Perspectives

Can we equitably manage the end of the fossil fuel era?☆

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ABSTRACT

This paper tracks the development of climate justice discourse around leaving fossil fuels in the ground. It then looks forward to the questions of equity that calls for the decline of fossil fuel production raise. It argues, following the Lofoten Declaration for a Managed Decline of Fossil Fuel Production around the World, that global distributive justice requires rich countries, who have benefited the most from fossil fuel extraction, and who have most alternative available development pathways must lead in leaving fossil fuels in the ground. However, the paper shows that equitably managing the end of the fossil fuel era is complicated by how economic efficiency or the interests of frontline communities might at times diverge from global distributive justice. In response, the paper argues that a useful short-term strategy is to focus on how equity and economic efficiency both suggest that wealthy historically polluting countries should leave high-cost, carbon-intensive fossil fuels in the ground. Beyond that, the paper highlights how difficult questions and trade-offs emerge at points where considerations of equity and economic efficiency diverge. Such points of divergence represent a considerable challenge for advocates of an equitable decline of fossil fuel production, and are areas of significant interest for future research and advocacy.

Across the world, momentum towards phasing out fossil fuels is gaining traction. Growing international cooperation on climate change, coupled with rapid advancements in clean energy and growing resistance to fossil fuels, potentially spell the beginning of the end of the fossil fuel era. In this essay, I consider some of the challenges related to determining which fossil fuels can or cannot be produced if we are to attempt to equitably transition away from fossil fuels. The paper begins by tracking the development of the interconnected concepts of the carbon budget and the carbon bubble, showing how they have informed calls to keep fossil fuels in the ground. It then discusses how such calls raise difficult questions of equity, both in terms of how we define what it means to equitably manage a transition away from fossil fuels, and also whether we can practically achieve an equitable transition, given competing political, moral and economic demands. The paper then demonstrates an emerging consensus among climate justice advocates and researchers, which argues that rich countries, who have benefited the most from fossil fuel extraction, and who have most alternative available development pathways must lead in leaving fossil fuels in the ground. I then argue that pushing such countries to leave more economically inefficient fossil fuels in the ground, such as Canada’s tar sands and Norway’s deep-sea oil reserves, represents a strategic point of focus for climate justice advocates, as they can point to the convergence between economic efficiency and equity. I then go on to explore how questions of equity become more difficult when we consider areas where economic efficiency and equity diverge. These points of divergence represent a significant challenge for those who advocate for an equitable decline of fossil fuel production, and are areas of significant interest for future research and advocacy.

1. The carbon budget & bubble

In 2009, at the United Nations Framework Convention on Climate Change (UNFCCC) 15th Conference of the Parties (COP 15) in Copenhagen, Denmark, governments across the globe began committing to the target of limiting global mean temperature change to below 2°C above pre-industrial levels [1]. The same year, a study by Meinshausen et al. [2] highlighted a large contradiction between proven oil, coal and gas reserves and the 2°C target. They showed that to stand a 75% chance of staying below the 2°C target, we could only afford to emit a cumulative amount of 1000 Gt CO2 in the atmosphere — this would not be possible...
our carbon budget. They pointed out, that staying within our carbon budget meant that less than half the proven economically recoverable oil, gas and coal reserves could still be burnt, otherwise we would put ourselves at increasing risk of pushing passed the 2 °C.

In 2011, building on Meinshausen et al.’s analysis, the Carbon Tracker Initiative (CTI), a London-based financial think tank, pioneered analysis of a concept they coined the carbon bubble. The carbon bubble referred to the fact that proven fossil fuel reserves were jointly up to five times greater, than could be burnt to limit global warming below 2 °C [3–5]. In other words, the amount of fossil fuel reserves collectively held by the fossil fuel industry, would push us as way passed our carbon budget if burned. On the other hand, if we acted on climate change in line with the 2 °C target, then fossil fuel companies would lose significant amounts of value and potential revenue, given that the value of their fossil fuel reserves is largely based on their ability to be burnt. In financial terms, this meant that fossil fuel reserves were at risk of turning into stranded assets – “assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities” [6].

Looking to the stock exchange, Carbon Tracker’s analysis showed that approximately 73% of the reserves listed on the world’s stock markets in the next 40 years contained enough emissions to blow passed the carbon budget for 2 °C [5]. Remarkably, the vast majority of fossil fuel reserves are not held by publicly traded companies, with 74% of fossil fuel reserves either owned by state or private-owned companies not registered on the stock market [7]. As such, not only would staying below 2 °C entail a potential financial asset bubble on the stock market, it would also entail major losses of revenue for state and private fossil fuel companies and countries reliant on fossil fuel rents and exports. Estimates suggested that adhering to the 2 °C target could result in $28-trillion in lost revenue in the next two decades, with the oil industry accounting for $19.3-trillion, gas $4-trillion and coal $4.9-trillion [8].

Recognition of the contradiction between the fossil fuel industry’s business model and needed climate action spurred to spur on the nascent fossil fuel divestment movement [3,9] – the movement also called for divestment from fossil fuels for reasons related to how the fossil fuel industry had blocked environmental action, spread misinformation, and perpetuated a range of injustices, especially against indigenous peoples and communities of color [10,11]. From the first divestment campaign starting in 2011, it became the fastest growing divestment movement in history, driving investors collectively representing over $5 trillion in assets away from fossil fuel investments by December 2016 [9]. Reflecting on the divestment movement’s growth, commentators, such as Bill McKibben, highlighted how in the space of a few years, divestment efforts had helped drive the “necessity of keeping carbon underground from the fringes into the heart of the world’s establishment” into places as diverse as the G20, the world’s major financial establishments, universities across the globe, and the world’s largest pension funds [12].

In 2015 at COP 21 in Paris, 195 governments across the world unanimously agreed to keep global warming not just to “below 2 °C” as was the previous international target. More ambitiously, thanks in large part to the efforts of small island nations, least developed countries, and those most vulnerable to climate change, the agreement committed to keep warming “to well below 2 °C”, and “to pursue efforts” to limit warming to 1.5 °C [13]. While the world still needed to put in place many new policies and ramp up domestic ambition to meet the Paris Agreement targets, the overall commitment to keeping warming to well below 2 °C meant that the fossil fuel industry was even further out of line with the world’s aspiration on climate change.2 IPCC analysis showed that to meet the Paris targets, global carbon dioxide emissions needed to be cut by half by the 2030s compared to 2010 levels, and to reach zero sometime between 2045 and 2070 [1,14]. Analysis showed that the potential carbon emissions just in the oil wells, coal mines or gas fields already in operation were sufficient, if burnt, to push passed 2 °C; and just the reserves in currently operating oil and gas fields, even with no coal, would take the world beyond 1.5 °C [15]. Contrary to the fossil fuel industry’s business model, the evidence was clear: to meet the Paris Targets and avoid dangerous climate change, fossil fuel production would have to rapidly decline.

2 For a variety of political reasons, the Paris Agreement did not specifically refer to the need to phase out fossil fuel production even though the implication of its targets clearly entailed that the world would need to do so. As Piggot et al highlight, the UNFCCC’s lack of explicit engagement with the need to manage the decline of fossil fuel production is an oversight which can detrimentally affect our ability to equitably manage the end of the fossil fuel era [26]. They argue that explicitly including discussion of and measures to equitably manage winding down fossil fuel production within the UNFCCC can enhance ambition and help the world meet the targets of the Paris Agreement.

2. Managing the decline?

Recognition of the contradiction between the fossil fuel industry’s business model and needed climate action spurred on increased global civil society calls for leaving fossil fuels in the ground, no additional fossil fuel development, no exploration for new fossil fuels, no expansion of fossil fuel projects, and for the managed decline of the fossil fuel industry [16,17]. These calls raised a significant, yet under-explored question: If we have far more fossil fuels than our carbon budget will allow, how do we determine which of the remaining fossil fuels we should extract? This question was in many ways a new and challenging one, particularly given that much conventional wisdom before the emergence of the carbon bubble was that we would run out of or hit a peak in fossil fuel supply [18]. However, conventional wisdom was turned on its head both by the growing recognition of the carbon bubble and by major advances in climate policy, clean energy, energy efficiency, and other factors, such as water constraints. The question became less about what do we deal with peak fossil fuels, but rather, how do we deal with more supply than is consistent with staying within our carbon budget [19].

While a large body of evidence shows that it is clearly in the global collective interest to promote climate action in line with the Paris Agreements [20–23], the potential negative impacts created by the decline of the fossil fuel industry raised a number of complex questions of justice and equity, including how do we fairly determine who gets to produce the remaining fossil fuels consistent with the carbon budget? Civil society, governments, the UNFCCC, and policy and academic circles, had long debated how to fairly share the ability to limit fossil fuels and emit greenhouse gas emissions. However, the question of how to fairly decide who gets to extract the last fossil fuels in a carbon constrained world had remained largely unaddressed and even the Paris Agreement remained silent on fossil fuel production [24–26]. Unlike a long history of complex debates and international agreements on which countries could burn how much fossil fuels, the current international order on fossil fuel production was, in the words of Jeremy Moss, pretty much that “any country can dig up what it likes” [27].

One of the first major governmental initiatives attempting to push back against the established order that “any country can dig up what it likes” was the Yasuní–ITT Initiative. The proposal, put forward in 2007, asked the international community to pay Ecuador’s government $3.6 billion in exchange for not developing the Ishpingo Tambococha Tiputini (ITT) oilfields – doing so could prevent more than 400 million tons of potential carbon dioxide emissions, as well as protect an incredibly diverse area of significant importance to local indigenous peoples [28]. The proposed funds from the Yasuni ITT Initiative, which were approximately half the value of the oil fields, would have been placed into social and environmental development programs, helping provide resources for Ecuador to transition to a post-oil future. Unfortunately, despite its benefits, the project collected only $13 million of the demanded $3.6 billion, and was called off in 2013 due to
challenges “including limited financing, intense political pressure, a national commitment to oil, and carbon leakage” [28]. Nonetheless, local peoples and activists continue to fight for the preservation of Yasuní on the ground of the ecological, cultural and economic benefits that it has, with many arguing that the benefits outweigh the benefits that oil production would bring [29] – indeed, analysis of the Yasuní Initiative revealed that if successful it would have resulted in much more significant social, environmental and economic benefits than the exploitation of the oil would have [28].

The Yasuní ITT Initiative was ahead of its time in many ways, including basing part of its motivation on the need to keep fossil fuels in the ground to address climate change. It was also one of the first government initiatives to apply a global climate justice analysis to claims about fossil fuel production. They argued that, having benefited disproportionately from an over-sized exploitation of fossil fuels, and thus having been a predominant cause of the climate crisis, the developed world had a responsibility to assist developing countries shift away from dependence on fossil fuel production. While this logic had long been applied to questions of burning fossil fuels and emitting greenhouse gases [30,31], the Yasuní-ITT was innovative in applying to fossil fuel extraction and production.3

Despite and/or because of its pioneering nature, the response to the Yasuní proposal demonstrated a wariness and broad lack of willingness from the international community to pay to keep fossil fuels in the ground. In the words of Sovacool and Scarpaci, “the proposal essentially asked the world: Who wants to pay for stranded assets? The deafening answer [appeared] to be nobody” [28]. Such a result led an Ecuadorian ambassador to argue that the world, particularly the rich developed world, had failed Ecuador, and that to ensure climate justice in the future, the world could not fail on other such proposals [32]. Unfortunately, despite such pleas, proposals for compensation for stranded fossil fuel assets have not garnered much momentum since the Yasuní-ITT Initiative [26].

3 OBefore even the Yasuní initiative, OPEC countries led by Saudi Arabia had argued within the UNFCCC that they should be compensated for all lost fossil fuel revenue created by climate action. In response, many argued that unlike Ecuador’s proposal, such claims from richer, fossil fuel producers like Saudi Arabia were less aimed at climate justice and more intent on derailing climate progress. This was informed by Saudi Arabia and OPEC’s long history of trying to derail climate progress, and by the fact that their proposal was prohibitively expensive entailing hundreds of billions if not trillions of finance [36]. Their proposals were met with significant resistance from the likes of the Alliance of Small Island States (AOSIS), one of whose diplomats argued that it was “absurd” for richer countries like Saudi Arabia who had benefitted significantly from fossil fuel production to take adaptation funding away from more vulnerable countries, as it goes “against the spirit of the talks, which is to help the poor adapt to something they did not cause” [51]. Ultimately, such claims for compensation from OPEC have been unsuccessful, and the opposition to it demonstrated the centrality of questions of climate justice in answering how the global community determines if and how to leave fossil fuels in the ground. (Thanks are due to Greg Mattitti from Oil Change International for a draft paper entitled What Role for OPEC in the Last Generation of Oil, which helped inform this footnote).

3. Equity, efficiency and the Lofoten declaration

Moving away from claims of compensation for developing nations, more recent attempts at defining which fossil fuels should not be extracted put significant focus on what was the most economically optimal or efficient solution. For instance, in 2015, McGlade and Ekins modelled a pathway to stranded assets consistent with a 2°C limit [33]. They aimed to determine which fossil fuels are most economically efficient in terms of being able to maximize overall global social welfare. Their analysis focused on the fact that some fossil fuels are more greenhouse gas-, capital- or resource-intensive than others, so the most economically efficient pathway should use the least greenhouse gas-, capital-, or resource-intensive fossil fuels, while striping those that were not. Efficiency approaches subsequently informed much climate change advocacy. For instance, civil society efforts pushing back against both tar sands expansion and Shell’s attempts to drill for oil in the Arctic, drew on McGlade and Ekins’ analysis to show that exploiting either resource was inconsistent with an economically efficient approach to the carbon budget [34,35].

Activist arguments would also sometimes combine appeals to efficiency with appeals to climate justice that focused on the responsibility of richer developed nations like the United States and Canada to take the lead in leaving fossil fuels in the ground, given their oversized role in causing the climate problem. A major milestone in such appeals to climate justice in the decline of fossil fuel production came with the development of the Lofoten Declaration for a Managed Decline of Fossil Fuel Production Around the World. The Declaration was developed in August 2017 “at a gathering in the Lofoten Islands of Norway of academics, analysts, and activists” [36]. With over 300 organizations from every continent across the globe having signed onto the Lofoten Declaration at the time of writing, it represented one of the first major civil society calls recognizing considerations of equity in determining who gets to produce the last fossil fuels.

The Declaration affirmed that new exploration and production of fossil fuels was incompatible with the Paris climate goals, and that many existing projects would need to be phased out “faster than their natural decline”. This task, according to the declaration, “should be first addressed by countries, regions, and corporate actors who are best positioned in terms of wealth and capacity to undergo an ambitious just transition away from fossil fuel production. In particular, leadership must come from countries that are high-income, have benefitted from fossil fuel extraction, and that are historically responsible for significant emissions”. The declaration helped to elevate a position on global distributive justice, which had previously been propounded in the small but growing body of literature exploring questions of equity and stranded assets [24,25,27,28,37]. For instance, a 2016 report commissioned by Oxfam, put forward a conception of global distributive justice for stranded assets based on the Principle of Common but Differentiated Responsibility and Respective Capabilities [25]. Correlating with the Lofoten Declaration, the report argued that an equitable approach to stranded assets, should give priority to those who: (a) have a lower standard of living, as measured by the Human Development Index; (b) have least extracted and benefitted from past fossil fuel extraction; and (c) have the least alternative means of meeting their developmental needs.

Unlike the Oxfam report, the Lofoten Declaration also included considerations of procedural and recognition justice, insofar as it recognized the need to stand in solidarity with, support, and elevate the voices of “frontline communities… around the world who are taking action to defend and protect their lives and livelihoods in the face of fossil fuel extraction and climate change” [36]. On the other hand, what was missing from the Lofoten Declaration, but included within the Oxfam report and broader discussions on stranded assets and equity, was explicit discussion of the need to consider questions of efficiency in addressing how we stranded fossil fuel assets. How we reconcile these three elements of global distributive justice, efficiency, and following the lead of frontline communities, represents significant challenges for those who aim to advocate for an equitable, managed decline to fossil fuel production.

4. Finding convergence between equity and efficiency

The Lofoten Declaration’s omission of considerations of efficiency sidesteps the question of how we balance considerations of efficiency against those of equity, given that they will not always point towards stranded the same assets. For instance, a least developed country might have deeply inefficient fossil fuel reserves, or a rich developed country may have very efficient resources. How then do we decide if and when equity should gain priority over efficacy and vice versa? Weighing the two against each other is a complex, value-laden, and politically tough question, which will arguably prove quite difficult to resolve under
circumstances where the two values compete against each other.

One way to avoid the possible tensions between equity and efficiency, is to focus on where we can find convergence between the two. For instance, recognizing such a convergence, recent advocacy and analysis has placed significant focus on Norwegian oil and gas production. Research from the Stockholm Environment Institute showed that global oil demand consistent with an efficient pathway to keeping to the “well below 2°C” target, would not require expansion of Norway’s more capital and resource-intensive deep sea oil [38]. The non-profit Oil Change International (OCI) combined similar efficiency-based analysis with an equity perspective to argue that Norway should “freeze further leases or permits for new oil and gas extraction projects or transportation infrastructure that would incentivize additional exploration” [39]. As one of the wealthiest nations, who has benefited significantly from fossil exploitation, and is well positioned to afford to diversify away from it, OCI and other activists argue that Norway has a special responsibility to lead in leaving their inefficient deep-sea reserves in the ground.

Norway’s government has responded to such calls by arguing that they are unfair, as they make Norway responsible not only for the emissions they produce at home, but also the emissions embedded within their oil exports [40]. They argue that this goes against the UNFCCC convention of holding a country responsible only for their own domestic emissions, and not for the emissions embedded in their fossil fuel exports. However, as climate ethicist Jeremy Moss has argued, while this may be the current convention, conventions are not necessarily just, and considerations of equity and stranded assets arguably require us to rethink this particular convention [27]. Resonating with other equity arguments we’ve considered, Moss argues that the responsibility of countries and considerations of what is their fair share of fossil fuel to produce and burn, should begin to include, to at least some degree, the emissions and harms from exported fossil fuels. He bases his argument both on: the need to take into consideration the harms embedded in fossil fuel exports; and in considerations of how countries like Norway should not take up more than their fair share of the remaining carbon budget, given that other countries have used much less than them, and are much less able to move away from fossil fuel production than a rich country like Norway is.5

A similar case to Norway can be made for Canada, a rich, well-off, major historical emitter with high per-capita GDP emissions, which relatively speaking has a wide range of other potential options open for development. Canada’s tar sands are carbon and resource intensive, polluting, expensive, and opposed by frontline communities, as evidenced by the Treaty Alliance Against Tar Expansion, which has been signed by over 122 first nations and tribes. Thus, preventing the expansion of Canada’s tar sands represents a strong convergence of equity and efficiency supported by frontline communities. Similarly, pushing back against coal field development in rich, high historical polluters like the U.S., Germany, and Australia represents another important point of convergence.

Furthermore, as analysis by Oxfam and Columbia University high-lights, efficiency reasons weigh particularly heavily in favour of phasing out coal first and foremost, as it is (a) a particularly high carbon form of energy; (b) not particularly valuable as an export; and (c) does not have significant value as a reliable source of cheap energy, particularly given how poorly it integrates with renewable energy [41]. Their analysis demonstrates that a wide scale phase out of coal would significantly reduce the amount of other fossil fuels we would have to strand to stay within the carbon budget. Thus a rapid phase out of coal production could make the task of equitably managing the transition away from fossil fuel production much easier.

5. Managing divergence?

While focusing on stranding inefficient fossil fuel reserves in rich developed countries like Norway, Canada, Australia, and the United States, might allow us to find convergences between equity and efficiency, in other instances equity and efficiency will not always converge, and that is where matters get trickier. Consider, for instance, Angola’s deep-sea oil reserves, which are inefficient relative to other fossil reserves available to meet a 2 ºC goal. Despite their inefficiency, they are part of a revenue source for a country which: a) comes 149th out of 187 in a ranking of countries by their Human Development Index.; b) has not benefited significantly in the past from exploiting fossil fuels, and; c) faces significant financial constraints in terms of affording to pursue alternative development pathways [25]. In terms of global distributive justice, Angola should be allowed to exploit its fossil fuel assets, but in terms of efficiency it should leave them in the ground.

In cases like Angola’s global distributive justice and efficiency clearly diverge, and so the question arises as to how to navigate this divergence. Some have suggested that we can resolve the conflict by stranding the least efficient assets, and then providing compensation to countries, like Angola, who would have been favoured if we had followed a more equitable pathway along the lines defined by Oxfam and the Lofoten Declaration [24,25,42]. However, reflecting on how the Yasuni-ITT Initiative was only able to garner 0.37% of its target compensation goal, gives ample reason to worry that the global community is simply not willing to shoulder the responsibility of putting in place such a compensation scheme [32]. Even, if we were to overcome the lack of political will around compensation, there are a range of questions that would need to be resolved to determine how much such communities should be compensated.

Consider that stranded fossil fuel assets will not come about only as a result of climate change policy, but rather due to a complex array of factors, including the rapid decrease of clean energy costs, varying costs of fossil fuel extraction, fossil fuel price volatility, increases in energy efficiency, lower fossil fuel demand, changing social norms, increased environmental regulation, and suppressed growth of demand for fossil fuels in key economies [43]. Likewise, the reasons why a community may want to leave fossil fuels in the ground may be manifold, ranging from community and ecological health, sovereignty, and alternative development preferences. This complex set of factors involved in constraining fossil fuel production, raises difficult questions for determining whether compensation is due and against what baseline. For instance, would compensation only be owed when assets were left in the ground or stranded explicitly as a result of climate rule-making, or would compensation also be owed under the more complex playing out of these inter-related factors? If the important element in questions of compensation is that countries have the ability to meet development needs, then does it matter what caused fossil fuels to be stranded if it ends up jeopardizing their ability to meet development needs? If the cause doesn’t matter, are some accounts of equity for unburnable fossil fuels reducible simply to arguments for prioritizing vital development needs? Perhaps that is as it should be, and that when it comes to leaving fossil fuels in the ground, what is ultimately important is that we alleviate the setbacks to development and vital human interests that are brought about as a result thereof. Such an approach would help differentiate why we should compensate or take care of workers, communities and people who lose out in the transition, but do not have similar responsibilities to companies or shareholders per se, as the latter’s losses do not in themselves threaten vital human interests. However, more work needs to be done on justifying such an approach.

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5 Pigot et al. have in favour of incorporating fossil fuel production into the UNFCCC [26].
6 Additionally, analysis by Fæhn et al. [52], demonstrated that Norway could more efficiently meet their greenhouse gas emission reduction targets by using not only demand side measures to reduce domestic emissions, but also pursuing supply-side constraints on fossil fuels, i.e. stranding their deep-sea oil assets. This points to the often under-appreciated significance of using supply-side policies as an effective part of global efforts to reduce greenhouse gas emissions, a topic explored in more detail by Lazarus et al. [53].
Another complication around compensation surrounds questions of the Resource Curse - the seeming paradox that countries with significant natural resources, such as fossil fuels and minerals, tend to have less economic growth, more problematic political relations, and worse development outcomes. While some countries, such as Norway, have been able to largely avoid the Resource Curse and gain significant benefits from oil and gas extraction, some theorists of the Resource Curse argue that many countries and communities, particularly in the developing world, would be better off if they did not so heavily rely on fossil fuel production, as extraction benefits a few at a large expense to the broader populace [18]. Resolving the extent to which the Resource Curse raises tricky questions about how to determine when and whether compensation is owed if there is the possibility that some communities and individuals may benefit more from reduced fossil fuel production. For instance, would the baseline for compensation be reduced according to the benefits that a reduction in fossil fuels would bring, or should compensation be determined relative solely to losses? Furthermore, if countries act to leave fossil fuels in the ground out of their own interest and leadership, does that nullify claims for compensation? For instance, in 2011, Costa Rica put in place a moratorium on oil exploration in the name of protecting their citizens right to a healthy environment [44]. Are they morally owed compensation, and if so, against what baseline?

Additional complexities for compensation, and equity more broadly, arise from the need to account for the interests or follow the lead of frontline communities who are most impacted by fossil fuel production, either positively or negatively. While incorporating the voices of frontline communities may be relatively easy when the voices of frontline communities align with broader global distributive justice considerations, such as First Nations’ resistance to Canada’s tar sands, it becomes more difficult in instances when frontline voices diverge from what equity or global distributive justice at a broader level might suggest. Consider, for instance communities in Appalachia in the United States, or the Native American Crow Tribe, whose leadership seeks to expand coal production, seeing it as one of few potential development options in an economically depressed and marginalized community [45]. The existence of such frontline voices supporting the expansion of a fossil fuel which most needs to be phased out to meet climate targets, raises challenging questions about how to weigh the voices and interests of frontline communities against broader considerations of global distributive justice and efficiency. If and when frontline communities interests conflict in these ways, when can we justifiably outweigh their interests? And, if we go against their interests, are they owed compensation, and support, and in what form?

6 For instance, Temper et al argue that according to 2011 net savings data from the World Bank, African countries would have increased their gross domestic products more by leaving fossil fuels in the ground than by extracting them [54]. Additionally, they argue that the externalities of fossil fuel extraction are in some cases “very possibly larger than the revenues gained” [55]. Additionally, as both Guit and MacGill and Burke and Stephans highlight, a renewable energy offers significant potential to upend and challenge unequal, problematic and hierarchical power relations associated with fossil fuels [56,57].

7 Additionally, a growing number of countries, towns, cities, counties, and municipalities across the world, are putting forward bans on certain types of fossil fuel production and on new fossil fuel infrastructure. For instance, fracking bans are growing worldwide, with nations such as Scotland, France, and the Netherlands putting in place nationwide bans, and many other sub-national entities implementing bans too [58]. Further upstream in the fossil fuel production chain, cities, such as Portland, Oregon, have banned the expansion of or development of new infrastructure for storing and transporting coal, methanol and various natural gas and oil products [59].

8 Although the negative impacts of a clean energy transition are on the whole much less than that of fossil fuels [61], they nonetheless raise important questions of equity and procedural justice, which are key to trying to create a just energy future. As such, it is not only the voices of frontline communities of fossil fuel extraction that need to be considered, we also need to consider the voices of those who are impacted by the transition to a clean energy future. For instance, as Phadke discusses in this special edition, considerable disagreement exists among some communities on the frontlines of extraction of rare minerals needed in the construction of the clean energy economy [60]. Even more significant concerns need to be addressed with regards to bioenergy, as Schelhas et al. (2018) et al highlight.

9 Moallemi and Malekpour highlight some of the challenges of engaging stakeholders in energy transitions, and propose a participatory exploratory modelling approach as a model to engage with the various different stakeholders involved in creating energy futures [62].
and efficiency diverge, and the unlikelihood of compensation claims being successful in the near future, it seems like a smart short-term strategy for climate justice advocates is to focus on points of convergence between global distributive justice, and efficiency, especially when supported by frontline communities. However, beyond these low hanging fruit, difficult tensions between efficiently taking climate action, equitably doing so, and listening to frontline communities are likely to emerge. These tensions are made more difficult by the deep lack of sufficient ambition on climate action, and resistance from rich and powerful states driven by entrenched fossil fuel interests, such as Saudi Arabia, Russia, the United States, Canada, and Australia [47].

Thus, while the increased attention paid to the need to equitably manage the decline of the fossil fuel production is encouraging, barring a significant shift in the developed world’s willingness to leave fossil fuels in the ground, and to assist and/or compensate developing countries for doing the same, it is hard to see action emerging at the scale and speed required to equitably manage the end of the fossil fuel era in line with the rapidly diminishing carbon budget. While the Lofoten Declaration represents an important milestone, the global community has a long way to go, in a short amount of time, if it is to both equitably manage the end of the fossil fuel era and avert dangerous climate change. Given that hard reality, care needs to be taken to ensure questions of stranded assets and equity do not derail progress on leaving fossil fuels in the ground altogether. It may be an injustice to not end the fossil fuel era entirely equitably, but much graver injustice and harm will come from not reducing fossil fuel production and acting on climate change, particularly for least developed and developing nations [49]. On the other hand, if we put in place measures to ensure an equitable end to the fossil fuel era, we may also reduce resistance to it coming to an end.

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