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Georgia Piggot, Peter Erickson, Michael Lazarus, and Harro van Asselt

SEI - U.S. Seattle Office
1402 Third Avenue, Suite 900
Seattle, WA 98101
USA
Tel: +1 206 547 4000
Web: www.sei-international.org

Author contacts:
Georgia Piggot,
georgia.piggot@sei-international.org
Peter Erickson,
pete.erickson@sei-international.org

Director of Communications: Robert Watt
Editor: Emily Yehle
Layout: Richard Clay

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## ABSTRACT

Reducing fossil fuel supply is necessary to meet the Paris Agreement goal to keep warming "well below 2°C". Yet, the Paris Agreement is silent on the topic of fossil fuels. This paper outlines reasons why it is important that Parties to the Agreement find ways to more explicitly address the phasing out of fossil fuel production under the UNFCCC. We describe how countries aiming to keep fossil fuel supply in line with Paris goals could articulate and report their actions within the current architecture of the Agreement. We also outline specific mechanisms of the Paris Agreement through which issues related to the curtailment of fossil fuel supply can be addressed. Mapping out a transition away from fossil fuels – and facilitating this transition under the auspices of the UNFCCC – can enhance the ambition and effectiveness of national and international climate mitigation efforts.

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## 1. INTRODUCTION

Since the mid-1990s, countries have been negotiating the global response to climate change under the United Nations Framework Convention on Climate Change (UNFCCC). Through the 2015 Paris Agreement, parties to the UNFCCC affirmed their commitment to limiting warming to "well below 2°C" and pledged to "pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (UNFCCC 2015b; Article 2) and "achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (UNFCCC 2015b; Article 4). In effect, this sets a long-term goal to reduce global emissions to effectively zero by the middle of the century (on a "net" basis, considering removals from atmosphere). It also requires each country to outline its climate goals in a "nationally determined contribution" (NDC) every five years.

What the Paris Agreement does not do is specify exactly how countries will attain these global temperature or emissions reduction goals. For example, even though fossil fuel combustion contributes the large majority of greenhouse gas (GHG) emissions, the Agreement does not describe how production or combustion of coal, oil, or gas may be phased down, either globally or for individual countries. Instead, as has long been the case under the UNFCCC, countries develop specific climate policies and measures domestically, in accordance with their own national circumstances.

This working paper describes ways in which countries could articulate future pathways for fossil fuels under the UNFCCC and, specifically, the Paris Agreement. It describes why focusing more explicitly on the phase-down of fossil fuel production could help strengthen efforts to reduce GHG emissions, and how recognizing and tracking corresponding actions to reduce fossil fuel production could be accomplished. For example, a country that showed how it intended to phase down coal, oil, or gas production would be sending clearer signals to private actors and fuel markets, allowing a smoother overall transition to a decarbonized economy (IEA 2016b). More explicit phase-downs of fossil fuel extraction would also help avoid over-production and ensure that the necessary fossil fuel reserves are left undeveloped (Meinshausen et al. 2009; McGlade and Ekins 2014).

Some may wonder whether now is an appropriate time to consider the issue of fossil fuel supply under the Paris Agreement or, more broadly, the UNFCCC. One major emitter – the United States – has recently announced its intention to withdraw from the agreement. Nevertheless, despite this and other recent trends away from multilateral cooperation, the Paris Agreement appears durable (Deese 2017), as does the trend away from fossil fuels (OECD 2017). Explicitly addressing fossil fuel supply under the UNFCCC could help strengthen the transition away from fossil fuels and, in so doing, help close the "gap" between current emissions pathways and what is needed to secure a climate-safe future (UNEP 2016; UNFCCC 2016b).

Indeed, as the central international forum for addressing anthropogenic climate change, the UNFCCC is well-placed for articulating the why and how of phasing down fossil fuels. This paper seeks to explore just how fossil fuel supply could be integrated into the UNFCCC. In so doing, we recognize that the UNFCCC is not the only international institution that could help govern the transition away from fossil fuels (van Asselt 2014; see Box 1).

The paper proceeds as follows. Section 2 first describes how a country seeking to manage its fossil fuel resources in a manner consistent with Paris goals would do so within the framework of the UNFCCC. It then illustrates a hypothetical NDC submission focused on fossil fuel supply. Section 3 explains the rationale for why a country would do this, by looking at what role the UNFCCC (and the Paris Agreement) play in facilitating and securing ambitious climate action. Section 4 dives into the specifics of the Paris Agreement, to explore how fossil fuels could be integrated into several components of the Agreement, such as NDCs or long-term low greenhouse gas emission development strategies (long-term strategy for short, hereafter referred to as LTS). Lastly, Section 5 discusses possible next steps for addressing fossil fuels within the UNFCCC, before we conclude the paper.

Overall, we argue for greater attention to fossil fuels – especially, to fossil fuel *production* – in the UNFCCC and subsequent refinements to Paris Agreement mechanisms, and we provide a range of options for doing so.

**Box 1: Other international institutions that could help govern the transition away from fossil fuels**

The UNFCCC is just one of a number of relevant international institutions that govern fossil fuel extraction. Other intergovernmental organizations include groups of energy producers and consumers, such as the International Energy Agency (IEA), the International Energy Forum (IEF), the Organization of the Petroleum Exporting Countries (OPEC), the Extractive Industries Transparency Initiative (EITI), and the Gas Exporting Countries Forum (GECF). In addition, several international organizations and forums have considered fossil fuel subsidy reform, including the Group of Seven (G7), the Group of Twenty (G20), the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), and the World Bank. This diversity of bodies means that international governance of fossil fuel extraction tends to be fragmented, with organizations working towards sometimes-conflicting goals (van Asselt 2014).

An obvious benefit of governing the transition away from fossil fuels under the UNFCCC (compared with other international energy or trade organizations) is that it has near-universal participation by states, and includes countries that both produce and consume fossil fuels (van Asselt 2014). The UNFCCC's mandate can also be interpreted as encompassing fossil fuel supply, as the need to phase out fossil fuels is implied by the agreed goal to keep global warming "well below 2°C" and balance emissions with removals by the latter half of the century.

## 2. HOW MIGHT A COUNTRY ARTICULATE A FOSSIL FUEL PHASE-DOWN UNDER THE UNFCCC?

Before we explore the details of the UNFCCC or Paris Agreement, we first want to illustrate what we mean by saying that countries could use the Agreement to articulate pathways for a fossil fuel phase-down.

In brief, we mean that a country could specify how it plans to phase down fossil fuel supply through its communications to the UNFCCC (such as an NDC or LTS), in addition and akin to how it specifies its plans for reducing GHG emissions. In essence, a country that already plans to reduce GHG emissions by a certain percentage could also plan to reduce its production of fossil fuels by a certain percentage. A country could aim for more or less ambition with its fossil fuel supply than with its own GHG emissions, depending on relative national capacities and circumstances. Other components could also be included, such as those relating to financing or capacity building.

In addition to these headline goals to limit fossil fuel supply, nations can specify that they aim to pursue a range of specific policy options.[1] These include removing subsidies for fossil fuel producers, implementing production and export taxes on fossil fuels, restricting exploration and extraction on government lands, or limiting financing for mining and infrastructure of high-carbon fuels (Lazarus et al. 2015). Countries could report on such activities alongside their GHG mitigation and fossil fuel reduction targets.

1 Following Lazarus et al. (2015), we distinguish between supply-side and demand-side climate policy in the following manner: supply-side climate policies are those focused on limiting the exploration, extraction and transportation of fossil fuels; whereas demand-side policies are those focused on limiting the consumption of fossil fuels (including consumption by electricity producers).

It is important to note that these goals should be complementary to the economy-wide GHG emissions goals envisaged for all countries to the Agreement. Many countries already communicate multiple goals, complementing GHG emissions targets with goals for expanding renewable energy, increasing energy efficiency or limiting deforestation (Hood et al. 2014). Complementing GHG emissions goals with goals or actions to reduce fossil fuel supply would thus fit within the framework of nationally determined contributions.

To flesh the idea out further, consider the following hypothetical enhancement to an NDC submission to the UNFCCC, intended to complement a country's existing plans and commitments (existing NDCs are reviewed in Section 4.1).

**Hypothetical Enhancement to an NDC to Address Fossil Fuel Supply**

- In addition to its GHG emission reduction targets, the country commits to a phase-down of fossil fuel production. Coal production will be reduced by 25% by 2025 from 2005 levels, oil production will be reduced by 20%, and gas production will be reduced by 10%.
- These production targets are fair and ambitious, and are consistent with our commitment to reduce economy-wide GHG emissions. The targets are consistent with a long-term goal of keeping warming "well below 2°C", while also leaving a substantial portion of the world's remaining carbon budget for other countries to utilize.
- The following domestic policies and measures will be adopted: A moratorium on further permits, concessions or leases for fossil fuel production on lands and waters owned by the government; removal of subsidies for fossil fuel exploration and production; a new tax on fossil fuel production, with a fraction of proceeds devoted to enabling a fair, orderly transition among affected communities; and new requirements in environmental review processes to ensure that new fossil fuel supply infrastructure is consistent with the temperature goals of the Paris Agreement.

While it may seem farfetched to propose that a country would voluntarily give up the right to extract fossil fuels, some nations have already taken steps to limit fossil fuel supply. For instance:

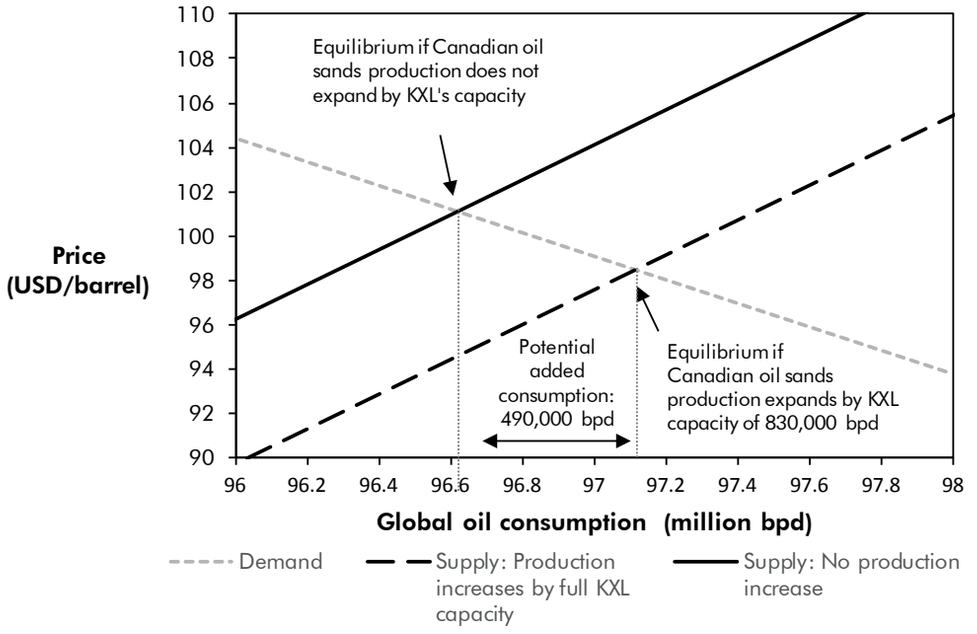
- India's cess on coal production, which taxes locally produced and imported coal at a rate of INR 400 [or about USD 6] per tonne (Sinha 2016);
- China's shuttering of outdated coal mines (Xinhua 2017);
- Costa Rica's moratorium on oil exploration and extraction (Kane 2014);
- The French Government's planned moratorium on new oil and gas exploration licenses (Bamat 2017);
- Ireland's divestment of coal, oil and gas investments from the Ireland Strategic Investment Fund (Osborne 2017); and
- Sweden's largest national pension fund divesting from fossil fuel companies that violate the Paris Agreement (Fouche 2017).

Actions that restrain fossil fuel supply, such as these, can have tangible effects on carbon dioxide ($CO_2$) emissions, and reduce the cost of attaining specific climate targets (see Box 2). Perhaps more importantly, articulating fossil fuel pathways and actions can have broader effects on how the problem of climate change is framed and understood, which ultimately could help increase the ambition of the Paris Agreement. This rationale, which builds on the central functions of the UNFCCC itself, is described in the next section.

## Box 2: How reducing fossil fuel supply can reduce $CO_2$ emissions

Efforts to constrain fossil fuel supply can reduce $CO_2$ emissions through the economics of supply and demand. At the most basic level, reducing supply of a fossil fuel means there is less of it available to combust, which leads to fewer $CO_2$ emissions. How fuel markets respond can be more complicated, however, and is often described and modelled using micro-economic principles. That is, when fossil fuel development is constrained, the supply of fuels (and competition among producers) is diminished, prices increase, and consumption of that fuel drops; consumers, for instance, buy (or drive) more efficient vehicles (Perloff 2007).

The "net", or incremental effect on $CO_2$ emissions, therefore depends on how both consumers respond to price and how much of the forgone supply is replaced by other producers. The chart below shows these relationships, using the example of the decision to build or reject the Keystone XL (KXL) pipeline, which would connect the Canadian oil sands to markets in the U.S. Gulf of Mexico. If the pipeline is built, and oil sands production expands by a corresponding amount (830,000 barrels per day), then the global supply of oil would shift to the right; both the added net consumption (490,000 bpd) and the displaced oil (340,000 bpd) no longer produced by a "marginal" oil producer can be inferred from the chart.




*Source: Erickson and Lazarus (2014)*

In addition to these incremental $CO_2$ emission effects related to supply and demand, constraining fossil supply can have other complementary benefits. Supply-side policies can help lower the cost of a given unit of $CO_2$ emissions abatement, because in some national contexts it may be more cost-effective to pursue a combination of supply- and demand-side policies, rather than demand-side actions alone (Fæhn et al. 2017). Or, as Green and Denniss (2017) recently put it, working on both supply and demand together helps policy-makers "cut with both arms of the scissors" to more cost-effectively reduce $CO_2$ emissions. Limiting fossil fuel production can also help avoid an over-supply of fossil fuels and the associated carbon lock-in of energy infrastructure and political systems that makes it more difficult and expensive to transition away from fossil fuels at a later date (Erickson et al. 2015). Lastly, supply-side action is more easily understood by the public, due to the tangible nature of fuels and fossil fuel projects versus the more-diffuse nature of $CO_2$ emissions. It thus has the potential to make climate change mitigation policies more accessible.

## 3. WHY ARTICULATING FOSSIL FUEL PATHWAYS AND ACTIONS COULD AID AMBITION AND EFFECTIVENESS

The UNFCCC serves several purposes related to the international response to climate change. Among them are the critical functions of aiding countries in agreeing to long-term global targets, recording contributions from each country, and reporting on the actions undertaken to address climate change. But even as the UNFCCC is the venue for these particular country-to-country negotiations, the institution also interacts, directly and indirectly, with society at large. Countries with strong social mandates for climate action can take more ambitious positions within the negotiations. Likewise, the way countries within the UNFCCC communicate the successes and failures of the negotiation process may shape how climate change, and climate action, is perceived by society.

In this section, we describe how country action within the UNFCCC helps shape the narrative about climate change and, in turn, how that action helps create a social mandate for increased ambition. Specifically, we discuss processes through which the articulation of a pathway away from fossil fuels could enhance ambition, and thereby help to meet the overall goals of the Paris Agreement. These are:

1. Providing recognition for actions by individual countries to move away from fossil fuels;
2. Fostering norms and intensifying moral pressure for action on climate;
3. Clarifying and strengthening signals to financial markets about a transition away from fossil fuels; and
4. Supporting a just transition for communities with a strong stake in the fossil fuel economy.

We describe each in more detail below.

### 3.1 Recognizing action by individual countries to move away from fossil fuels

Reporting actions to the UNFCCC (and by virtue, to other nations) helps those actions get recognized as aiding global climate mitigation efforts. While several processes exist under the Paris Agreement for countries to communicate pledges and plans, and report on their progress – such as NDCs, LTSs, annual GHG inventories and biennial reports – there is no explicit guidance for nations to report on plans or activities relating to fossil fuel extraction or production. Theoretically, nothing prevents any country from submitting information to the UNFCCC related to fossil fuel supply (such as the hypothetical example in Section 2, or through less formal means such as national communications). However, in the absence of clear guidance, or an explicit call to include information on fossil fuel supply, there are very few incentives for Parties to provide information on supply-side actions planned or taken and, subsequently, for such actions to gain recognition.

Recognizing Parties' actions on fossil fuels at the international level serves several purposes. It provides a public signal of the nation's climate commitments, which enables debate and discussion about whether such commitments are fair and ambitious. It may help reduce the chances of policies being overturned, because policies become official commitments, and thus are harder to walk away from without harming the nation's reputation (Guzman 2005). It communicates plans to other countries, facilitating reciprocity among states (Creamer and Simmons 2016). And it may facilitate financial, technological, and capacity-building support for such actions.

### 3.2 Fostering norms and intensifying moral pressure

One of the key roles of the UNFCCC is to promulgate norms about how nations should respond to climate change (Cass 2005; Cass 2006; Green 2016). The UNFCCC helps to set the bar for

climate action through the text included in agreements, decisions by governing bodies, reporting mechanisms, and the discourse at international forums. If consideration of fossil fuel extraction and production is missing from discussion and documentation at the international level, it becomes easier for it to be ignored at the national level as well. The UNFCCC can help normalize the idea that transitioning away from fossil fuel extraction and production is a necessary part of climate policy, by highlighting the actions nations are already taking, and providing opportunities for social learning about policies to limit fossil fuel development (cf. Haas 2000).

UNFCCC meetings also provide an opportunity for nations and civil society actors to exert moral pressure on each other to meet goals and adhere to previously agreed commitments. Nations can exert peer pressure on each other through diplomatic processes, or "naming and shaming" bad actors. In terms of limiting fossil fuel supply, Collier and Venables (2014) argue that directed pressure on a small group of nations (e.g. major coal producers) would provide the "moral force needed to mobilize collective international action" (p.492) to keep fossil fuel supply in line with climate goals.

Moral pressure can also be exerted by non-state actors, such as environmental organizations, religious leaders, indigenous peoples, and business and industry actors calling for action both domestically and internationally (Nasiritousi et al. 2016; van Asselt 2016). For example, since 1999, the Climate Action Network has awarded a "Fossil of the Day" award to nations obstructing progress at the annual Conference of Parties (COP) meetings (CAN 2017); this provides moral pressure by "naming and shaming" bad actors.

The UNFCCC has been relatively open to letting non-state actors exert moral pressure, allowing accredited observer organizations to attend its meetings and organize side events. Members of the UNFCCC Secretariat have also lent their "moral authority" to movements seeking to limit fossil fuels, such as the divestment movement. For instance, former UNFCCC Executive Secretary Christiana Figueres has made public statements calling for universities and faith groups to divest from fossil fuels (Figueres 2014a; Figueres 2014b), and the official UNFCCC Twitter account has supported the divestment movement (Carrington 2015). Intensifying moral pressure from both state and non-state actors can be a key tool for ratcheting ambition to help meet Paris goals.

### 3.3 Clarifying and strengthening signals to financial markets

In the days and weeks following the negotiation of the Paris Agreement, observers noted that the Agreement's long-term emissions goals sent a strong signal to investors and financial markets (Davenport 2015; Vidal and Vaughan 2015), and even that the Paris climate targets were the "nail in the coffin for global coal" (Hulac 2015). A post-Paris survey of predominantly energy and infrastructure investors confirmed these initial sentiments, finding that the Agreement's long-term emissions goal, transparency framework, and individual country NDCs for emission reductions were important for creating a favourable investment climate for low-carbon technologies (Sandalow et al. 2016). These findings indicate the importance of the UNFCCC as a signal to investment markets.[2]

Still, investors have noted that the strongest signals to financial markets will come from the details of how countries plan to implement their targets; especially important will be the domestic laws and policies that will be adopted and the long-term plans for decarbonizing the economy (Sandalow et al. 2016). Furthermore, a much greater shift from "brown" to "green" finance is needed to meet the Paris Agreement's long-term goal of net zero emissions by mid-century and

2 Though not necessarily directly related to the Paris Agreement or the UNFCCC, at least three major coal companies – Peabody, Arch Coal, and Alpha Resources – filed for bankruptcy protections in the few months surrounding the December 2015 Paris Agreement, and the International Energy Agency reported "buoyant" trends for investment in renewable power (IEA 2016b), suggesting that capital markets may be shifting from so-called "brown" to "green" finance (Climate Transparency 2016).

its 2°C temperature target (IEA 2016b). There also is a risk that investors may still "misread" the magnitude and ambition of the needed low-carbon transition, over-investing in fossil-based technologies and thereby undermining the chances (and increasing the costs) of limiting warming to 2°C (IEA 2015, p.156).

Together, these trends suggest that investors, too, could benefit from clearer, predictable national policy frameworks that help the market anticipate, and adjust to, the 2°C transition, including by scaling back investment in fossil fuels over time (Carney 2016). By providing a venue for more clearly articulating fossil fuel phase-down trajectories, the UNFCCC could aid in producing a stable, predictable, investment pathway.

### 3.4 Supporting planning for a just transition

UNFCCC meetings have long been a space for examining questions of fairness and justice in terms of climate change contributions and impacts. The UNFCCC can continue to fulfil a similar role as a space for nations to explore the tensions associated with a planned, or managed, decline in fossil fuels.

Transitioning away from fossil fuels raises a number of questions about equity and justice for those who rely on fossil fuel extraction for their livelihood, or who were anticipating using fossil-fuelled energy to meet development needs (Kartha et al. 2016; Kartha et al. 2017). With a limited remaining "carbon budget" for fossil fuel development, important questions need to be answered about who gets to extract remaining reserves, and how to support those who forgo extraction. A number of factors could feed into this decision-making process, including the carbon-intensity of different fuels, the number of jobs at risk, the capacity to meet development priorities without extraction, and historical gains from extractive industries. Determining a fair distribution among countries of remaining fossil fuel extraction, if possible at all, would require consideration of all of these factors. UNFCCC meetings seem the appropriate international venue for ongoing planning for a just transition, as we will outline further in Section 4.

## 4. COMPONENTS OF THE PARIS AGREEMENT THAT COULD ADDRESS FOSSIL FUEL SUPPLY

The prior sections have shown, in broad terms, how and why countries could use the UNFCCC to communicate plans for phasing down fossil fuel production. This section discusses the Paris Agreement in detail, showing how fossil fuels could be integrated into various components of the Agreement.

Though there is nothing currently preventing nations from discussing fossil fuel extraction in the context of the Paris Agreement, there is also no clear link made in the text between climate change goals and fossil fuel development. As long as fossil fuel supply is not explicitly tied to climate change, some producers can be "strategically ignorant" about the impact of extracted fuels on GHG emissions, or the pace of change necessary to ameliorate climate impacts (McGoey 2012; Rayner 2012).

Here, we discuss specific mechanisms of the Paris Agreement through which the need to limit fossil fuel supply can be addressed. We include both formal commitments and reporting requirements called for in the Agreement, as well as actions that could be taken by the UNFCCC Secretariat and Parties in response to specific provisions in the Paris Agreement. We discuss components of the Agreement in four categories: mitigation; accounting, reporting and

review; finance; and additional support mechanisms. In each category, we identify a number of places where the UNFCCC Secretariat and Parties to the Paris Agreement could embed action on fossil fuel supply within existing frameworks and frameworks currently being developed. A summary of all the areas of the Agreement where we identify fossil fuel implications is provided in Table 2.

### 4.1 Mitigation

One of the key roles of the UNFCCC is setting the global agenda for climate change mitigation. Here we discuss four elements of the Paris Agreement related to setting mitigation goals (both internationally and at the country-level): the global goal to keep warming well below 2°C and the pursuit of limiting warming to 1.5°C; the requirement for NDCs; the request for nations to develop LTSs; and the so-called "response measures" track of the UNFCCC.

#### *Holding temperature increase to "well below 2°C"*

While the Paris Agreement does not explicitly call for a transition away from fossil fuels, it sets goals for limiting temperature rise that necessitate deep reductions in fossil fuel use and production. The Agreement calls for nations to hold "the increase in global temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit temperature increase to 1.5°C above pre-industrial levels" (UNFCCC 2015b; Article 2.1), as well as to "achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (UNFCCC 2015b; Article 4).

Modelling suggests that, barring large-scale adoption of carbon capture and storage (CCS),[3] these goals require a radical reduction in fossil fuel consumption (Peters 2016; Rogelj et al. 2015; Rockström et al. 2017). This implies that significant portions of the world's fossil fuel reserves will have to remain unburned to keep within a 'global carbon budget'[4] that is consistent with a "well below 2°C" target (McGlade and Ekins 2015).

The goal to keep warming "well below 2°C" therefore provides the rationale for the UNFCCC to pursue a global transition away from fossil fuels. It also provides a measuring stick against which this transition can be monitored. For instance, a mapping of fossil fuel phase-down pathways could be included in the forthcoming Intergovernmental Panel on Climate Change (IPCC) special report on the 1.5°C warming goal. The UNFCCC Secretariat, Parties, and non-state observers could then use IPCC scenarios to track alignment of global fossil fuel development with a 1.5 to 2°C warming goal over time.

#### *Nationally determined contributions (NDCs)*

The Paris Agreement calls for Parties, in aggregate, to "reach global peaking of greenhouse gas emissions as soon as possible … and to undertake rapid emissions reductions thereafter in accordance with best available science" (UNFCCC 2015b; Article 4.1). Accordingly, all Parties are required to communicate their commitments towards reducing emissions through NDCs

3 The feasibility of using large-scale CCS to meet climate goals has been questioned for a number of reasons, including the cost, slow uptake, social acceptability, and potential technological risks. Anderson and Peters (2016) suggest it constitutes a "high-stakes gamble" and a "moral hazard" to rely heavily on levels of CCS deployment that are not yet proven feasible. Kartha and Dooley (2016) echo this concern, arguing that reliance on unproven technologies could leave society "stranded with an insufficiently transformed energy economy and a carbon debt that cannot be repaid" (p.22).

4 The Intergovernmental Panel on Climate Change (IPCC) estimates that to have a "better than average" chance of avoiding a 2°C temperature rise, cumulative emissions need to be limited to 870-1,240 Gt CO2 between 2011-2050 (IPCC 2014; McGlade and Ekins 2015). This figure can be considered the 'global carbon budget'. Early drafts of the Paris Agreement proposed using a global carbon budget as a means of operationalizing mitigation goals, but this was dropped in the final revisions (Yeo 2015).

every five years. There is a good deal of flexibility in the scope and contents of NDCs. The Paris Agreement is not overly prescriptive, only stating that developed nations should submit "economy-wide absolute emissions reduction targets", while developing nations should continue enhancing their mitigation efforts, with a goal of moving over time "towards economy-wide emissions reduction or limitation targets" (UNFCCC 2015b; Article 4.4). Likewise, the information to be communicated alongside NDCs at present still leave significant room for discretion (UNFCCC 2015c; Paragraph 27). Together, NDCs should add up to a combined, international effort capable of limiting warming to well below 2°C, though evidence suggests that existing contributions are not yet sufficient to meet this goal (UNFCCC 2016b; UNEP 2016).

At present, fossil fuel supply is not a central focus of most NDCs, though some countries do communicate measures that would constrain fossil fuel development. For example, India includes discussion of its coal cess (tax) on extracted and imported coal in its NDC. However, this is the exception rather than the norm. An examination of the NDCs from the top ten fossil-fuel-producing nations (Table 1) reveals that for the most part, they discuss fossil fuel extraction in terms of the impacts of climate mitigation measures on fossil-fuel-dependent economies, or future plans to make the industry greener or more efficient.

Table 1 shows that India is the only nation in the top ten fossil producing countries that mentions a policy that constrains supply or disincentivizes fossil fuel production in their NDC (via a coal tax). Three fossil-fuel-producing nations (Russia, Indonesia and Australia) are completely silent on the topic of fossil fuel supply in their NDCs. The remaining six nations present fossil fuel supply activities as mitigation opportunities (e.g. enhanced coal-bed methane recovery, or increasing gas production) and/or discuss the impact of climate policies on their economies (and the subsequent need for economic diversification or consideration within the "response measures" track of the UNFCCC). This table, while covering only the top producers, highlights the significant scope for NDCs to more explicitly and comprehensively address fossil fuel production and the steps needed to prepare for its ultimate decline.

Nations could embed supply-side strategies in their NDCs in a number of different ways. Alongside their emissions reduction targets, nations could include fossil fuel production phase-down targets (see the hypothetical example in Section 2). In addition, countries could include commitments to constrain investment in fossil fuel supply, such as by pledging to remove subsidies to fossil fuel producers (van Asselt and Kulovesi 2017). Within their description of mitigation activities, Parties could also include measures such as moratoria on new fossil fuel infrastructure or taxes on fossil fuel exports. Nations could also discuss policy measures to ensure a just transition for extractive-industry workers, such as job-retraining programs.

In some cases, nations are already undertaking these actions, but have not included them in their NDCs; for example, China and Indonesia issued temporary moratoria on new coal mines (Indonesia Investments 2016; Aibing and Yang 2015). The UNFCCC Secretariat, or related agencies who provide support to nations preparing NDCs (such as the UN Development Programme and GIZ), can help normalize the inclusion of supply-side policies in NDCs. They could make fossil fuel supply an explicit part of guidance documents on NDC development, and feature fossil fuel supply strategies as a separate category in synthesis reports of NDCs (such as UNFCCC 2016b).

**Table 1: Inclusion of fossil fuel supply in NDCs for the ten largest fossil fuel producers[5]**

| Country | $CO_2$ Emissions profile (million tonnes $CO_2$) | | Fossil fuel extraction explicitly discussed in NDC | Context in which fossil fuel extraction is discussed in the NDC | | | |
|---|---|---|---|---|---|---|---|
| | Territorial fossil fuel emissions | Extraction-based emissions (see Box 3) | | Policies limiting fossil fuel supply | Economic diversification | Impacts of response measures | Other statements related to fossil fuel extraction |
| **China** | 9135 | 8095 | Y | | | | Reach 30 billion cubic meters of coal-bed methane production.<br>Enhance oil and coal-bed methane recovery. |
| **USA** | 5176 | 4848 | Y | | | | Address methane emissions in the oil and gas sector. |
| **Russia** | 1468 | 3261 | N | | | | |
| **Saudi Arabia** | 507 | 1639 | Y | | Plans to diversify the economy away from heavy reliance on income generated from a single resource [oil]. | Socio-economic and technological research on response measures to understand impacts and increase resilience. Aim is to achieve a growth of domestic industries that exceeds the loss of revenue from oil export. | Ambitions contingent on a robust contribution from oil export revenues to the national economy.<br>Increase natural gas production.<br>Pilot test $CO_2$ enhanced oil recovery.<br>Methane recovery. |
| **Indonesia** | 437 | 1358 | N | | | | |
| **Australia** | 374 | 1294 | N | | | | |
| **India** | 2020 | 1228 | Y | Cess [tax] on coal: INR 200 (USD 3.2) per tonne of coal extracted or imported. | | | List of illustrative mitigation technologies includes underground coal gasification. |
| **Canada** | 555 | 1017 | Y | | | | Reduce methane emissions and improve energy efficiency in the oil and gas sector |
| **Iran** | 556 | 825 | Y | | | Dependence on revenues from oil production and exports have made the country vulnerable to mitigation of GHG emissions. | Availability of hydrocarbon resources have made national development rely on energy-intensive industries. These have made upward trend of GHG emissions inevitable. |
| **Qatar** | 78 | 558 | Y | | Enhance the diversification of the economy away from hydrocarbons | Due to dependence on the export of oil and gas, response measures may negatively impact the strength of economy and potentially quality-of-life of residents. | Hydrocarbon extraction contributes to the economic and social growth of the state.<br>Qatar has been exporting Liquefied Natural Gas as a clean energy. |

5 The largest fossil fuel producing nations were selected by taking the top five oil, gas, and coal producers from the 2016 BP Statistical Review of World Energy, which summarizes 2015 production data (https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf).

NDCs were sourced from the UNFCCC NDC registry (http://www4.unfccc.int/ndcregistry/Pages/All.aspx) using the most recently uploaded version on 6/6/17, except Russia, Iran, and Qatar, which were sourced from the UNFCCC INDC database (http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx) because they had not ratified the Agreement at the time of writing.

Territorial fossil fuel $CO_2$ emissions were sourced from the 2016 IEA Emissions from Fuel Combustion (http://www.oecd-ilibrary.org/statistics), using the latest year available at the time of writing (2014).

Extraction-based emissions estimates were calculated using the amount of fossil fuels produced in each nation from the 2016 BP Statistical Review of World Energy (2014 data to match consumption statistics: https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf). From these fossil fuel production statistics, eventual $CO_2$ emissions were estimated based on standard IPCC carbon contents (Vol 2; Table 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html), adjusted to account for the average portion of each fuel that goes to non-energy uses (and assumed not combusted), using 2014 data from the 2016 World Energy Balances (http://www.oecd-ilibrary.org/content/serial/25186442).

Statements included in this table were condensed or paraphrased for the sake of brevity.

### *Long-term strategies (LTSs)*

In addition to the requirement for NDCs every five years, the Paris Agreement calls for parties to "formulate and communicate long-term low greenhouse gas emission development strategies" (UNFCCC 2015b; Article 4.19). The development of LTSs is not a binding requirement, and there are no terms of reference for their content. The intention is that nations should develop plans for decarbonizing their economy by 2050, to provide an overarching framework for shorter-term NDCs.

Parties were invited to provide their LTSs to the UNFCCC Secretariat by 2020, and at the time of writing, six countries had already submitted strategies: Benin, Canada, France, Germany, Mexico and the United States (UNFCCC 2017a). An examination of the content of these strategies found that, like NDCs, LTSs focus more on demand-side measures than fossil fuel supply. While all six nations discuss the need to transition away from fossil fuels in their LTSs, no country explicitly mapped out a phase-down of fossil fuel extraction. For example, Germany's LTS takes a strong stance towards reducing fossil fuel supply, calling for a movement away from coal-fired electricity and associated lignite mining, but its LTS stops short of outlining concrete steps to limit fossil fuel extraction. The U.S. and Germany also implicitly acknowledge their intention to phase out fossil fuel production in their LTSs through the discussion of the need to support workers and communities in fossil-fuel-producing regions.

The process of LTS development provides an ideal opportunity for nations to plot out a managed decline in fossil fuels. Nations can incorporate trajectories for fossil fuel production and investment in their LTSs that are consistent with a 2°C goal. This could form the basis for a "climate test", where proposed fossil fuel infrastructure is assessed against national commitments and development trajectories (Oil Change International et al. 2016; Erickson 2017). As an illustrative example of what this may entail, the U.S. government previously considered how it could track and limit the provision of federal coal leases against a 2°C target (BLM 2017). A similar approach could be incorporated into LTSs for different types of fossil fuel reserves within a given country.

### *Impacts of response measures*

The Paris Agreement acknowledges that some measures taken to reduce emissions (known as "response measures") may have negative social and economic impacts. The Agreement therefore calls for Parties to "take into consideration in the implementation of this Agreement the concerns of Parties with economies most affected by the impacts of response measures, particularly developing country Parties." (UNFCCC 2015b; Article 4.15).

Historically, the "impacts of response measures" have been heavily promoted by oil-producing countries, who have expressed concern about the implications of a movement away from fossil fuels on their economies, and have been known to resist stronger climate action (Chan 2016; Depledge 2008). More recently, the focus of the "response measures" track has begun to shift, as labour unions have joined deliberations, calling for consideration of the impacts on workers in extractive industries, and the need to plan a transition towards cleaner jobs (ILO 2015; ITUC 2015).

To help address these concerns, the UNFCCC negotiations established a Forum on the 'Impact of the Implementation of Response Measures'. The Forum developed a work program focusing on two areas: "economic diversification and transformation" and "just transition of the workforce, and the creation of decent work and quality jobs" (UNFCCC 2015a). The notion of a "just transition" is also included in the preamble to the Paris Agreement, which recognizes "the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities" (UNFCCC 2015b).

The "response measures" track provides a space for planning the transition away from fossil fuels. Indeed, the first UNFCCC technical report on "just transitions" acknowledges that the Paris Agreement implies the decline of the fossil fuel industry, stating that "climate policies will need to bring about a fundamental change in the global energy mix in coming years and decades. The result will be further job losses in the fossil fuel sector – in coal mining, in exploration and production of oil and gas, and at fossil fuel-powered power plants*"* (UNFCCC 2016a, p.31).

The open acknowledgement that meeting Paris goals will lead to a decline in jobs within the fossil fuel sector is an important first step. The next challenge is ensuring that this decline proceeds in an equitable fashion. There are a number of unanswered questions regarding an equitable decline in fossil fuels, such as how to prioritize any fuels that fit within the remaining carbon budget, and how to support nations transitioning away from extractive economies (Kartha et al. 2017). The improved forum on response measures seems the appropriate space within the UNFCCC for addressing such questions.

### 4.2 Accounting, reporting, and review

To track progress against global goals, the Paris Agreement also includes provisions for monitoring, reporting and review of national climate action. In this section, we discuss how fossil fuel supply is accounted for in the Paris regime, and how fossil fuels could be incorporated in the "enhanced transparency framework," a key component of the Paris Agreement to track national actions. We also discuss how this can feed into an ongoing "global stocktake" of international action.

#### *Accounting for nationally determined contributions*

The Paris Agreement calls for Parties to "account for their nationally determined contributions … in accordance with guidance adopted by the Conference of the Parties" (UNFCCC 2015b; Article 4.13). The decision accompanying the Agreement specifies that accounting should follow the "methodologies and common metrics assessed by the [IPCC]" (UNFCCC 2015c; Paragraph 31).

Greenhouse gas emissions are currently accounted for under the UNFCCC using a production-based or territorial accounting framework. Emissions from fossil fuels are counted in the nation where they are released, such as when fuels are combusted for power generation or transport. Countries report emissions in the form of national inventory reports. National inventories are typically compiled following the guidance of the IPCC, which breaks domestic emissions into five categories: energy; industrial processes and product use; agriculture; forestry and other land use; and waste (IPCC 2006). A territorial approach therefore rewards actions that reduce emissions domestically, but does not recognize actions that might reduce emissions offshore (such as restricting fossil fuel exports). Thus, the existing framework gives no credit to nations who export fossil fuels if they limit the supply. An alternative accounting framework based on extraction-based emissions (see Box 3) would help ensure that such efforts are reflected in national accounts.

Establishing a standardized methodology and capacity for territorial emissions accounting has been a long, iterative process. Rather than displacing this territorial framework, an extraction-based accounting system could be established in parallel to monitor the alignment of fossil fuel supply with climate goals. As a first step, nations who are already considering restricting fossil fuel supply could begin accounting for their extraction on a voluntary basis. At the same time, the IPCC could develop standards for extraction accounting, and collect baseline data on existing and planned fossil fuel extraction. This would lay the foundation for more comprehensive tracking of extraction-based emissions in the future, as ambition rises to meet global climate targets.

**Box 3: Extraction-based emissions accounting**

Alternative models for national GHG accounting exist that examine emissions through different lenses, beyond the IPCC's territorial accounting approach. For instance, consumption-based accounting attributes emissions that occur during production to the countries that consume the resulting goods and services (Davis and Caldeira 2010). Income-based accounting attributes emissions to countries along the supply chain in proportion to the value they add in production, or their contribution to income earned (Steininger et al. 2016). An extraction-based framework attributes emissions to the country that extracts the fossil fuels that will ultimately be responsible for downstream emissions (Davis et al. 2011; Erickson and Lazarus 2013). The attribution of emissions to countries varies widely based on the type of accounting framework chosen (Steininger et al. 2016; Peters et al. 2012).

For the purposes of tracking emissions generated from fossil fuel supply, extraction-based accounting makes the most sense. Extraction-based accounting involves determining how much fossil fuel has been extracted in a given region, multiplying this amount by the carbon content of each fuel extracted, and then adjusting for the fraction of fossil fuels that will not be combusted because it ends up contained within a product, such as plastics (Davis et al. 2011; Heede 2013).

There are a number of virtues associated with an extraction-based accounting framework. First, it is relatively simple to calculate extraction-based emissions using the formula outlined above. Second, data are often readily available, as national governments and fossil fuel producers frequently collate data on their extraction activities for economic reasons. Finally, fossil fuel deposits are mostly concentrated in a few large economies, so a simpler accounting system can be used to track a larger proportion of emissions than in other accounting frameworks. However, extraction-based accounting does have some blind-spots (such as non-fossil fuel emissions, e.g. methane from agriculture or waste). Furthermore, it does not solve (or even simplify) the question of relative responsibility for reducing emissions (or fossil fuel production). This is because the countries that have greater fossil resources are not necessarily those with greater responsibility for climate change. Still, as no one system of accounting can capture all of the dimensions of a phase-out of fossil-based GHG emissions, extraction-based emissions accounting offers an important, complementary perspective. Pursuing multiple forms of emissions accounting at the same time can help overcome the limitations inherent in any single method (Steininger et al. 2016).

### *Enhanced transparency framework*

The Paris Agreement states that "in order to build mutual trust and confidence and promote effective implementation, an enhanced framework for transparency and support" will be created (UNFCCC 2015b; Article 13.1). At present, details of the transparency framework are still under negotiation; however, the Agreement does spell out some features. In particular, it calls for Parties to provide "a national inventory report of anthropogenic emissions" using methods specified by the IPCC (see previous section), as well as "information necessary to track the progress made in implementing and achieving its national determined contribution" (UNFCCC 2015a; Article 13.7). It further suggests that some developing countries will have more flexibility in light of their capacities.

Negotiations under the Ad Hoc Working Group on the Paris Agreement are developing common modalities, procedures and guidelines by the end of 2018; these form an important aspect of strengthening transparency on mitigation, adaptation, finance, technology transfer, and capacity building (Winkler et al. 2017). The issue of accounting for actions that fall outside existing national inventories will likely be discussed during negotiations on the new transparency framework, because countries have proposed a variety of non-GHG emissions targets in their NDCs. Such targets, for instance, include reducing short-lived climate pollutants (e.g. black carbon), and increasing renewable energy production or energy efficiency (Levin and Finnegan 2013; Hood et al. 2014; van Asselt et al. 2016; Briner and Moarif 2016). A framework that is flexible enough to incorporate these diverse targets could also accommodate tracking a phase-down of fossil fuels.

As no country has yet set goals to limit fossil fuel supply in their NDC, this opportunity may be missed in the development of the new framework. It is therefore important to provide sufficient flexibility so that new, more ambitious goals (such as restricting new extraction) could be reported (and subsequently reviewed).

In addition to reporting, the Paris Agreement calls for information submitted under the transparency framework (i.e. national inventory reports and biennial reports on progress made towards NDCs) to "undergo a technical expert review" as well as a "facilitative, multilateral consideration of progress" (UNFCCC 2015b; Article 13.11 and 13.12). One way to help mainstream national actions on fossil fuel supply restriction is for Parties to nominate experts to the UNFCCC's roster of technical reviewers who can provide knowledge and support regarding fossil fuel production, its impact on global emissions, and policies to support just and orderly transitions. Alternatively, Parties could provide appropriate training in this area for existing expert reviewers. Parties can also ensure during negotiations that the mandate for reviewers includes explicit consideration of these measures.

### *Global stocktake and facilitative dialogue*

The transparency framework is expected to feed into a "global stocktake", which will assess "collective progress towards achieving the purpose of [the] Agreement and its long-term goals" (UNFCCC 2015b; Article 14.1). The process of tracking alignment of national efforts with global long-term goals begins with a "facilitative dialogue" in 2018, and will continue with a "global stocktake" starting in 2023 and held every five years thereafter. As with other elements of the Agreement, the details of the global stocktake are still to be determined. For instance, beyond a few broad categories of information sources (e.g. IPCC reports; see UNFCCC 2015c; Paragraph 99), it is not yet clear what types of information will be gathered and assessed. The ultimate form of the stocktake will dictate the types of data that Parties should ideally report under the transparency framework.

The global stocktake could include tracking fossil fuel extraction as one set of actions working toward a 1.5°C or 2°C target, which would help illuminate which fossil fuel reserves could be utilized in the future while still meeting Paris Agreement goals. Models exist for this type of analysis on a global scale. For instance, McGlade and Ekins (2015) have mapped out the regional distribution of reserves that are "unburnable" in a 2°C warming scenario, and the IEA's annual *World Energy Outlook* estimates regional fossil fuel production under low-carbon scenarios. The five-yearly stocktakes would provide an opportunity to revisit the assumptions of models, and determine where declines in extraction are most needed to keep temperatures below targets. Information for a stocktake of a fossil fuel phase-down could come directly from Parties, through scientific assessments like the IPCC's Assessment Reports, or from non-state actors tracking national commitments.

## 4.3 Finance

The Paris Agreement addresses climate change mitigation finance in several places. That includes a headline goal to keep finance flows consistent with a pathway towards low greenhouse gas emissions, the creation of a mechanism for the international transfer of mitigation outcomes, and the reiteration of the need – as expressed by the UNFCCC – for developed nations to provide financial support to developing nations. Here we discuss how finance reforms could be used to drive a transition away from fossil fuels.

### *Finance flows consistent with a low-GHG pathway*

One of the headline goals of the Paris Agreement is to make "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (UNFCCC 2015b; Article 2.1). This goal has major implications for investment in the fossil fuel industry. At present, energy investment is heavily weighted towards fossil fuels. The IEA estimated that in 2015, over

three-quarters of energy investment remained in fossil fuels, amounting to more than 1 trillion US dollars (IEA 2016a). The situation is compounded by fossil fuel subsidies provided by governments around the world, which amount to hundreds of billions of dollars annually (OECD 2017, p.196) and which increase fossil fuel investment and production (Erickson et al. 2017). Bringing finance flows in line with a "pathway towards low greenhouse gas emissions" requires reforming these subsidies, and more generally, reducing investment in fossil fuel infrastructure.

There are a number of ways that investments in fossil fuel supply could be addressed within the framework of the Paris Agreement. First, Parties could agree to high-level goals that align fossil fuel financing with the "well below 2°C" warming goal, such as a global agreement to phase down fossil fuel subsidies (van Asselt and Kulovesi 2017) or a commitment to exclude fossil fuel infrastructure from eligibility for climate finance (Bodnar et al. 2017). Progress could be tracked either by the UNFCCC Standing Committee on Finance, or alternatively by non-state actors outside the UNFCCC, and assessed in the five-yearly global stocktake. Second, Parties can make individual commitments to align their public financing with global climate goals in their NDCs. For example, thirteen countries have already committed to fossil fuel subsidy reform in their NDCs (Terton et al. 2015). Third, the UNFCCC Secretariat and other supporting bodies could help Parties who want to undertake finance reform access technical expertise, either through capacity building, or by holding technical expert meetings (TEMs) on reforming financial support for fossil fuels (van Asselt and Kulovesi 2017). Inviting experts to present at UNFCCC TEMs would help build the knowledge base for mitigation strategies focused on limiting fossil fuel supply. In doing so, the UNFCCC could build on the work of other forums and international organizations, such as the G20 and G7, who have committed to phasing out inefficient fossil fuel subsidies (Merrill et al. 2017), or the OECD and IEA, which compile detailed information on countries' subsidies on an ongoing basis.

### *Mechanism for international "transfer of mitigation outcomes"*

The Paris Agreement provides a means for countries to support mitigation measures outside their borders to meet their emissions reduction targets, through the use of internationally transferred mitigation outcomes (ITMOs) (UNFCCC 2015b; Article 6.2). Under this framework, countries can voluntarily cooperate to undertake mitigation activities outside their borders, and use this to demonstrate progress towards their NDC, as long as the actions are not double counted by both countries.

The concept of "net avoided emissions" is one way that countries could create certifiable ITMOs focused on restricting fossil fuel supply. Namely, countries could be granted emissions credits for ceasing fossil fuel exploration and extraction and could then transfer those credits to other nations (Köhler and Michaelowa 2014). The Ecuadorian government suggested such a mechanism following the launch of its now-defunct Yasuní ITT initiative (Republic of Ecuador 2011). Under the initiative, the Ecuadorian government asked the international community to compensate them for abstaining from extraction in portions of the Yasuní National Park (Larrea and Warnars 2009). However, the Yasuní ITT initiative ultimately failed to generate the requested funding from the international community, and the Ecuadorian proposal for a "net avoided emissions" market mechanism under the "framework for various approaches" did not gain traction within the UNFCCC (Sovacool and Scarpaci 2016).

The idea of crediting forgone resource extraction activities has historical precedent in the UNFCCC. The concept of "reducing emissions from deforestation and forest degradation" (REDD+) similarly focuses on avoiding rather than reducing emissions, in this case from deforestation rather than fossil fuel extraction. There are a number of challenges associated with avoided deforestation through REDD+, such as determining what is beyond "business as usual" (additionality), guaranteeing that avoided activities will not be resumed in the future (permanence), and ensuring that emissions reduced in one region are not displaced elsewhere (leakage). Granting credits

for avoided extraction suffers from all of these challenges, plus some additional concerns. For example, the emission reductions associated with avoided extraction – i.e. decreased fossil fuel consumption due to higher fossil fuel prices – could occur in other countries, where those same emission reductions might be counted towards meeting emission targets or be used to generate other ITMOs. That leads to a serious risk of "double-counting", which the Paris Agreement explicitly seeks to avoid. Furthermore, it could be difficult to determine with sufficient accuracy (for a crediting mechanism) how much fossil fuel extraction would be avoided, given the uncertainty and limited transparency of data on the amount of fossil fuel that would be economical to extract from specific deposits. Given these weaknesses, it appears unlikely that the concept of "net avoided emissions" for extraction could (or should) be translated into a new ITMO mechanism. Nevertheless, financial assistance could help some developing countries with fossil fuel-dependent economies manage the transition, as will be discussed below.

### *Provide financial resources to assist developing countries*

The Paris Agreement stipulates that developed country Parties need to provide financial support to developing countries, recognizing that many nations have limited financial capability to mitigate and adapt to climate change (UNFCCC 2015b; Article 9). In Copenhagen in 2009, developed countries agreed to mobilize USD 100 billion a year by 2020 to support developing countries; the decision adopting the Paris Agreement calls for countries to scale this commitment up over time (UNFCCC 2015c; Paragraph 53). The Agreement also calls for greater transparency in international climate financing (UNFCCC 2015b; Article 9.7), and for funds to be managed through the Green Climate Fund and the Global Environment Facility (UNFCCC 2015c; Paragraph 58). In practice, climate financing for developing countries occurs through a patchwork regime of multilateral, bilateral and private funding sources (Selin 2016).

There are several steps that could be taken to limit investment in fossil fuels, and ensure financing for developing nations remains "consistent with a pathway towards low greenhouse gas emissions". First, developed nations can phase down fossil fuel infrastructure investment in developing nations. Examples abound of development funding being funnelled to fossil fuel infrastructure (notably, Japan has even claimed that several coal projects in Asia count as climate finance) (Chen et al. 2016). This funding locks countries into a development pathway that limits their long-term ability to transition away from fossil fuels (Erickson et al. 2015; OECD 2017). Governments can phase down funding for fossil fuel extraction and exploration in their own bilateral institutions – including overseas aid and export credit agencies – and work to ensure that multilateral institutions make similar commitments (Doukas and Bast 2017).

Second, governments can redirect funding currently used to support fossil fuels to meet international climate finance goals. For instance, annual fossil fuel subsidies represent more than six times the "financing gap" between national pledges and the USD 100 billion goal (Merrill et al. 2017). Redirecting fossil fuel subsidies towards climate financing would have the dual outcome of reducing GHG impacts created by the subsidies, and freeing up funds for low-carbon development.

Finally, funding agencies can support developing countries in accessing finance for transitions away from a fossil fuel economy. For example, "just transition" funds could be established to assist nations who wish to retrain workers in fossil-fuel-dependent communities (Rosemberg 2017). Expanding the scope of funded activities to include mitigation efforts focused on fossil fuel supply is necessary to help nations develop in an appropriate manner for a climate-constrained future.

## 4.4 Additional support mechanisms

The Paris Agreement includes measures to ensure nations are supported (beyond the financial support discussed above) and meet their agreed pledges. Here, we discuss how some of these measures could help normalize activities focused on fossil fuel supply. Specifically, we look at

the additional steps that could be taken to ensure capacity building and enable non-state actors to help limit fossil fuel extraction.

### *Capacity building*

It has long been recognized within the UNFCCC that some nations lack the capacity or the public support needed to implement effective climate strategies. For this reason, the Paris Agreement calls for capacity building and public education on climate change (UNFCCC 2015b; Articles 11 and 12). Capacity-building efforts under the Paris Agreement will be coordinated through the Paris Committee on Capacity Building (PCCB). In addition, there are a wide range of global initiatives set up to help national governments achieve Paris goals, such as the NDC Partnership and the Low Emission Development Strategies Global Partnership.

Capacity-building and education programs are key areas where norms are spread about appropriate climate responses. As such, Parties and the UNFCCC Secretariat could help ensure that capacity-building efforts address the links between fossil fuel supply and climate goals, as well as provide tools and support for nations transitioning away from fossil fuel extraction. Technical and institutional capacity could be developed by assessing the emissions implications of restricting fossil fuel supply, evaluating whether proposed fossil fuel infrastructure is consistent with climate goals, estimating fossil fuel subsidies, designing fossil fuel subsidy reform, and planning workforce transitions. Given that some of these issues only relate to a sub-set of UNFCCC Parties, it may make sense to build a dedicated network for extractive economies to engage in learning on climate change and fossil fuel supply.

### *Participation by non-state actors*

Proactive sub-national governments, businesses, and civil society organizations have long been taking steps to reduce climate change impacts. These actions were formally recognized in the Paris Agreement, where parties were called upon to "enhance public and private sector participation in the implementation of nationally determined contributions" (UNFCCC 2015b; Article 6.8). Non-state actors play multiple roles within the international climate regime, including agenda-setting, raising public awareness, representing marginalized voices, lobbying, providing expert advice, implementing their own climate actions, and monitoring and enforcing Parties' commitments (van Asselt 2016; Nasiritousi et al. 2016).

Non-state actors will undoubtedly play an important role in a managed decline of fossil fuel production. Indeed, it has been non-state actors that have pushed much of the climate action focused on limiting fossil fuel supply so far. For instance, civil society actors have led a global divestment movement, which has resulted in more than 5 trillion dollars of investment being pulled from fossil fuel industries (Ayling and Gunningham 2017; Fossil Free 2017). Research organizations and other non-governmental actors have also been responsible for changing the discourse on climate change mitigation to bring more attention to fossil fuels, providing critical research on "unburnable carbon" and "stranded assets" in a 2°C scenario (Leaton 2011; HSBC 2012). Labour unions have also played a key role in ensuring that global negotiations consider a "just transition" for those affected by the loss of fossil fuel jobs (ILO 2015; ITUC 2015).

Importantly, the commitment to increase public and private sector participation also means that fossil fuel companies have an acknowledged role in meeting Paris goals. This is critical, because a significant portion of global emissions come from the combustion of fossil fuels carried out by a small group of companies (Heede 2013; Frumhoff et al. 2015; Heede and Oreskes 2016). To date, action on climate from these fossil fuel companies has been mixed, with some companies working to undermine climate policies, while others have begun to invest in renewables and address their own emissions (Nasiritousi 2017; Bach 2017). The role for the fossil fuel industry within the Paris framework remains up for debate, with some arguing that the industry has a conflict

of interest in any climate agreement, and others seeing the industry as playing a critical role in achieving Paris goals. This debate will likely intensify if fossil fuel production takes a more central role in the UNFCCC.

The UNFCCC can support non-state actors who are contributing to the transition away from fossil fuels. For example, the UNFCCC could recognize specific supply-side actions in the Non-State Actor Zone for Climate Action (NAZCA – the online portal for registration of non-state activities). At present, categories within NAZCA emphasize demand-side action, with no dedicated category for supply-side initiatives (such as divestment, or initiatives to close coal mines), giving the impression that supply-side efforts are not significant climate mitigation options (UNFCCC 2017b). The UNFCCC could also provide opportunities for non-state actors to contribute to monitoring and ambition-raising mechanisms (such as the global stocktake); civil society actors, for instance, could report on whether their governments' fossil fuel extraction activities align with global commitments.

## 5. RESPONSIBILITIES FOR ADDRESSING FOSSIL FUELS WITHIN THE UNFCCC

In the previous section, we presented a range of ways that a phase-down of fossil fuels could be embedded within the current mechanisms of the Paris Agreement. However, we recognize that the existing structure of the UNFCCC makes some of these actions more feasible than others. We see few barriers (beyond those relating to domestic politics) to individual Parties voluntarily adopting some of the suggested approaches in Section 4, such as reporting fossil fuel production targets within their NDCs. However, actions that require new processes to be developed at the UNFCCC level, or a COP decision, will be more challenging to enact.

The UNFCCC makes decisions by consensus, only adopting new strategies if no one objects. While some of the smaller actions outlined in Section 4 appear to be within the scope of day-to-day operations of the Secretariat (such as adding new categories to the roster of experts, or NAZCA), many are significant enough that they would warrant a consensus by Parties. Within the current political climate, some oil, gas and coal producing nations would likely block efforts to include fossil fuels within the global stocktake or to tie fossil fuel supply to overarching Agreement goals.

How then should nations who are willing to phase down fossil fuels proceed? First, they can lead by example and ensure that their own national efforts reflect their commitment to limiting fossil fuel supply. For instance, they can include measures to address fossil fuel production in their NDCs, map a transition away from fossil fuels in their LTS, and ensure their financial support does not support the ongoing growth of the fossil fuel industry. Second, they can work with other like-minded nations to advocate for the explicit inclusion of fossil fuels in the mechanisms of the Paris Agreement, as outlined in Table 2.

Nations may consider forming dedicated coalitions to address fossil fuel transitions (Weischer et al. 2012). Party coalitions with related interests – such as small island states, least developed countries, and rainforest nations – have worked together throughout the evolution of the climate regime (UNFCCC 2017c), with new coalitions emerging over time, such as the Climate Vulnerable Forum. A similar grouping could be set up for those pursuing a managed decline in fossil fuels. As an example of what such a group could achieve, Collier and Venables (2014) propose that a "coalition of the willing" could work together to phase out coal, the most polluting of the fossil fuels. While there is no reason such a group would need to exist within the auspices of the UNFCCC, tying it to Paris Agreement goals would make more explicit the need for other nations to address fossil fuel supply.

**Table 2: Components of the Paris Agreement that could address fossil fuel supply**

| Elements | Component of the Paris Agreement | Where found in Agreement | Calls for… | Implications for fossil fuel supply |
|---|---|---|---|---|
| **Mitigation** | Hold temperature increase "well below 2°C" and pursue efforts to limit the increase to 1.5°C | Article 2, paragraph 1 | "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C…" | Provides a rationale for the UNFCCC to pursue a transition away from fossil fuels |
| | Nationally determined contributions | Article 4 | *"Each party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions."* | Provides an opportunity for Parties to set targets and communicate efforts to limit fossil fuel supply |
| | Long-term strategies | Article 4, paragraph 19 | "All parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies…" | Provides an opportunity for Parties to plot out a managed declined of fossil fuel production by 2050 |
| | Impacts of response measures | Article 4, paragraph 15 | *"Parties shall take into consideration in the implementation of this Agreement the concerns of Parties with economies most affected by the impacts of response measures, particularly developing country Parties."* | Has led to the creation of a UNFCCC work program focused on "economic diversification" and "just transition of the workforce" |
| **Accounting, reporting and review** | Accounting for nationally determined contributions | Article 4, paragraph 13 | "Parties shall account for their [NDCs]…in accordance with guidance adopted by the Conference of the Parties…" | Could create a parallel and complementary accounting framework for extraction-based emissions |
| | Transparency framework | Article 13 | *"In order to build mutual trust and confidence and to promote effective implementation, an enhanced transparency framework for action and support, with built-in flexibility which takes into account Parties' different capacities and builds upon collective experience is hereby established."* | Could track progress on measures to restrict fossil fuel supply |
| | Global stocktake | Article 14 | "[T]he meeting of the Parties to the Paris Agreement shall periodically take stock of the implementation of this Agreement to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals…" | Could include assessing fossil fuel supply against the 1.5-2°C goals |
| **Finance** | Finance flows consistent with a low-GHG pathway | Article 2, paragraph 1 | *"Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."* | Provides a rationale for reforming fossil fuel subsidies and shifting investment from fossil fuels to lower-carbon infrastructure |
| | International transfer of mitigation outcomes | Article 6, paragraph 2 | "Parties shall, where engaging on a voluntary basis in cooperative approaches that involve the use of internationally transferred mitigation outcomes towards nationally determined contributions…" | Could include crediting for "net avoided emissions" from forgone extraction |
| | Provide financial resources to assist developing countries | Article 9 | *"Developed country parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention."* | Highlights the need for funders to ensure that financial support does not lock countries into pathways that limit their ability to develop low-carbon economies |
| **Additional support mechanisms** | Capacity building | Article 11 | "Capacity-building under this Agreement should enhance the capacity and ability of developing country Parties … to take effective climate change action…" | Could include capacity-building tools and support for Parties transitioning away from fossil fuel extraction |
| | Participation by non-state actors | Article 6, paragraph 8 | "Enhance public and private sector participation in the implementation of nationally determined contributions…" | Could provide support and recognition for non-state actors who are pursuing activities to limit fossil fuel supply |

## 6. CONCLUSION

In this paper we have outlined ways that the UNFCCC can support countries transitioning away from fossil fuels, by building recognition and reporting tools into the existing architecture of the Paris Agreement. We have demonstrated in Section 4 that there are multiple avenues through which restrictions on fossil fuel supply could be embedded within the elements of the Paris Agreement.

The idea of directly addressing fossil fuels within UNFCCC is not new. In fact, some of the first submissions to the Kyoto Protocol called for special consideration of fossil fuel producers, given their unique role in the climate regime (Chan 2016). For those who are familiar with this history, it begs the question: why tackle fossil fuel supply now? Given that securing the Paris Agreement was a hard-fought battle, it might seem prudent to avoid such a politically charged issue. However, we would ask a different question: if not now, when? Current national commitments are expected to lead to a significant overshoot of agreed temperature limits (Rogelj et al. 2016), and countries will soon consider how to enhance their collective ambition. Now may be the ideal time to consider supplemental approaches to attaining that ambition.

Furthermore, in the next few years, some of the Paris Agreement's key features – including those outlined here – will set in place concrete pathways for mitigating climate change. In 2018, countries will undertake a facilitative dialogue to determine whether national commitments are sufficient to meet global goals, and will set the terms for the global stocktake. At the same time, countries will agree on the detailed "rulebook" specifying the structure of NDC, as well as the design of the enhanced transparency framework and the global stocktake. Alongside these efforts, the IPCC will be revising guidelines for national inventories of GHGs. If fossil fuel production is left aside in all of these discussions, a decade or more could pass before the issue is revisited. At that point, it will be well past the period that a "managed decline" in fossil fuels will be possible while still limiting warming to "well below 2°C" (Muttitt et al. 2016).

We also see signs that some countries are becoming more open to addressing fossil fuel supply. As we outlined in Section 2, several countries have begun enacting policies that would have the effect of limiting fossil fuel supply (notably, large emitters such as China and India). Likewise, there is a greater push from civil society actors to move away from fossil fuels (Piggot 2017). This shifting socio-political landscape opens up new opportunities to address fossil fuel supply.

A key difference between the Paris Agreement and its predecessor, the Kyoto Protocol, is that countries now have more freedom to pursue different pathways to reach global goals (Falkner 2016). This means that a "coalition of the willing" could work to restrict fossil fuel supply, in addition to working towards GHG emissions goals, even if some major producer nations choose not to participate. In this paper we have provided some possible avenues for such a coalition to reshape the international regime so that ceasing fossil fuel production features more prominently as a climate solution.

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**SEI - Headquarters**
Stockholm
**Sweden**
Tel: +46 8 30 80 44
*Executive Director: Johan L. Kuylenstierna*
info@sei-international.org

*Visitors and packages:*
Linnégatan 87D
115 23 Stockholm, Sweden
*Letters:*
Box 24218
104 51 Stockholm, Sweden

**SEI - Africa**
World Agroforestry Centre
United Nations Avenue, Gigiri
P.O. Box 30677
Nairobi 00100
**Kenya**
Tel: +254 20 722 4886
*Centre Director: Stacey Noel*
info-Africa@sei-international.org

**SEI - Asia**
15th Floor
Witthyakit Building
254 Chulalongkorn University
Chulalongkorn Soi 64
Phyathai Road, Pathumwan
Bangkok 10330
**Thailand**
Tel: +(66) 2 251 4415
*Centre Director: Niall O'Connor*
info-Asia@sei-international.org

**SEI - Oxford**
Florence House
29 Grove Street
Summertown
Oxford, OX2 7JT
**UK**
Tel: +44 1865 42 6316
*Centre Director: Ruth Butterfield*
info-Oxford@sei-international.org

**SEI - Stockholm**
Linnégatan 87D, 115 23 Stockholm
*(See HQ, above, for mailing address)*
**Sweden**
Tel: +46 8 30 80 44
*Centre Director: Louise Karlberg*
info-Stockholm@sei-international.org

**SEI - Tallinn**
Lai str 34
10133 Tallinn
**Estonia**
Tel: +372 627 6100
*Centre Director: Lauri Tammiste*
info-Tallinn@sei-international.org

**SEI - U.S.**
*Main Office*
11 Curtis Avenue
Somerville, MA 02144
**USA**
Tel: +1 617 627 3786

*Davis Office*
400 F Street
Davis, CA 95616
**USA**
Tel: +1 530 753 3035

*Seattle Office*
1402 Third Avenue, Suite 900
Seattle, WA 98101
**USA**
Tel: +1 206 547 4000

*Centre Director: Michael Lazarus*
info-US@sei-international.org

**SEI - York**
University of York
Heslington
York, YO10 5DD
**UK**
Tel: +44 1904 32 2897
*Centre Director: Lisa Emberson*
info-York@sei-international.org

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