without sufficient cooling, water vapour does not condense into rain. Water vapour stays in the atmosphere and feedback into further warming[7].

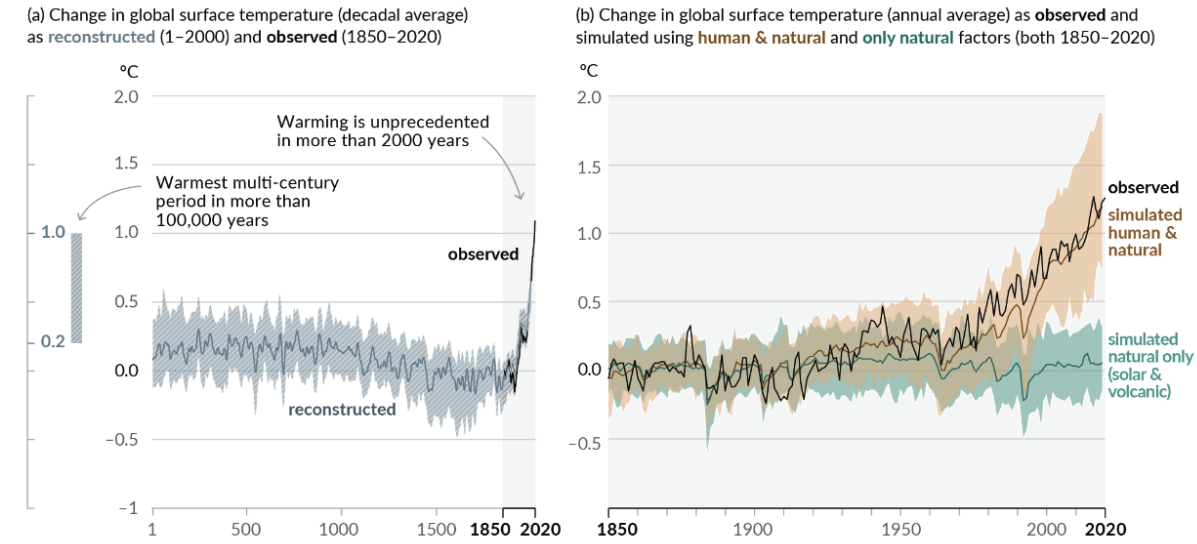
As human activities have historically emitted and continue to release GHGs into the atmosphere, the accumulation of carbon stock in the atmosphere has not been balanced by an adequate rate of long-term carbon sequestration, thereby storing energy (as heat) in the atmosphere. This, in turn, causes extreme climate responses, cascading further disruptions in natural and human systems[8]. As climate feedback can be induced by past emissions over varying timeframes[9], it is therefore important to take into account historical and cumulative GHG emissions.

[7] NASA (2011)

[8] Extreme climate responses include extreme weather behaviours but are not limited to weather. For example, warming of the earth's energy balance can lead to the melting of earth pole's permafrost required to cool down the ocean current heated up in the tropics. The disturbance or eventual shut down of this ocean circulation that regulates weather of world regions that made life possible can lead to mass casualty events.

[9] Yuan et al. (2022)

Figure 1: Changes in global surface temperature relative to 1850 – 1900



Source: IPCC (2021)

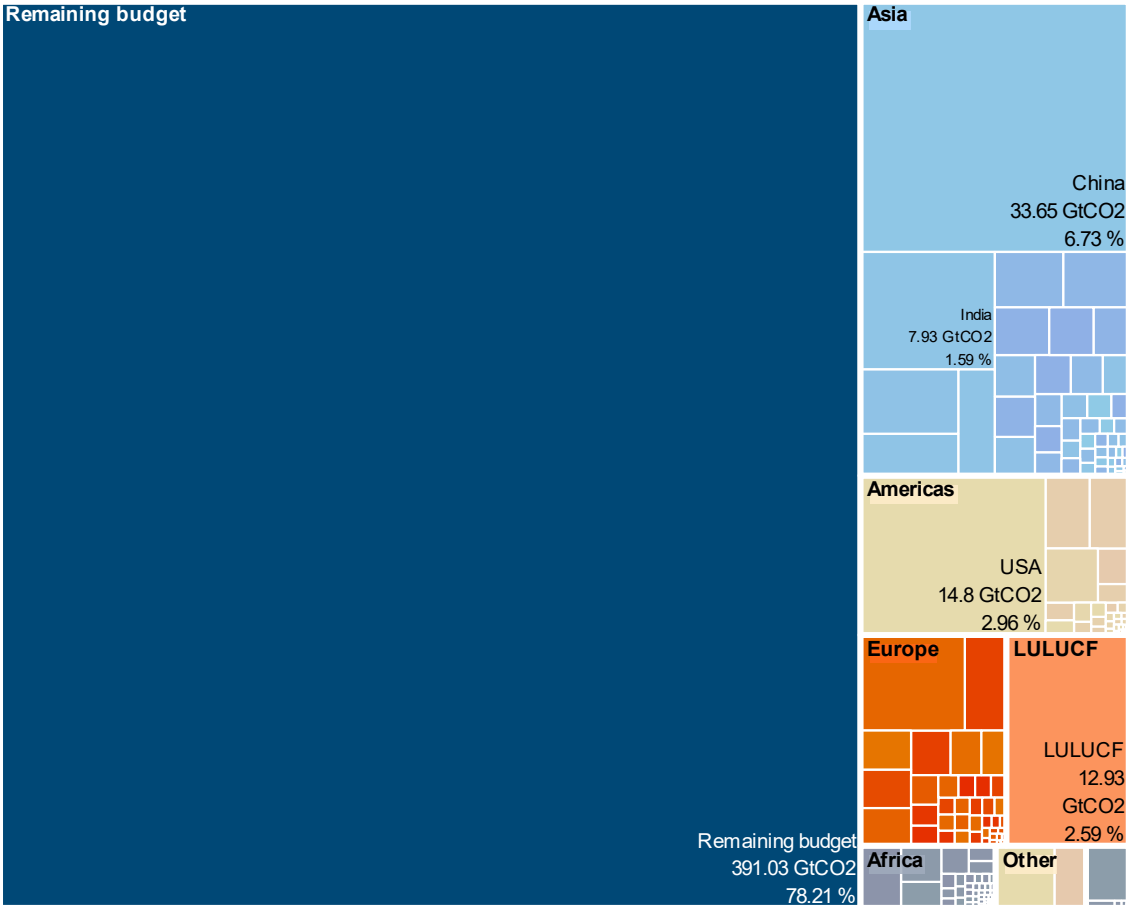
The atmosphere can be visualised as a bathtub, which can be thought of as a dumping ground for excessive GHGs. Human activities linked to economic growth and physical development are analogous to a faucet that fills up the tub with GHGs. The danger level at which the climate system threatens human existence becomes a "tipping point". We can imagine this tipping point as the point when the bathtub overflows, where further emissions will lead to a warming above further cascading effects beyond human control.

The limit on GHG emissions can be seen as a "carbon budget". As of 2020, the budget for a 50% chance of limiting global warming at an acceptable temperature of 1.5 degrees Celsius above pre-industrial levels is 500 gigatonnes of carbon dioxide equivalent ($GtCO_2e$)[10]. The budget varies if we set different targets, as are the likely consequences of exceeding the budget. Given our current global GHG emissions level, which is 40.2 $GtCO_2e$ as of 2021, if we maintain the same rate of emissions in 2021, this budget will likely be used up in less than ten years[11].

[10] Paris Agreement Article 2(a) sets the long-term climate mitigation goal, which asks countries to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and strive to "limit the temperature increase to 1.5°C above pre-industrial levels". There are contentions associated with the temperature threshold in climate negotiations and unavoidable impacts (see Navraj Singh Ghaleigh, 2020), nonetheless it is recommended by the Intergovernmental Panel on Climate Change (IPCC) for temperature to be kept within 1.5°C above pre-industrial levels to limit risks of climate extremes compared to 2°C (IPCC, 2018).

[11] Total anthropogenic GHG emissions were 40.2 $GtCO_2e$ in 2021. The total carbon budget to meet as calculated by Global Carbon Project is 380$GtCO_2e$ for all GHGs.

Figure 2: Country use of remaining carbon budget as of 2022 ($GtCO_2$)



Source: Friedlingstein (2023); Author's visualisation
Note: The treemap shows carbon dioxide emissions from fossil fuel sources by country. Emissions from LULUCF, international shipping, and international aviation are accounted for as separate sources from countries. Other GHGs are not included; however, the total carbon budget includes all GHGs. The remaining budget may be smaller if all GHGs are included.

This crude analogy may omit more complex realities of the Earth's feedback system, which makes gauging the effects of exceeding this limit much more uncertain. If we focus solely on the objective of limiting all global GHG emissions below 500 $GtCO_2e$, fairly sharing the available carbon budget, and at the same time pursuing sustainable development with lowered GHG emissions, we may stand a chance of avoiding catastrophe[12].

[12] Kemp et al. (2022)

Fairly sharing the burden of solving global warming

As most of humanity is affected by climate change, solving the climate problem requires a collective effort. However, it would be grossly unfair to assume everyone is equally responsible, let alone equally capable.

It would be unfair to ask everyone to contribute the same amount, as some have used up more atmospheric resources in the past than others. Those struggling to make ends meet can barely allocate resources to emissions reduction and may need more of the carbon budget to achieve a more dignified life. Not to mention those who are affected by the ramifications of devastating climate impacts.

Differences in responsibility and capability worldwide are so stark that only 31 countries are responsible for half of the world's cumulative emissions[13]. Developed countries like the United States (USA) account for a quarter of cumulative GHG emissions in the world[14]. Russia, China, and India have only recently risen to top emitters, although their per capita emissions remain low[15]. If we measure capabilities by national affluence, using gross domestic product (GDP) per capita as a proxy, only ten countries have five times more capabilities than the world average[16].

This tells us two important things: first, in sharing the effort of solving the climate problem, **an equitable burden-sharing regime is needed to allocate the burden of mitigating climate change fairly**. Second, most developing countries are still in dire need of reaching levels of social well-being that are impossible without also improving material conditions, which warrant some levels of GHG emissions.

For fairness in a system that allocates burdens and benefits, one commonly refers to rules such as "polluters pay" and needs-based allocation. These rules recognise the equity obligations of those who have caused the problem and benefited most from doing so, even if unwittingly. Furthermore, with more capacity to clean up the mess, they need to assume responsibility[17].

A fair burden-sharing regime should function like a progressive tax system, where those with more responsibility for causing the problem and higher capabilities should contribute much more. It is no coincidence that high-responsibility and high-capability countries overlap most of the time, because GHG emissions of the past are correlated with the lopsided growth of the world economy and the grossly unequal development of their economic and financial capabilities[18].

[13] These countries are EU-27, UK, USA, Russia, and China.
[14] Friedlingstein et al. (2022)
[15] Per capita emissions represent the total GHG emissions of a country, divided by total population of that country. As GHG emissions necessarily produce an amount of benefit to the society, which is presumably shared among the citizens within the territorial boundary, per capita emissions represent the individual responsibility for GHG emission.
[16] IMF (2023)
[17] Ringius, Torvanger, and Underdal (2002)
[18] Dhakal et al. (2022); Lecocq et al. (2022)

These capabilities allow developed countries to experience accelerated technical change that makes their current economic decoupling from emissions possible[19].

Measuring fair shares of mitigation obligation

International climate treaties do not define the metrics of differentiated responsibility and capability. This has spawned many attempts to bring burden-sharing by CBDR-RC into practice.

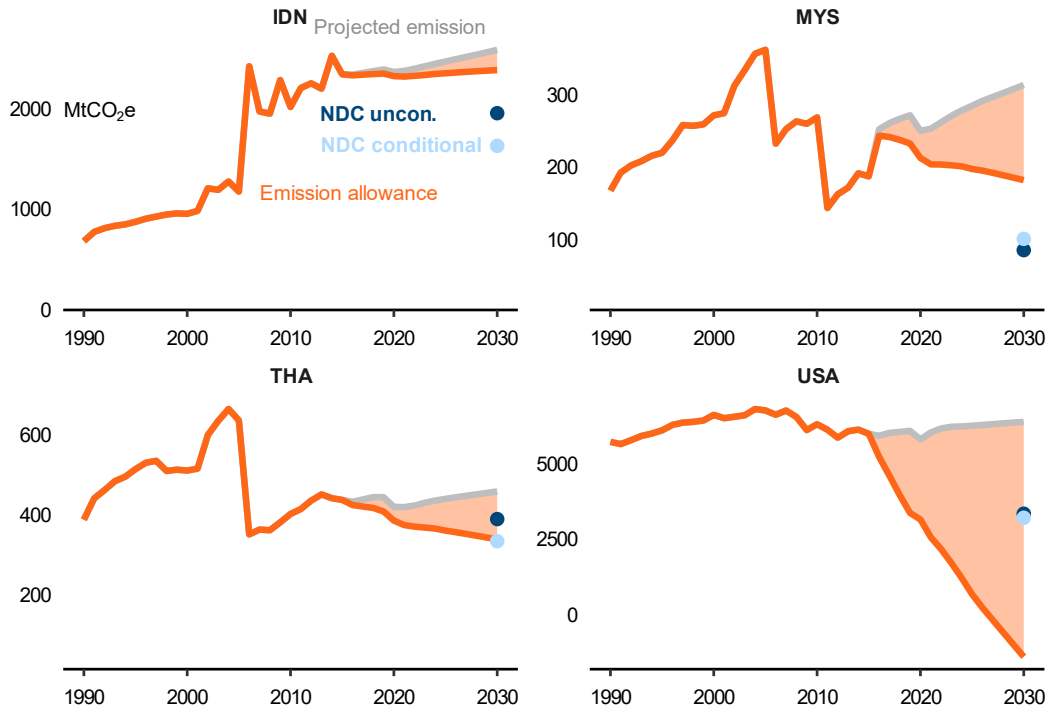
Burden-sharing approaches differ in the principle of allocation. For example, some approaches that utilise the climate debt concept allocate emissions allowance according to per capita historical emissions. This approach allocates the least-responsible and most vulnerable countries with the most atmospheric resources or the right to emit. Most burden-sharing frameworks follow the "polluters pay" principle regardless of methods. The common measure of historical responsibility is cumulative GHG emissions, and the common measure of capability is the economic size of a country or average national income (GDP per capita).

Conceptualising differentiated burden-sharing and putting it into practice is equally challenging[20]. The Paris Agreement provisioned that developed countries should "take the lead by undertaking economy-wide absolute emission reduction targets". Developing countries are "encouraged to move over time towards economy-wide emission reduction"[21]. In this, developing countries are given the space to pursue developmental priorities before climate goals, while developed countries ought to lead by either enacting deeper emission reduction or achieving targets earlier. How much should they outdistance the developing countries, and how ought the criteria of the differentiation be determined? How much each country should contribute to addressing climate change to be considered a fair contribution?

The Climate Equity Reference Project (CERP) developed a burden-sharing framework that takes into account both responsibility and capability in quantifying the countries' fair shares to meet the required 1.5°C pathway[22]. The approach allocates the burden as a share of the required global emission reduction to each country based on the country's cumulative emissions and the obligated share of per capita national income.

[19] Economic decoupling hitherto was attributed to structural changes of developed economies to service sector, which moved emission-intensive production activities out of territorial boundaries through trade. Trade-adjusted or consumption-adjusted emission can account for this.
[20] This is carried out by the Working Programme
[21] UNFCCC (2015), Article 4(4)
[22] Holz et al. (2019), more details on the method can be found at https://climateequityreference.org/

Figure 3: Emission and NDC targets until 2030, incl. LULUCF ($MtCO_2e$)



Source: Holz et al. (2019); Author's calculation and visualisation

Using the online calculator, a quick comparison of the fair shares of the USA, Indonesia, Thailand, and Malaysia shows that a rich country such as the USA should reduce emissions much more than developing countries because of its high historical cumulative emissions and high capability. Comparing the country's pledged emission reduction targets in its Nationally Determined Contribution (NDC) with the fair amount of emission reduction, the country's NDC target fell below its fair share. As opposed to the net-zero by 2050 ambition that the USA has set in its long-term strategy, the country ought to reach net-negative emissions before 2030. Observers have noted the political difficulties of driving this reduction domestically[23]. Besides, the mere scale of its responsibility points to the need for the USA to facilitate mitigation outside of its territorial boundaries and support climate action in developing countries.

Article 6 of the PA provides for a mechanism of cross-border transfer of emission reduction among cooperative country parties. However, these offset projects are fraught with ethical and practical problems[24], which entrench inequitable outcomes for vulnerable groups such as indigenous communities. On the other hand, Articles 9 and 10 of the PA also provide for the transfer of finance and technology from developed to developing countries; this is one means of facilitating climate actions outside of national boundaries, as emissions are growing in many

[23] Basseches et al. (2022)
[24] Lakhani (2023)

developing countries that also lack the capacity to transition to a low-emissions economy. The transfer of these resources, however, has been sorely underdelivered[25].

For a middle-income developing country like Malaysia, the obligation to reduce emissions is certainly lower but not zero. If we compare our pledged emission reduction targets to the fair share of emission reduction we ought to achieve; our commitment is found to be more than our fair share. If we do not include removals from our forest sinks, we remain 1MtCO_2e below our fair share. However, Malaysia is also a country with developing needs. The heavy dependence of our development history on fossil fuels already makes it challenging for us to pursue emission reduction as an environmental imperative, whilst the country also needs to balance other equally important sustainable development goals, such as economic growth and decent work, energy security, as well as income equality.

Conclusion

At the current juncture, not only does the impact of unabated emissions rein in the development pathways for developing countries, but the deep inequalities and interdependence of our global economic system make it hard for them to develop sustainably alongside building climate resilience. Vulnerable individuals in developing countries can be further marginalised by national climate policies that are inequitably designed. Climate solutions designed in the name of market efficiency cannot deliver the fairness that the global climate effort needs, nor does it take into account the needs of the vulnerable in developing countries. Governments of developing countries should follow the equity principle in adopting and implementing climate solutions and avoid policies that can harm overall sustainable development goals.

[25] UNFCCC and Transitional Committee (2023). Finance flows to developing countries are 5-10 times below needs the estimated annual needs of USD 160-340 billion by 2030 and USD 315-565 billion by 2050.

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