SEVEN PILLARS INSTITUTE SPECIAL REPORT

AN ETHICS ASSESSMENT OF

THE IEA'S *NET ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR*

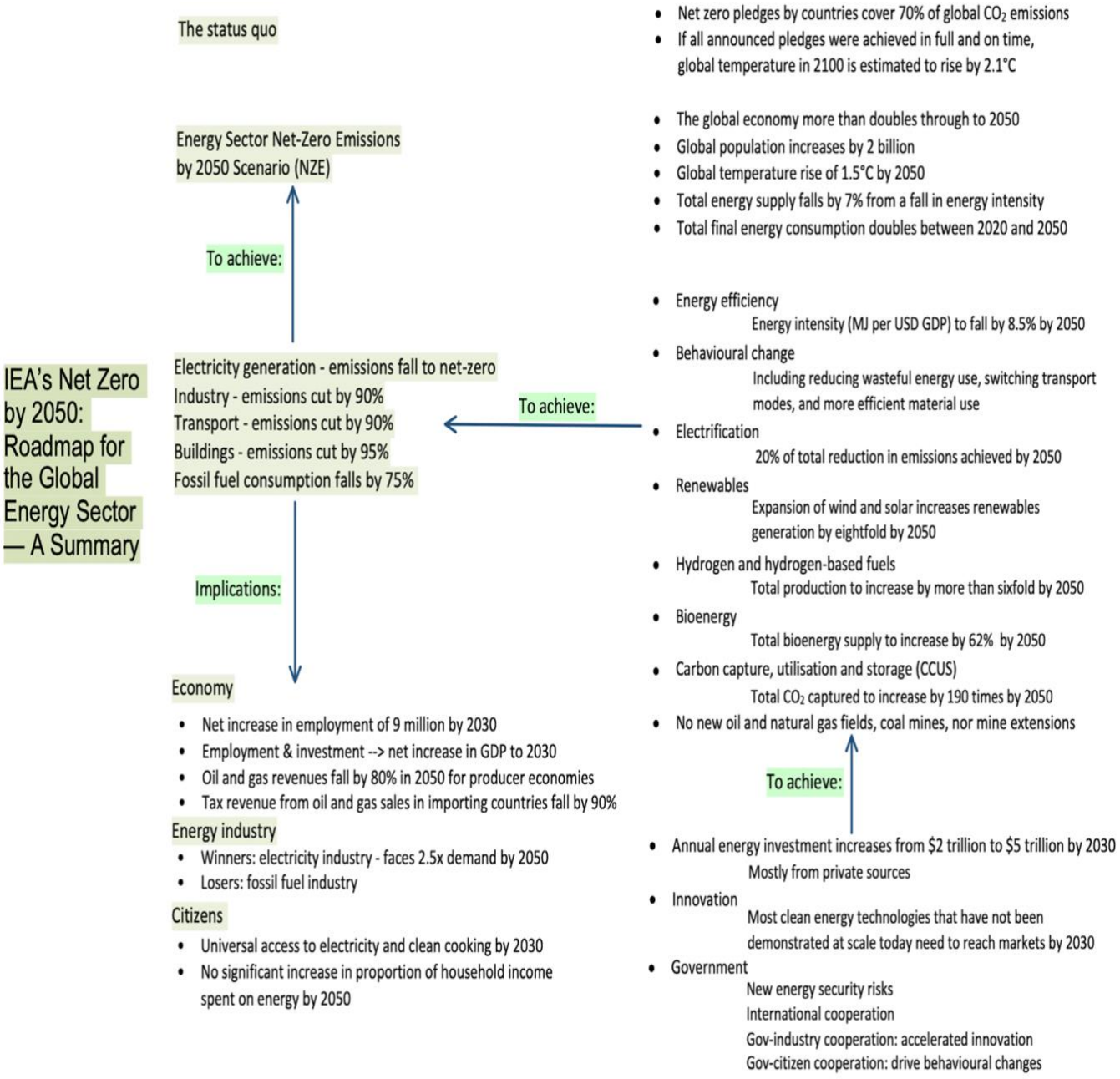

Figure 1: The IEA's Net Zero by 2050 Roadmap

Executive Summary

1. The International Energy Agency (IEA) published its flagship report Net Zero by 2050: A Roadmap for the Global Energy Sector – in May 2021 (Roadmap), ahead of COP26 in November, 2021. Now, as the global community approaches COP27 this November, we assess the ethics of the IEA's report, in the hope of contributing to the worldwide effort to achieve a 'just transition' to Net Zero, by bridging the conversations held by civil-society actors and academia with that of state actors. We find the report is lacking in terms of distributive and corrective justice, but point out the solution may lie in procedural justice, namely allowing democratic participation in the decision-making processes throughout the transition.

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2. This report acknowledges the significant welfare gains the transition as outlined by the IEA promises to achieve, for example, its ambition to meet some of the Sustainable Development Goals (SDGs) by providing universal access to energy and clean cooking solutions, as well as reducing air pollution. The IEA's roadmap also imagines a boost to the economy due to the transition's demand for additional investment and employment. Such welfare improvements make the IEA's roadmap ethically desirable from a consequentialist perspective.

3. However, this report further highlights the ethical shortcomings of the IEA's report, focusing on the impact of its suggestions on distributive justice and corrective justice. We introduce three major principles of justice from the literature:

    a) Strict egalitarianism – the view that benefits and costs must be distributed equally
    b) Luck egalitarianism – that benefits and costs must not be distributed differentially based on factors outside of one's own control
    c) Desert-based principles, which claim that one's input determines how much one gets in return.

4. The IEA has paid more attention to distributive justice within countries, in particular across different sectors of employment, as well as different income groups. Yet, assessed against all three principles, the redistributive measures recommended by the IEA fall short of delivering distributive justice. Furthermore, this report raises aspects of distributive justice overlooked by the IEA, namely races and ethnicities, and genders. Some recommendations by the IEA may in fact exacerbate pre-existing gender and racial inequalities, calling for greater attention to these issues.

5. Also omitted by the IEA is the issue of corrective justice, which, in the context of climate change, is largely understood to concern the global North's moral duty to remedy the sufferings its colonial and industrial past has caused the global South. Such omission does not make the IEA 'impartial', but makes it complicit in allowing neo-colonialist behaviours to perpetuate during the transition. Here, neo-colonialism takes the form of 'climate colonialism' and 'green extractivism', where due to the global South's rich renewable resources and its lack of political power, it may be exploited to supply the North with emission allowance. As well as avoiding such neo-colonialist tendencies, the IEA needs to ask developed countries to contribute far more to alleviate the consequences and attaining

Net Zero than their developing counterparts, as the former have contributed far more to cumulative emissions to date compared to the global South.

6. As a first step to attaining distributive and corrective justice through the transition, we propose the IEA and other decision-making bodies aim for procedural justice. Procedural justice is desirable per se because by involving all stakeholders in the conversation, respect is shown to their equal moral status –both at the individual and the national levels. By ensuring the participation of all stakeholders, procedural justice is also desirable as it allows instances of injustice to be raised, discussed, and addressed. Although ideal, implementing democratic participation is a difficult task that always requires conscious efforts.

Introduction

At the 2015 United Nations Climate Change Conference (COP21), 196 countries signed the Paris Agreement, a legally binding treaty aimed at limiting global warming to preferably 1.5°C compared to pre-industrial levels ((United Nations Climate Change). To this end, global greenhouse gas emissions must achieve net zero by 2050. However, current progress has been lagging. At the current rate of reduction, global warming would be 2.7°C by 2100 (IEA, p.29).

…the report does not directly concern itself with the ethical aspects of the transition to net zero. Nonetheless, an ethics assessment of the report is justified.

To facilitate the transition, the International Energy Agency (IEA) published its flagship report – Net Zero by 2050: A Roadmap for the Global Energy Sector – in May 2021, ahead of COP26 in November. The report focuses on the necessary steps to be taken for *the global energy sector* to achieve net zero (p.3). It aims for technical feasibility, cost-effectiveness, and social acceptance alongside net zero, and through backward induction produces suggestions on what needs to be done to achieve these aims (ibid). A summary of the suggestions can be found in Figure 1.

With its self-proclaimed aims, the report does not directly concern itself with the ethical aspects of the transition to net zero. Nonetheless, an ethics assessment of the report is justified. This is because, firstly, irrespective of the party implementing the report's suggestions, they would affect people's lives, therefore have ethical implications. Secondly, most actions reflect some underlying ethical principles even if the actor does not intentionally engage with one – this is particularly true when it comes to distributive matters – matters regarding who gets the benefits and who bears the costs, which are important aspects of climate policies. Lastly, the report itself uses the phrase "just transition" to describe its recommended pathway, rendering ethics a relevant issue (p.50). It is worth noting that despite employing the notion of 'justice', the IEA, like many other public organisations, does not state what 'justice' entails. We will discuss different concepts of justice later. During the evaluation, though, we should keep in mind that the IEA plays the role of an advisor here – thus, we cannot hold it responsible for countries' lack of commitment nor their potential failure to follow the roadmap.

Therefore, this report examines the suggestions made in the IEA's roadmap from a consequentialist perspective, with a view to its implications on welfare, distributive justice, and corrective justice. The recommendations promise to deliver an overall welfare gain and display some awareness for issues of distributive justice. However, they also lead to some sections of the society to bear a disproportionately high cost of the transition, especially the developing countries. Despite the roadmap's technical nature, it could benefit from greater procedural justice and considerations of distributive principles. This report also argues that the roadmap has largely

omitted corrective justice, meaning that the pathway overlooks historical injustices in global emissions.

Overall Welfare Improvements

With cost-effectiveness as one of the goals the Roadmap seeks to maximize, if delivered the Roadmap produces an overall positive impact on people's welfare globally. This is achieved mainly through widened access to electricity and improved health, particularly in developing economies, as well as a boost to global economic growth and employment. An overall welfare improvement justifies the recommendations from a utilitarian perspective, which is the view that an action that maximizes total welfare is morally good[1]. Of course, achieving net zero and curbing climate change lead to extraordinary welfare improvements, too, although the Roadmap does not mention these.

The IEA prides itself on meeting the UN's energy-related Sustainable Development Goals (SDG) in its Net Zero Emissions by 2050 Scenario (NZE) (p.167). The Roadmap seeks to achieve SDG 7.1, which seeks to "**ensure universal access to affordable, reliable and modern energy services**" by 2030 (UN SDGs). It advocates governments and private sector to expand access to electricity by increasing electricity generated from renewables and connecting more people to the grid system (p.167). This entails providing access to 679 million people who would otherwise not have electricity by 2030 (UN SDGs). Populations in sub-Saharan Africa and developing Asia benefit from the extended access (p.167). The Roadmap also seeks to provide clean cooking options to the 2.6 billion people who lacked these in 2020 – mostly located in sub-Saharan Africa, India and rural China – by replacing the use of traditional biomass (p.168). This substitution would significantly improve people's living standards and productivity, thereby having an indirect positive impact on the economy, too.

The Roadmap also meets SDG 3.9, to "**substantially reduce the number of deaths and illnesses from hazardous chemical and air, water and soil pollution and contamination**" by 2030 (UN SDGs). In prioritizing renewables, phasing out coal, and replacing traditional biomass in cooking, the Roadmap hopes to reduce main air pollutants – sulphur dioxide, nitrogen oxides and fine particulate matter – by around 85% (IEA, p.169). This reduces the annual number of premature deaths caused by air pollution by 2 million, nearly half of the 2020 level (ibid). Again, emerging market and developing economies are to benefit from the increased productivity and reduced strain on healthcare systems.

Apart from indirectly boosting the global economy with gains in labour productivity with the above welfare improvements, the IEA's suggestions also directly add to global economic growth as they involve remarkable investment injections from the energy sector, and the infrastructure projects required by the transition create many employment opportunities. The Roadmap requires an extra $3 trillion global annual energy investment by 2030, which trails off to $2.5 trillion by 2050 as capital investments get completed, more than doubling the current energy investment (p.81). With the investment and spending on energy, the IEA estimates a net increase of 25 million jobs in the energy sector, considering the job losses caused by the shift away from fossil fuels (p.17). Combined, this leads to a 0.5% increase in global annual GDP growth compared to the growth rate forecasted to result from the policies currently stated (p.156), positioning global GDP in 2030 at 4% higher than current trend (p.22). In choosing a path that does not involve a trade-off between economic growth and environmental protection, the IEA has made net zero much more acceptable to the public.

[1] Assuming that the IEA's claim that the pathway is "cost-effective" is true, which is too technical to be investigated within this report.

Issues of Distributive Justice

An overall welfare improvement is not the end of the story. As individuals make up global society, how benefits as well as costs are distributed to individuals of different characteristics – such as nationalities, genders, and income groups – constitutes a problem of distributive justice. Whether a distribution is just depends as much on the principle of justice adopted as it does on the distributive outcome. We explore the distributive outcomes in the NZE, acknowledging that the issues raised below do not form an exhaustive list. It should be noted the world today is not distributively just no matter the principle adopted, and it can be rightly said the world would likely never be completely just. Therefore, the aim of this section is not to judge whether an end state is distributively just – as it wouldn't be – but to evaluate if the net zero transition represents a dynamic move closer to or further away from the ideal world of distributive justice.

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Principles of Distributive Justice

A principle of distributive justice offers moral guidance on how benefits and costs should be distributed between different parties (Lamont and Favor). We provide a brief overview of some principles of distributive justice below. Although all principles face criticism, they all have substantial intuitive appeal, too.

Strict Egalitarianism – Like the name, strict egalitarians advocate strict equality, meaning for them, a just distribution is one where everyone in the society gets the same level of benefits and burdens (ibid). Depending on what are viewed as benefits and burdens that require distribution and how 'levels' of benefits and burdens are measured, the pursuit for strict equality could yield different outcomes.

Strict egalitarianism is most often understood as advocating an equal distribution of income. In the context of a "just transition", this could mean sharing the additional GDP created by the transition and its economic cost evenly between everyone. Another interpretation, as suggested by Peter Singer, is that justice entails equal per capita carbon emission (Wheeler Centre). Adopting the measure developed by the Advisory Council on Climate Change for the German government, where per capita carbon emission is depicted as an emission allowance, defined as the amount of carbon each person may emit without causing the risk of serious anthropogenic climate change, Singer cites that those in developed countries have used up a far greater proportion of their allowed per capita emission compared to their counterparts in developing countries (ibid). This means from a purely distributive perspective, the former should emit far less and contribute far more to carbon offsetting than the latter in the "just transition" to stick to their allowance (ibid).

The justification for strict egalitarianism is the moral equality of each human being, which all should agree with (Lamont and Favor). However, whether moral equality translates into material equality – and material equality in which specific form – is hotly debated. Concerns include firstly, strict material equality often sacrifices welfare, as voluntary trade – which diverges from equality – allows all parties involved to be better off; secondly, the idea that material equality inevitably results in the gains of hardworking people getting taken away from them and provided to those who 'laze about' sits uncomfortably with many, and leads to desert-based principles; finally, there is the libertarian concern that any forced redistribution constitutes a violation of individuals' property rights (ibid).

Luck egalitarianism – Luck egalitarians believe justice entails an equality of opportunity, which means that everyone should be given the same economic opportunities, including, for example, the same probability of college attendance, to be admitted to a certain role, and so on, regardless of individual characteristics which an individual has no control over - such as one's gender, birth, and race (ibid). Some luck egalitarians take a negative approach of non-discrimination which aims at a formal equality of opportunity (ibid). For example, if a company's hiring process is gender-blind so that all candidates face the same probability of getting the role regardless of their gender, then it would be considered just on this view. However, others – including John Rawls, who set the foundations for the study of distributive justice – hold that equality of opportunity needs to be substantive and requires active redistribution, as there are many other factors out of the individual's control but have significant impact on their economic prospects (ibid). Continuing with the hiring example, even if the hiring process is gender-blind, the company may still hire significantly more men than women due to factors such as unequal distribution of educational resources, which calls for an active redress. The latter view is the one usually adopted today.

Applied to the transition to net zero, such luck egalitarianism could mean using the transition as an opportunity to compensate those who have been previously disadvantaged due to bad luck – for example, to compensate those in the global South who are on average worse off than those in the global North by dint of where they were born. It also indicates the impact of the transition on individuals should be neutralised as to not to give anyone undue benefits or costs.

The central assumption behind luck egalitarianism is luck is morally irrelevant (ibid). However, the principle suffers from the difficulty to determine what is the result of luck, and what is the result of one's own choices (ibid). This makes luck egalitarians prone to a 'slippery slope', as some may argue the ability to make rational choices to self-benefit is not within one's own control and thus a result of luck, calling for radical redistribution similar to that under strict egalitarianism.

Desert-based principles – Those who uphold a desert-based principle believe benefits should be distributed according to how much each individual inputs towards improving the standard of living, a socially desired product (ibid). There are several theories regarding what counts as an 'input', including effective contribution – for example the amount of GDP produced by someone, effort – for example the number of hours one puts in, and costs incurred during one's production of the socially desired product, such as how much capital investment one puts in (ibid). To be 'eligible' for redistribution under a desert-based principle, one is required to 'actively' bring about a more socially desired outcome. Therefore desert-based principles are similar to luck egalitarianism in the sense things outside of one's control are meant to be irrelevant (ibid). However, some desert-based principles are sensitive to luck, for example, scientific discoveries such as that of penicillin were largely due to luck, but nonetheless substantively contributed to our living standards. Nonetheless, the general idea of such principles is justice entails a pattern of distribution where the more one inputs, the more one gets.

The transition to net zero is a socially desired product, therefore, applying desert-based principles means individuals who have inputted more towards net zero should gain more benefits compared to others. The positive externality of net zero as a public good implies a radical redistribution of income or wealth would be necessary to attain distributive justice, as without any redistribution the free riders – those who input the least – would get the most.

Aspects of Distributive Justice in the IEA's Roadmap

Employment Sectors:

Despite an overall increase in employment opportunities across sectors, some sectors boom – such as clean energy where employment increases by 14 million by 2030, whereas others – such as oil, gas and coal fuel supply and power plants – see sharp declines of around 5 million jobs (IEA, p.158). An additional 16 million clean-energy-related jobs are also created, in areas such as the manufacturing of more efficient appliances, electric and fuel cell vehicles, as well as in retrofitting buildings and energy-efficient construction (p.17). At the same time, losses are to be seen in the production of goods and services to be replaced – e.g., of internal combustion engines which will be replaced by batteries (p.159).

Some of the jobs to be phased out have equipped workers with transferable skills, for example, some skills obtained from the oil and gas industry can be applied to offshore wind, carbon capture utilisation and storage (CCUS) and low-carbon gas production (p.151). Some of the jobs created by the transition will also absorb regional unemployment caused by it, for example, many fossil fuel hubs can be converted into wind and solar hubs – two of the major sources of energy in the NZE (George et al.). Nonetheless, not everyone can benefit from such flexibilities. Communities that have previously depended on fossil energy production are to suffer acutely from the structural unemployment (p.158). The impact of unemployment would also hit low-income households the hardest, as they tend to have less training which reduces occupational mobility and often restrained in geographical mobility due to lack of funds or caring responsibilities.

The uneven distribution of employment gains and losses has been a central issue in the discourse regarding net-zero transition. The phrase "just transition" which the IEA uses in its Roadmap was originally adopted in this context, used to highlight the need to take care of unemployment caused by the shift away from fossil fuels (McCauley and Heffron). It is also at the crux of environmental justice (ibid).

If unaddressed, the transition's effects on employment may lead to greater distributive injustice. Under strict egalitarianism, the resultant greater income gap between those who have gained a job due to the transition and those who have lost one is clearly a move away from strict equality of income, therefore calling for redistribution between these two groups. Under luck egalitarianism, the difficulty to distinguish factors of luck and those within one's own control makes it harder to determine the course of action. One may argue that the sectors of employment as well as people's skillsets are determined by a mixture of luck and one's own choice. For example, many coal miners in the US are coal miners "by birth" – they were born into that area, and into a family of generations of coal miners (Vice). At the same time, even they could have chosen differently with a high school degree – the minimum education requirement for US coal miners (Coal Miners: Requirements).

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As the sector of employment people end up in is a mixture of luck and personal choice in different proportions for different individuals, it is difficult to tell whether the structural unemployment caused by the transition has disadvantaged one group's earning opportunities compared to another based on luck. With that said, there are people hit particularly hard by unemployment due to factors of luck, for example those born into low-income households and have not been able to escape the poverty trap. The underlying distributive injustice in our society is reflected in the effects of the transition.

Governments should offer re-training programmes and economic support to these particularly disadvantaged due to factors of luck, as well as those whose employment is largely determined by factors of luck, in order to move closer to the luck egalitarian ideal. Interestingly, under desert-based principles with net zero as the socially desirable product, only when input is measured by cost could redistribution maybe be justified. When input is measured by contribution and effort, it may be rightly argued that those who work in fossil fuel industries or unemployed do not actually contribute any effort towards the transition to net zero, nor make any actual contribution, compared to those who work in renewable energy. Only when cost borne by the individual is seen as the measure of input, can it be argued that those who become unemployed have paid for the transition, and therefore should reap the economic benefits of the transition, in this case the employment opportunities it creates.

The IEA has implicitly chosen an egalitarian approach, with structural unemployment as an injustice. It states that "it will be vital to minimise hardships associated with these disruptions" (p.18). It proposes that governments respond to this injustice by "retraining workers, locating new clean energy facilities in heavily affected areas wherever possible, and providing regional aid" (ibid). All suggestions are in line with our previous analysis. The IEA also suggests governments "adopt more detailed surveying approaches for energy industry employment" as a first step to understand better the impact of the transition on employment (p.158).

Income Groups:

The transition to net zero also impacts different income groups differently. Here we focus on income disparities within countries.

Some benefits of the transition target low-income households. The initiative to provide universal access to electricity and clean cooking is one such example. The positive externalities of this initiative, namely, improvement in air quality and consequently health, are also felt more by low-income households, who tend to suffer more from indoor pollution due to low quality housing and heating fuels (Gould et al.).

Switching away from fossil fuels also benefits on-site workers who tend to be from low-income backgrounds as data show that electricity production from clean electricity production (hydropower, wind, nuclear and solar) causes far fewer death per terawatt-hour than high-emitting sources such as coal, oil, and gas ('Death Rates per Unit of Electricity Production'). Health and safety in the workplace in the energy industry, which are crucial for one's wellbeing but also more concerning for low-pay roles, are on average improved in the NZE.

The IEA forecasts in the NZE, average annual household energy bill as a percentage of income falls in developed economies (p.171). Assuming the population composition by income remains similar, this could improve people's living conditions by freeing up their spending capacities on items other than energy, a benefit with more significant impact for low-income households than high-income households.

Some policies within the transition help narrow the income gap, too. For example, the Roadmap proposes to eliminate consumption subsidies for fossil fuels which amounted to $180 billion globally in 2020 ('IEA: Energy Subsidies'). The IEA points out that these subsidies benefit wealthier parts of populations disproportionately (IEA, p.170).

However, there are also many aspects of the transition which may exacerbate income inequality without careful policy interventions.

Energy cost is one such issue. Although in developed countries average household energy expenditure as a share of disposable income falls, it increases moderately in developing countries due to increased demand for modern energy services (p.17). As how a fall in income share spent on energy impacts low-income households disproportionately, so does an increase. This may slow the adoption of modern energy services as well as the transition to net zero if left unattended.

In the IEA's pathway to the NZE, carbon pricing is required (p.14). Carbon pricing is designed to increase the cost of carbon consumption, thereby incentivizes consumers to switch to low-carbon products. However, studies have found that although high-income households consume three times more carbon than low-income households, the latter spend a much higher share of their income on high carbon goods (Great Britain and Treasury, p.6). Consistent with this, a working paper associated with the LSE's Grantham Research Institute on Climate Change and the Environment also finds that carbon pricing is regressive, namely, incurs a greater cost on low-income individuals, both within countries and across countries (Sager). This is a potential source of injustice as it not only means greater inequality in disposable income and living conditions, but it also implies that low-income households who have on average polluted less are effectively subsidizing the heavy polluters – high-income households. The increased energy costs prove especially problematic at the current moment, against the backdrop of a cost-of-living crisis induced by COVID, imprudent monetary policies, and the Ukrainian war.

Similarly, the sort of behavioural responses which the IEA deems key for the transition also incurs a disproportionately high cost on low-income households (IEA, p.84). For example, the report suggests governments impose low-emissions zones in cities to facilitate the switch to electric vehicles (EVs) (p.88). However, it is low-income households who do not have the funds available for a new car that tend to be driving obsolete and polluting vehicles. Low-emissions zones which charge drivers of polluting vehicles are therefore likely to incur greater financial strains on these households, further reducing their ability to afford a new vehicle.

Whether the transition exacerbates or mitigates income inequality in a society depends on its net effect, which cannot be quantified within this report. If, overall, income inequality has been exacerbated, then the transition has of course contributed towards greater distributive injustice in terms of both strict and luck egalitarianism, as unequal access to opportunities – such as unequal education resources – contributes greatly to income inequality. Even if overall income inequality has not been exacerbated by the transition, though, income redistribution is still needed for distributive justice, as the transition inevitably makes some poorer in terms of purchasing power based on factors out of their control – for example, carbon pricing disadvantages low-income households whilst as previously discussed, household income is no small part affected by factors of luck. Under desert-based principles, redistribution may be necessary for greater justice, too, as low-income households have emitted less than high-income households, contributing more to net zero, and therefore should gain more benefits from the transition based on the 'the more one inputs, the more one gets' principle.

It may be argued income does not cover all aspects of the transition. For example, having access to clean cooking and the resulting health benefits do not straightforwardly get reflected in household income. In this case, one may wish to use welfare as the standard for strict and luck egalitarianism. However, without considering cases such as individuals with severe health conditions, welfare positively correlates with income, so the kind of intervention needed should be similar.

The IEA does recognize that some aspects of the transition would impact low-income groups particularly negatively. It urges the use of "policy tools that can direct support to the poorest", including "tax credits, loans and targeted subsidies" (p.17). By targeting low-income households,

these measures help achieve greater justice on all three perspectives introduced here. To this end, the IEA should also advocate the redistribution of income from measures such as carbon pricing, as studies have shown that such revenue recycling can alter the incidence of the energy tax by making it less regressive, especially when the revenue is used for lump-sum per capita rebates (Fullerton; Rausch et al.). Climate investment – a crucial part of the transition – may also serve as a useful tool to address the pre-existing income inequality. For example, the US has pledged to spend 40% of its climate investments to benefit disadvantaged communities in particular (The White House).

The IEA also suggests governments adopt a "people-centred and inclusive" approach in the transition, which represents at least a partial attempt to deal with the complexity of individual circumstances, namely the fact that one's circumstances are a mixture of luck and personal choice, by considering them closely (p.17). To achieve an inclusive transition, governments should seek more participation from citizens instead of adopting a completely top-down approach. Participation could be fostered by involving community groups in the decision-making process, conducting citizen opinion polls and studies, and ensuring transparent and open communication (Bhatnagar et al.). Such participation requires an active effort from governments to get people of all characteristics involved, as otherwise the voice of the disadvantaged groups will likely be drowned out by more privileged groups who have more resources and lower economic costs to participate. The foci of participation should include not just different income groups, but races and ethnicities as well as genders, too, as will be discussed next.

***Races and Ethnicities*:**

The IEA has completely overlooked the transition's different effects on people of different races and ethnicities. It could to some extent be excused for such omission because a lot of the issues which reflect inequalities between races and ethnicities are mediated by income groups. For example, people of colour are more likely to be from low-income households due to historical injustices, therefore policies targeting low-income households could cover them as well (Baker et al., p.2).

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With that said, races and ethnicities should nonetheless be presented as a standalone aspect of the transition because there are racial or ethnic differences within income groups, too (ibid). For example, a study in the US finds that low-income Black households are more likely to struggle with their energy bills than low-income White households as they tend to have homes that require more energy to keep warm or cool due to historic systematic segregation (ibid). Another US study finds that ethnic minority households – in particular, Hispanic households – experience a disproportionately high energy bill, even negative health outcomes, as a result of certain types of demand response programmes (White and Sintov). Demand response programmes are designed to manipulate consumers' patterns of demand for electricity to provide energy flexibility to intermittent renewable electricity sources such as wind and solar – the main sources of electricity in the NZE (IEA, p.24; Office of Electricity). In the Roadmap, the IEA calls for a "major increase" in demand response programmes, increasing the need for considerations for ethnic minorities when designing the transition (p.23).

The omission of the racial aspect of the transition constitutes an injustice from all three perspectives: strict egalitarianism, luck egalitarianism, as well as desert-based principles, as one's race and ethnicity are the causes for their being differently affected. Such omission is also an injustice in another aspect, which is that it underplays racial inequalities and unjust treatments to people of colour in today's society, if not completely ignores the experiences of people of colour.

Genders:

Another overlooked aspect is the effects of the transition on women. In the report, the IEA mentions women twice, both times in the context of how universal energy access would have a positive effect on gender equality because replacing traditional biomass in cooking with modern energy services frees up women's time (p.167). Women – especially those in developing economies – tend to bear the burden of collecting firewood and cooking (ibid).

Although a noteworthy improvement for gender equity, this gain is insufficient because it is only a side effect of universal access to energy and clean cooking. There needs to be an active attempt to consider the NZE from a gender perspective, as well as a greater policy focus on ensuring gender equity in the NZE.

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Employment opportunities in the NZE would be one such area where gender differences have been overlooked. According to PwC, the sectors gaining most employment opportunities in the transition are utilities, construction, and manufacturing, all of which employ significantly more males than females. PwC's forecast shows that with the transition to net zero, the gender gap – as defined by the percentage of additional men in employment compared to women – would increase to 22.47%, 0.52% higher than without the transition (Sridhar et al.).

Similar to the issue of races and ethnicities, gender inequality caused by the transition is a distributive injustice from all three perspectives. Not considering the issue of gender may be seen as an injustice in itself, as it represents a lack of awareness to the unequal treatment of women in current society, consequently a lack of equal respect for all genders.

Issues of Corrective Justice

We proceed to consider the impacts of the transition in an international context, where the right treatment of the global South - developing economies who have only recently experienced economic growth, and many of which experienced colonialism in the past – has been the centre of attention.

In the literature of climate justice, the notion of Double Inequality is used to describe how throughout history, the global South has contributed the least to the current climate crisis compared to the industrial global North as the South has emitted far less – this constitutes the first inequality (McCauley and Heffron, p.4). Due to the geography, global warming would hurt the global South more than the global North, too, as any additional increase to the already high temperatures of the South could lead to more destructive climate catastrophes, such as droughts, floods, and unbearable heat – such is the second inequality (ibid).

The Double Inequality represents a lack of corrective justice. Distinct from distributive justice, corrective justice is based upon a remedial principle which seeks to establish whether someone has 'wrongly interfere[d] with another's legitimate holdings' (Miller). It is apt to interpret the access to a habitable environment as a right held by all. In this case, Double Inequality - the fact the global North's emissions in the past and present contribute far more to the climate crisis and threaten the global South's right to a habitable environment, as well as causing suffering amongst the global South, constitutes a violation of rights and an injustice. Principles of corrective justice vary, but revolve around two central ideas. The first is that no one should be harmed by others' wrongful, or careless behaviour; the second is that no one should be allowed to benefit from their wrongdoing (ibid). As both principles are violated, there must be a remedial act. Firstly, for the

global North to eliminate the effects of their wrongdoings forced onto the global South by as much as possible; secondly, which is also the more controversial aspect, the global North should give up its gains from its excessive emissions. The first part is succinctly captured by the phrase 'polluters pay' (Ward and Hicks). With the second part, the practical challenge is to determine the size of payments, as it is difficult to understand which gains in particular are causally brought about by the emissions.

Unfortunately, the IEA's Roadmap has fallen short of attaining corrective justice by a huge margin. Throughout the report, there is no mention of the need for the global North to bear any more responsibility for the transition than the global South. Although calls for financial support for developing economies in the global South do appear in the report, mentions are generic and vague without any quantification on how much support is required (p.21). Furthermore, the wording of the report as well as its content reflect an implicit assumption that every country – regardless of their historical emissions - must contribute as much as possible to the transition to net zero (within the energy sector). The reason the IEA calls for international cooperation is also more out of technical concerns, namely the concern that without cooperation net zero cannot be achieved on time, rather than moral concerns such as each country's responsibility as required by corrective justice. This is misleading as it implies that countries in the global North and South are just countries with different 'natural' circumstances working towards a common goal on an equal footing, ignoring the crucial fact these circumstances are manmade, and the global South are in a disadvantaged state in a large part due to historical if not current exploitations from the global North.

Throughout the report, there is no mention of the need for the global North to bear any more responsibility for the transition than the global South.

For an alternative with a greater consideration for ethics, one may look to the Climate Fair Share framework developed by Friends of the Earth International in cooperation with other organisations, where the contribution to reducing emissions demanded from one country is determined by the remaining carbon budget, the country's past emissions, its capacity as well as its right to sustainable development ('Climate Fair Shares'). This framework encompasses the idea of corrective justice and reflects the fact that a habitable environment is a right. Under this framework, it has been calculated the US must reduce 195% of emissions based on 2005 levels by 2030, of which 125% to be undertaken by financial and other forms of international support to developing countries (Bhatnagar et al.).

The IEA's proposal also contains aspects which may exacerbate international injustice, as some of its recommendations could potentially lead to neo-colonialist behaviours. Neo-colonialism refers to all actions and things which indirectly serve to continue colonial practices (Afisi). Colonialism is a practice of domination, where one people is under the control of another, both politically and economically, and often culturally as well (ibid). In the modern age, no independent state is under overt control of another. However, sometimes through institutions such as the financial system (e.g., how the West African Economic and Monetary Union's official currency, the CFA Franc, is pegged to the Euro and partially controlled by the French Central Bank) and MNCs (e.g., how large foreign MNCs from the global North get lobbying power in the government of developing countries after they gain large market shares in the countries), some developed countries continue to exert significant influence and control over developing countries, often in the global South. Though the IEA does not endorse any such neo-colonial behaviour, its recommendations nonetheless favour the global North at the cost of the global South, and could easily be exploited by others with colonial tendencies. This means that instead of trying to remedy the historical injustices from colonial periods, the IEA's roadmap may serve to perpetuate it in some parts.

For example, the IEA states that to deliver carbon dioxide removal (CDR) programmes as well as the transition in general, "international co-operation is needed to fund and certify these programmes, so as to make the most of suitable land, renewable energy potential and storage resources, wherever they may be" (p.188). Although seemingly innocuous, we need to ask ourselves, who are going to be those funding the programmes? It will most likely be rich countries in the global North. Where may these resources be? Most would be in developing economies, in the global South (Robin). Such financial relationships give the funder decision-making power in the territory of those being funded. Without a conscious effort to avoid exerting control on independent states with relatively less economic thus political power, the global North as funders may easily exploit their decision-making power, undermining the sovereignty of the developing economies where the projects are located in.

… we need to ask ourselves, who are going to be those funding the programmes? …Where may these resources be?

What is worse, those receiving the funding in the global South tend to be well-off businessmen or bureaucrats, who may actively give up their decision-making power for rent (Bhatnagar et al.). These CDR programmes themselves may also change the indigenous communities' way of life by taking over the space upon which their livelihood depends, robbing them from their source of income and potentially turning them into cheap labour working on these projects (ibid). In the past, some of these programmes used violence to drive indigenous people out of the land they had inhabited for hundreds of years (Wang).

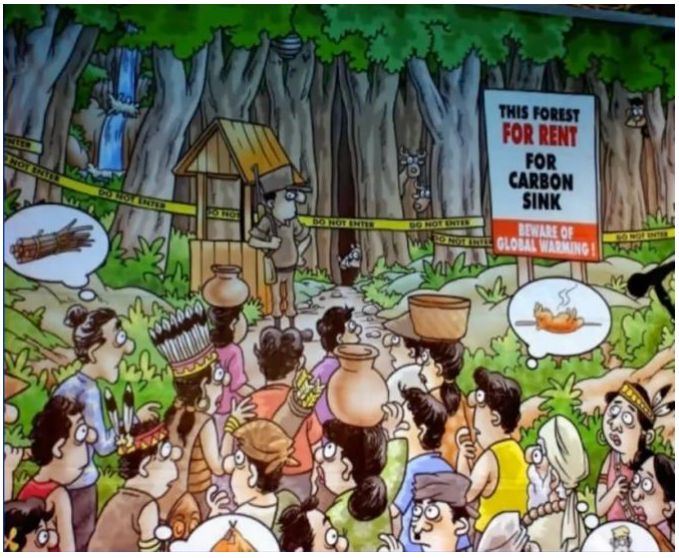

Fig. 2: Dipti Bhatnagar's Presentation at Global Climate Justice against Neo-Colonialism: New Concepts and Priorities for Just Cooperation, May 2021 https://web.sas.upenn.edu/sociospatialclimate/global-climate-justice-against-neo-colonialism/

And finally, to top it all, is the fact to date, the global North emits more than the South per year, and a large proportion of emissions is for consumption beyond that necessary for a decent living standard (Bhatnagar et al.). This could mean the disruptions in the global South are merely funding indulgences of the global North with more emission budget (Wang). Such behaviour has been termed 'climate colonialism' by the philosopher Olúfẹ́mi Táíwò, and constitutes new injustices (ibid). The IEA seems to have disregarded this stark potentiality but instead tries to cover it up using so-called 'international co-operation'.

Apart from CDR programmes, building renewable energy plants and manufacturing EV batteries and solar PVs – some of the most important aspects of the transition to Net Zero 2050 according to the IEA's Roadmap – all risk giving rise to such climate colonialism. Of course, this list is not exhaustive.

The problem of renewable energy plants is similar to that of CDR programmes, where through their investment, developed countries get to dictate the use of land and resources belonging to the global South, under a deal the latter has little power to refuse. Desertec – a solar power project in the Sahara Desert funded mostly by Western private sector players and big MNCs – is an illustration of what may happen. Desertec is designed and advertised to power Europe, though the power plant is using up the Middle East and North Africa (MENA) region's precious water supply (Hamouchene). With the IEA's emphasis on private sector investment driving the transition, one cannot help but notice the high likelihood of 'Desertec 2.0' occurring in the global South (IEA, p.21).

When it comes to the manufacturing of EV batteries and solar PVs, as well as wind farms, the problem lies with the critical minerals these products require. The IEA notes how in its Roadmap, the demand for 'copper, cobalt, manganese and various rare earth metals [will] grow almost sevenfold between 2020 and 2030' (p.23). This increase is due to the greater demand for such minerals by the aforementioned products and processes, compared to the fossil fuel power sources currently employed. The IEA presents this mostly as an economic opportunity which could compensate for some of the losses from a shrinking fossil fuel industry. However, this perspective overlooks the negative externalities of the mining process.

Firstly, there is the potential risk of human rights abuse. For example, it has been repeatedly reported that mines in Africa have been using cheap child labour (Broom). The working conditions of miners in developing economies also tend to be exceptionally poor, leading to health and safety concerns. Secondly, there is the environmental concern of the mines using up scarce water resources in the locality, as well as the toxic waste the mining process releases in the case of rare earth metals (UN Environmental Programme, p.17; Nayar). As the map below illustrates, some countries in the global South are resource rich in critical minerals such as cobalt and lithium (USGS). Their relatively weak institutions make human rights abuse and waste disposal issues more likely to occur, as mines tend to be badly managed. Although the IEA does mention these concerns, it does not engage with them in much depth (p.179). Further, there is again the concern the global South is extracting these critical minerals at its own cost to fulfil mostly the energy demands of the global North, leading to what is called 'green extractivism' (Bhatnagar et al.).

Having made all the 'accusations' above, we should also keep in mind as an international advisory agency, the IEA has its own mandate and is constrained in the matters it can concern itself with. In particular, issues of corrective justice often cut across national borders and thus fall into the realms of international affairs and politics. Any explicit consideration of corrective justice may be outside the remit of the IEA as an organization primarily dealing with technical issues, and may conflict with its supposed impartiality. Nonetheless, as we have come to see, not taking a stance

means taking up the 'default position', which is still the largely western-centric position that disadvantages the global South. As in many cases where justice is involved, silence may mean complicity instead of impartiality.

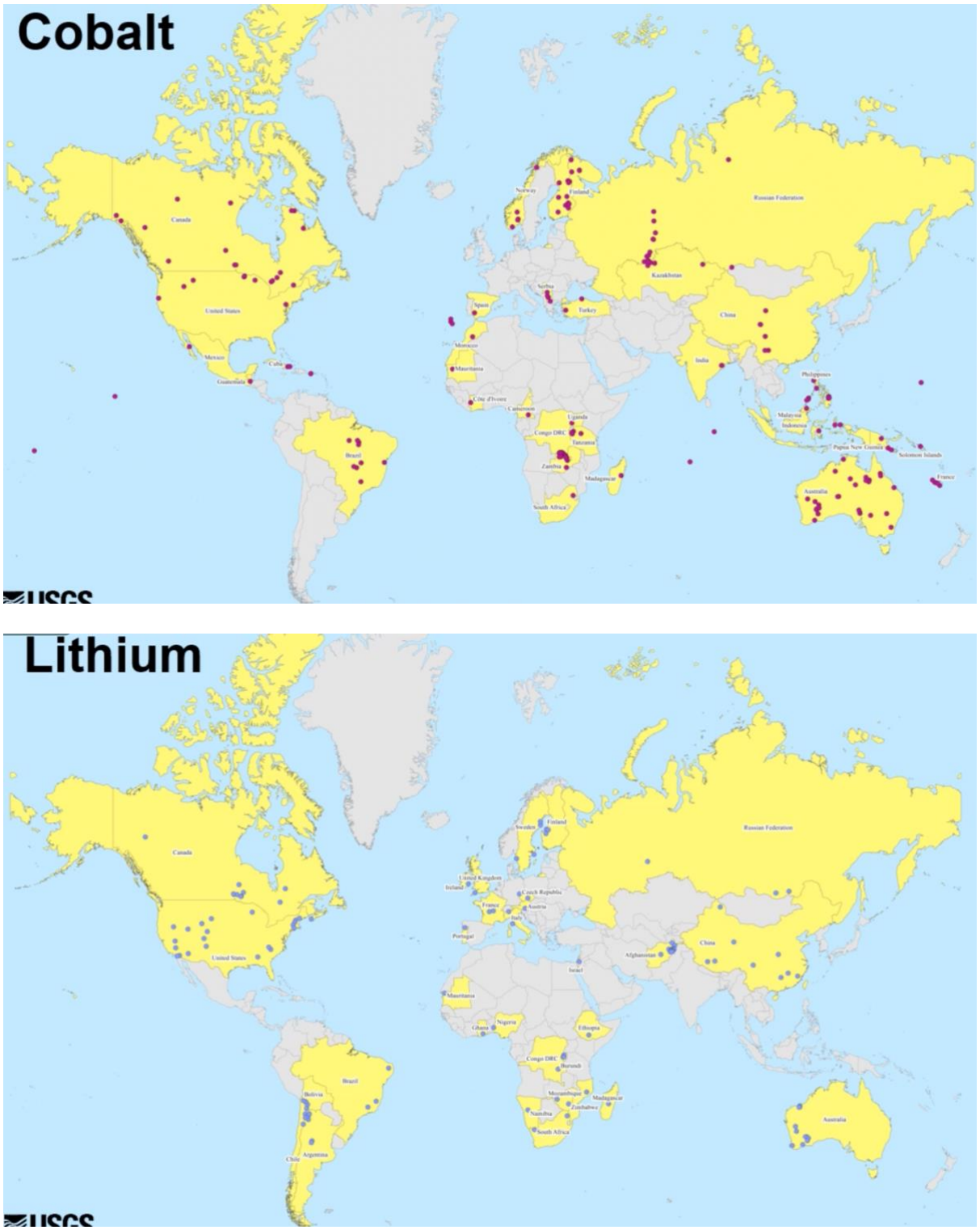

Fig. 3 & Fig. 4. Global distribution of critical minerals, in particular Cobalt and Lithium.
Screenshots from video, accessed at https://mrdata.usgs.gov/pp1802/

Procedural Justice – An Imperfect Solution

Procedural justice can be broadly understood as providing all stakeholders with the access to decision-making processes (Bickerstaff et al.). This report proposes that the distributive and corrective injustices outlined above may be partly alleviated or prevented by enhancing procedural justice in every step of the transition to Net Zero. This would help to achieve real 'international co-operation' on the international level, and a genuine 'people-centred' transition on the national level. The idea is simple: to involve every party at the decision-making table. However, for genuine participation in the decision-making process, being present is not enough. Everyone attending should be empowered to speak up, and extra care should be given to ensure everyone's needs are indeed heard, and any final decision is acknowledged by all. Like a democratic institution, a transition that has achieved procedural justice has an inbuilt 'injustice correction mechanism'. This mechanism is simply that those who perceive themselves getting less than they should in a distributive outcome, or those who perceive historical unjust treatments towards themselves, would raise the issue, and spark a discussion around it. Rousseau believed the 'general will' of the people emerges out of such discussions, and the general will cannot err (p.66). We may only hope such a general will can be produced, but even when it cannot, procedural justice demonstrates an equal respect to all individuals and all nations regardless of their characteristics, and is an ideal on its own.

The production of the Roadmap – the very first and most crucial stage of the transition to Net Zero – needs to be procedurally just. It is unfortunate the IEA's attempt has not been so: almost all member countries, association countries, are either developed economies, rich countries, or large emerging economies, and none of the peer reviewers of the report is from the global South, or a civil society organization. Instead, many private sector industry players are amongst the peer reviewers (IEA). We are of course not suggesting industry players, given their expertise, should not be heard. However, it is indeed puzzling a flagship report aimed at directing all countries' future environmental policies on a topic that affects everyone on the planet should be produced by such a select section of the global society. Again, we fully appreciate the importance of expert knowledge, yet, as policies fundamentally change people's lives, technical policy solutions should nonetheless keep an eye on the human side of the issue – the ethical side of the transition.

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