

# Fossil fuel production in a 2°C world: The equity implications of a diminishing carbon budget

There are, broadly speaking, two main perspectives on equity as it relates to the supply of fossil fuels, both of which are highly visible in the current climate change debates. One could be labelled “extraction as pollution”; the other, “extraction as development”.

The essence of the first is that extraction of fossil fuels is the ultimate source of fossil carbon emissions, and hence suppliers should be treated as polluters. This view has lent impetus to calls for transparency and disclosure of “carbon risk”, campaigns for fossil fuel divestment, and legal efforts to assign liability for climate damages to fossil fuel suppliers and withdraw the “social license” that the industry has long taken for granted.

The other perspective is that for countries that have fossil fuel resources, the ability to extract them is a key contributor to development, especially in developing countries with large unmet energy needs, and where fossil fuels are an important source of export revenue. From this perspective, countries have a sovereign right – driven by a developmental imperative – to extract their fossil resources.

The tension between these two perspectives is embodied within the text of the United Nations Framework Convention on Climate Change (UNFCCC), which stresses in its Preamble:

*States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.<sup>1</sup>*

Two decades of climate negotiations have not resolved that tension, which has kept the Parties from addressing fossil fuel supply under the UNFCCC. This discussion brief aims to foster dialogue by unpacking those two equity perspectives. While there is growing interest among researchers, policy-makers and activists in supply-side climate policy options,<sup>2</sup> the attendant equity questions have received relatively little attention – and far less than equity questions pertaining to fossil fuel consumption.

Climate equity discussions to date have been dominated by questions about international burden-sharing with regard to emission reduction, climate finance and technology transfer, both within academia and civil society.<sup>3</sup> Thus, even though the climate change literature and negotiation discourse on equity are relatively rich and deep, equity as it relates to the supply of fossil fuel is relatively uncharted territory.

Three premises underlie our analysis: (i) countries will eventually take action to substantially curtail global CO<sub>2</sub>



The offshore drilling platform Iran Khazar in use by Dragon Oil in the Cheleken field, Turkmenistan.

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emissions, (ii) carbon capture and storage will not obviate the need for significant constraints on fossil fuel exploitation, and thus (iii) fossil fuel extraction will need to decrease substantially relative to business as usual.<sup>4</sup> To the extent that any of these premises proves unwarranted, the overall relevance of the equity issues relating to constrained fossil fuel supply is correspondingly diminished.

The remainder of this section provides a brief review of the scientific and political context of fossil supply issues, before delving into the two broad equity perspectives. We then present some quantitative insights into the financial implications (expressed in terms of rents) of historical fossil fuel extraction, and the anticipated financial consequences of constraining extraction. We also quickly review some explanations for the lack of deeper examination of these equity-related issues in the scholarly literature and policy discourse. The closing section provides some final comments and directions for future research.

## The scientific context

Serious efforts to reduce global greenhouse gas (GHG) emissions have important implications for the amount of fossil fuel resources that are exploited. In its *Fifth Assessment Report*, the Intergovernmental Panel on Climate Change (IPCC) makes it clear that if future carbon dioxide emissions exceed roughly 850 billion tonnes (Gt CO<sub>2</sub>), then there is a worse than 1-in-3 chance that warming will exceed 2°C. If future emissions exceed 250 Gt CO<sub>2</sub>, then there is a worse than 1-in-3 chance that warming will exceed 1.5°C.<sup>5</sup>

As shown in Table 1, this available carbon budget is less than one-third the amount contained in proven reserves, and a very small fraction of carbon contained in estimated recoverable reserves. The budget constraint is even starker in light of the

recent Paris Agreement, in which nations have committed to “holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”.<sup>6</sup>

	Proven reserves	Remaining recoverable
Oil	660	2,390
Natural gas	410	2,080
Coal	2,150	48,500
<b>Total<sup>7</sup></b>	<b>3,220</b>	<b>52,970</b>
<b>Carbon budget</b>		
(for likely chance of warming below 2°C)	<b>850 Gt CO<sub>2</sub></b>	
(for likely chance of warming below 1.5°C)	<b>250 Gt CO<sub>2</sub></b>	

**Table 1: Carbon budget compared with carbon emissions from combustion of fossil fuel resources**

Notes: The budget is an upper limit for future (i.e., from 2015 onward) emissions consistent with maintaining a “likely”, i.e., greater than 66% chance, of keeping warming since pre-industrial times below 2°C. It is the remaining CO<sub>2</sub> emissions budget assuming that ambitious efforts are undertaken to reduce non-CO<sub>2</sub> GHG forcing along a pathway consistent with the most ambitious of the four “Representative Concentration Pathways” considered by the IPCC, RCP 2.6.

The implications are clear: Meeting global climate change mitigation objectives will require leaving a majority of proven fossil fuel reserves in the ground – to say nothing of ultimately recoverable resources. One study estimates that a third of oil reserves, half of gas reserves and more than 80% of current coal reserves should remain unused in 2010–2050 if the 2°C target is to be met.<sup>8</sup> Other approaches might come to different conclusions about the relative shares of oil, gas, and coal that can be exploited, but the overall point is clear: To achieve climate targets, we must keep a large fraction of fossil fuel assets in the ground.

### The political context

A focus on the equity dimension of fossil fuel extraction is timely and politically relevant. Policy-makers and civil society are increasingly questioning the support given to fossil fuel industries (e.g. producer subsidies), and limits on supply infrastructure are being proposed or enacted.<sup>9</sup> Indeed, as is argued below, concerns that fossil fuel extraction could be constrained are now key drivers of opposition to mitigation policy, internationally and in individual countries. Yet equity perspectives on fossil fuel production are still largely neglected in the academic literature.

The “extraction as development” perspective has been central to climate politics since the start of international climate negotiations. Countries that were engaged in fossil fuel extraction emphasized the importance of these activities to their economies, and highlighted their countries’ vulnerability to mitigation policies (e.g. carbon pricing and regulation), linking it to the vulnerability of countries to climate impacts.<sup>10</sup>

As a result, the climate convention includes a provision that “Parties shall give full consideration to ... the impact of the implementation of response measures, especially on ... [c]ountries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-in-

tensive products”.<sup>11</sup> At the Durban Climate Change Conference in 2011, the Parties agreed to adopt a Work Programme and establish a Forum on the Impact of Implementation of Response Measures.<sup>12</sup>

This issue has also been employed as an argument to slow international progress on climate policy.<sup>13</sup> For example, major oil-exporting countries have presented arguments under the UNFCCC asserting the “discriminatory” nature of mitigation policies such as gasoline taxes and an aviation levy on oil exporters,<sup>14</sup> and invoked equity in relation to the potential negative consequences of measures such as carbon caps or taxes.<sup>15</sup> In debates within countries, the ability to extract fossil fuels has also been equated with energy security (or independence) and jobs, thus bolstering arguments in favour of fossil fuel infrastructure and investments.<sup>16</sup>

The “extraction as pollution” perspective, on the other hand, has rapidly risen to prominence as a driver of political action and social mobilization. Opposition to fossil fuel infrastructure has spanned the supply chain, from extraction sites (hydraulic fracturing, oil sands, coal mines), to transport infrastructure (oil by rail, ports, pipelines), to power facilities. Indeed, this opposition has been identified as having reinvigorated civil society involvement in climate issues.<sup>17</sup>

At the same time, the financial sector is increasingly paying attention to the potential impact of policy constraints and social stigmatization on the profitability of companies involved in fossil fuel extraction.<sup>18</sup> This attention to “carbon asset risk” has led to pressure to disclose exposure to those risks and – increasingly – to calls for divestment from the underlying fossil fuel-related assets altogether.<sup>19</sup> This pressure is being directed toward a wide range of financial instruments, from pension funds, to municipalities, to university endowments, to foundations, among others. Legal liability has also emerged as a focus of civil society political initiatives.<sup>20</sup>

Actors with an economic interest in continuing to exploit fossil fuel resources have engaged politically as well, actively opposing the adoption of policies that might constrain such exploitation. Given the economic and political power of the fossil fuel sector in many countries and globally, the impact of



A standard Petrobras land oil pump, popularly known as Wooden Horse (Cavalo de Pau), in Natal, Brazil.

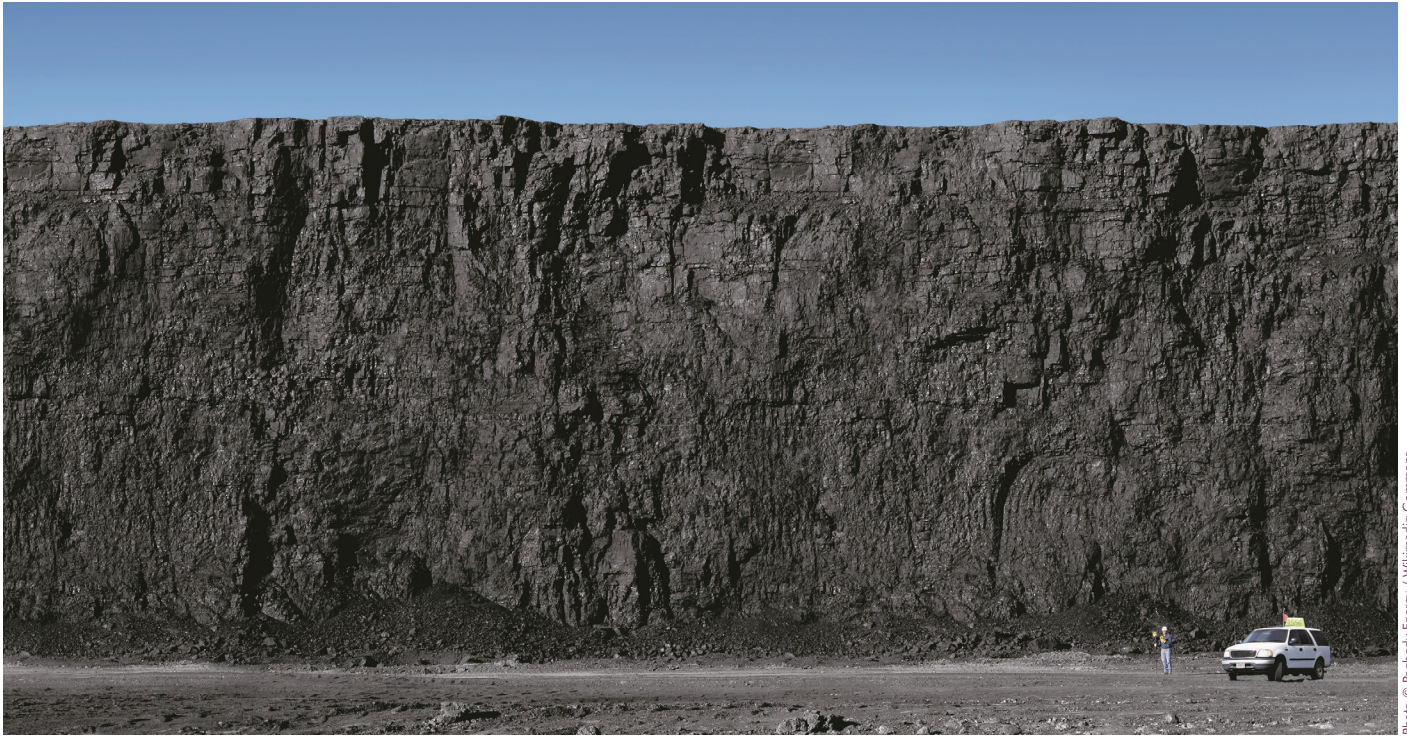


Photo © Peabody Energy / Wikimedia Commons

An 80-foot coal seam at the North Antelope Rochelle open-cut mine in Campbell County, Wyoming. Operated by Peabody Energy, this is the largest and most productive coal mine in the United States.

those efforts has been significant. Not only have they strongly influenced domestic climate and energy policies, but they have been very successful at shaping public opinion.<sup>21</sup>

### Equity and the supply of fossil fuel resources

When the subject of fossil fuels arises in equity debates – and in the relevant academic literature – it is almost always with regard to the *use* of fossil fuels: for example, whether developing countries should be able to build new coal power plants, even as emissions on a global scale are sharply curtailed to meet climate goals. As a result, much of the discussion has focused on the disparities in historical emissions and on allocating the remaining atmospheric carbon space equitably (as well as the responsibility for reducing emissions).<sup>22</sup>

Given the growing interest in supply-side climate policy measures, it is important to look just as seriously at their equity implications. Many countries and communities are counting on benefits from fossil fuel extraction and trade to support economic growth and development. Which suppliers should be induced to stop or limit their activities, and which should be able to keep extracting, and to what extent? We begin our analysis by looking more closely at the two broad equity perspectives that we identified above.

#### Extraction as pollution

The act of producing fossil fuels generates greenhouse gas emissions, but arguments about producers' responsibility go well beyond these direct emissions. From the "extraction as pollution" perspective, those who supply fossil fuels (and profit from this activity) also bear some responsibility for their subsequent use and the resulting emissions. Efforts to draw attention to fossil fuel producers has taken various forms, but all aim to apply economic and/or political pressure to limit future fossil fuel supplies and achieve climate goals.

One form of this pressure is the call for increased transparency with respect to "carbon asset risk" – the prospect that climate

policy could curtail future activities (and even leave assets "stranded").<sup>23</sup> These efforts are not driven by equity concerns, but by the argument that the efficient allocation of capital requires financial due diligence, which depends on transparency and the full disclosure of policy and other risks. And Under pressure from share-holders and consumers, many companies are now disclosing, in some form or another, carbon-related risks.<sup>24</sup>

Companies involved in fossil fuel production not only face questions about the financial viability of their business models. Increasingly, they are being targeted for divestment – a "moral stand" necessary to fulfil an "ethical responsibility".<sup>25</sup> In this context, comparisons are regularly drawn between fossil fuel extraction sector and the tobacco industry, apartheid-era South Africa, or even slavery.<sup>26</sup> In calling for divestment, advocates are explicitly working to withdraw these industries' social license.<sup>27</sup>

These challenges on ethical grounds have also given rise to efforts to assign legal liability for climate damages to fossil fuel extraction companies, including specific proposals that have been put forward for linking fossil extraction companies to the loss and damage mechanism under the UNFCCC.<sup>28</sup> This is an effort to apply the "polluter pays" principle to the initial source of the fossil fuel, rather than the final source of the GHG emissions.<sup>29</sup>

#### Extraction as development

A key assumption in the "extraction as development" perspective is that countries benefit from exploiting their fossil resources. Many countries take this as an article of faith, contending that constraining these activities would threaten their development. This concern is salient enough that Parties to the UNFCCC were moved to highlight, in the Preamble, "the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions".

Indeed, there is no question that oil production has transformed many economies on the Persian Gulf, for instance. Similarly, domestic coal resources have fuelled industrialization across Europe, in the United States, and more recently, in China, to name only the most prominent examples.

In general, widely cited benefits of fossil fuel exploitation for social and economic development include affordable energy, energy security, employment, foreign exchange, and geopolitical power. At the same time, there can also be negative impacts: environmental degradation, dispossessing of local communities and other human rights violations, concentration of wealth and power, macroeconomic overreliance (“Dutch disease”) and, not least, geopolitical instability.<sup>30</sup> Were fossil fuel production to be limited, those positive – as well as negative – impacts would be lessened.

But all would not be affected equally. Control over fossil resources is unevenly distributed among countries, and even among regions and individual economic entities within them – as are the benefits of exploiting those resources. This means that some countries, regions and economic entities stand to lose much more than others from any future constraints on fossil fuel extraction.<sup>31</sup>

Why does this case warrant consideration as an issue of global equity, however, even though there are many other examples of countries forgoing the benefits of exploiting sovereign resources? For instance, countries choose to halt the logging of forests for watershed protection, to curb the mining of high-sulphur coal to improve air quality, or to limit withdrawals from freshwater resources to maintain minimum river flow rates for ecosystem preservation and other purposes.

These examples differ from fossil fuel extraction in one key respect: who benefits. The benefits in the examples (watershed protection, improved air quality, restored river flow rates) are enjoyed within the same country. However, the main (but not necessarily the only) motivation for forgoing fossil fuel extraction would be to contribute to preserving a global commons.

As highlighted by the IPCC, “Effective mitigation will not be achieved if individual agents advance their own interests independently.”<sup>32</sup> No single country is able to protect its own climate by reducing its own emissions, and thus no country can solve its climate problem by itself – rather, it must persuade other countries to join in the effort to reduce global emissions. And, crucially, a country is only likely to succeed in inducing reciprocal effort among its negotiating partners *if it is perceived to be doing its fair share of the effort*.

Thus, a cooperative agreement among countries is likelier to be agreed and successfully implemented if it is based on an equitable distribution of the required effort. Countries will expect to be treated equitably by others, and will be expected by others to do their “fair share”. In other words, there is a strong argument for equity based not in ethics, but in enlightened self-interest. As the IPCC has put it: “The evidence suggests that outcomes seen as

equitable can lead to more effective cooperation.”<sup>33</sup> Especially for a global climate mitigation effort that is ambitious enough to meet the Paris goal, an approach that is broadly seen as fair will be necessary.<sup>34</sup>

### The equity consequences of constraining fossil fuel extraction

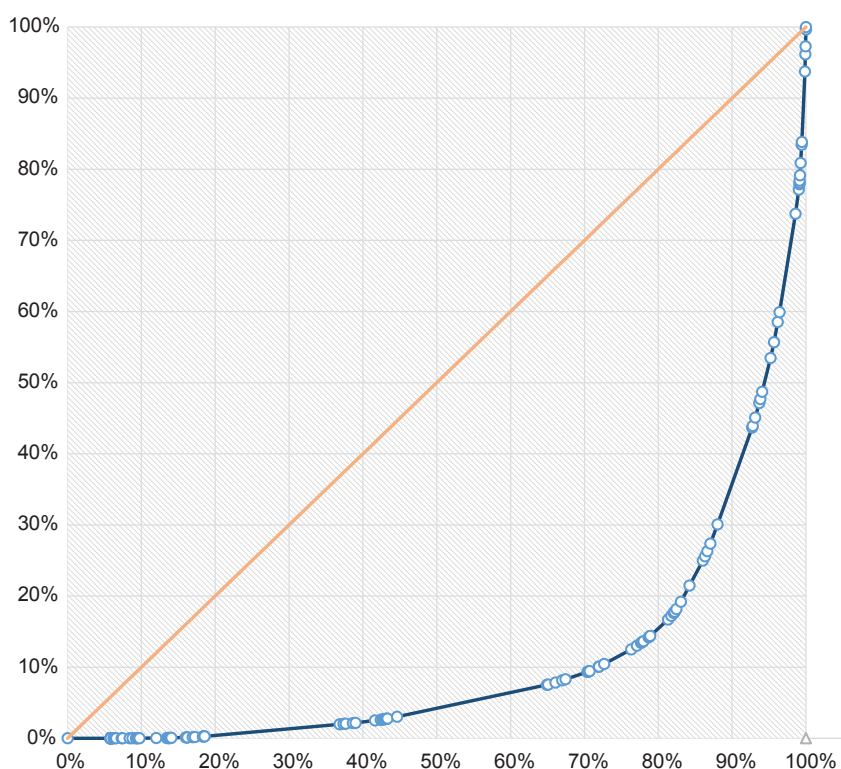
A detailed examination of the multiple dimensions of “extraction as development” is beyond the scope of this brief, but will be taken up separately.<sup>35</sup> Here we consider the issue from a conventional – albeit highly simplified – perspective: We examine the direct financial benefits of exploiting fossil fuel resources, as terms of rents, and consider the future impacts of carbon constraints in terms of forgone rents.

We start by looking at the scale and regional distribution of fossil resource rents over the past decades. We then examine widely cited modelling scenarios to compare the rents as expected under a business-as-usual fossil extraction with rents under an overall carbon constraint roughly consistent with a 2°C emissions pathway.<sup>36</sup>

### Historical data: distribution of rents from past fossil fuel extraction

Given that fossil fuel resources are distributed unevenly, there are also large disparities in fossil fuel rents across different regions. Some countries have also profited more from their own resources than others, depending on whether they were colonized, the extent to which foreign entities handled extractive activities, and the terms negotiated with those entities.

Over the past four decades, during which the vast majority of all fossil fuels have been extracted, some regions and countries have reaped markedly higher earnings from fossil fuel production than others, largely from the production of higher



**Figure 1: Lorenz curve for fossil fuel rents (1970–2010).**

This shows the percentage of fossil fuel rents (1970–2010) relative to the percentage of population (in 2010). For example, the 70% of people lived in countries that together received less than 10% of the world’s fossil fuel rents; the corresponding Gini coefficient for this distribution is 0.78.

## Lorenz curves and Gini coefficients

The Lorenz curve, developed by the economist Max Lorenz to describe income inequalities, plots the percentage of total income versus percentage of population receiving that income, with population ordered by income per capita. A Lorenz curve representing a society with income distributed perfectly equally among all people would be a straight diagonal line from (0%, 0%) to (100%, 100%), shown in Figure 1 as a red line.

The Gini coefficient, developed by the sociologist Corrado Gini, represents the extent to which the actual Lorenz curve deviates from a Lorenz curve for the society with a perfectly equal income distribution, which would have a Gini coefficient of 0. A country with a maximally unequal income distribution (in which all income is earned by one

person, and all others get no income) would have a Gini coefficient of 1.

Using this same approach, here we plot percentage of total fossil rents versus percentage of population receiving those rents, with population ordered by rents per capita. Various refinements of this methodology could be considered. A time-dependent analysis could discern any trends across the 1970–2010 period. The aggregation across the time period and the use of an intra-national analysis could disaggregate within each country's entire population, instead of treating of the population with each country as if they received an equal share of the national rents. (To the extent that the distributions within countries are less equal, the global Lorenz curve would be correspondingly less equal.)

profit-margin crude oil and gas resources. Most of the profitable development of fossil fuels over the 1971–2010 period has been in conventional oil (63% of rents) and conventional gas (27%).

Data for this period are available for 141 individual countries.<sup>37</sup> Over half of the cumulative fossil fuels (expressed in terms of carbon content) were extracted within only four countries: the United States (19%), Russia (13%), China (13%) and Saudi Arabia (5%). In terms of rents, over half the cumulative rents over this same period arose in only seven countries: the United States (14%), Russia (14%), Saudi Arabia (10%), Iran (5%), China (4%) and Mexico (4%).

The distribution of fossil fuel rents can be expressed more comprehensively as a Lorenz curve, as shown in Figure 1. The Lorenz curve (further explained in the box) shows the share of fossil fuel rents as a percentage of world's population receiving those rents. For instance, the 70% of the world's population lives in countries that received less than 10% of total fossil fuel rents, while the 10% of the world's population lives in countries that received more than 65% of the total rents. This is a highly unequal distribution of rents, corresponding to a Gini coefficient of 0.78 (0 is perfect equality, 1 is the greatest possible inequality). A Gini coefficient this high represents a greater level of inequality than the income inequality of any country for which the World Bank has calculated a Gini coefficient.<sup>38</sup> For reference, recent Gini coefficients of three countries known for their exceptionally

high levels of income inequality – South Africa, Haiti and Brazil – are 0.65, 0.59, and 0.53, respectively.

### Projecting the distribution of rents under fossil fuel extraction constraints

To present a comparison between a future in which there are no carbon constraints and one in which there are carbon constraints consistent with a 2°C pathway, we draw upon the scenarios developed for the Global Energy Assessment. The GEA serves as a useful frame for considering the long-term implications of a low-carbon future on fossil fuel production, including on the regional distribution of production and associated rents.<sup>39</sup>

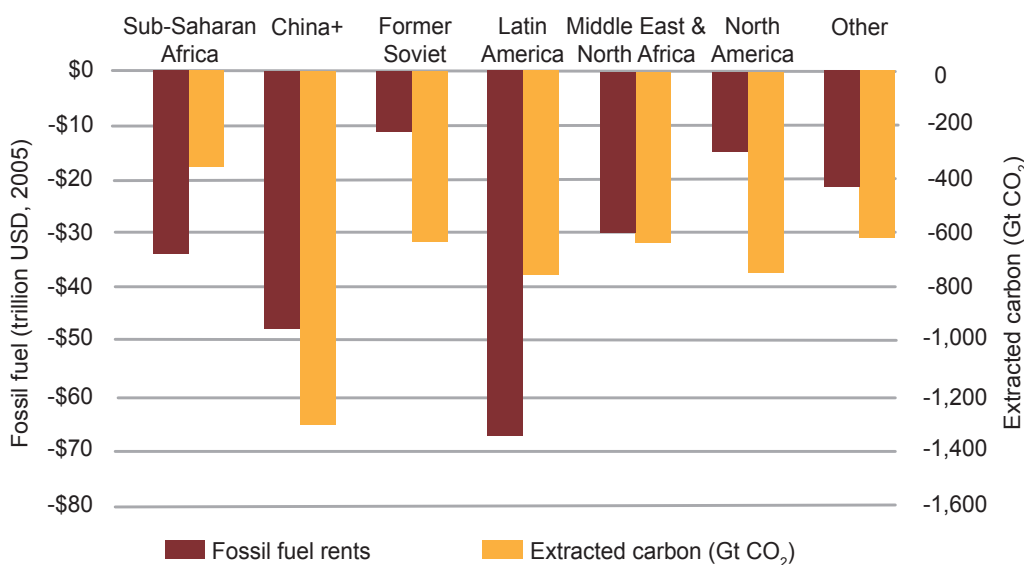
To represent a future unconstrained by climate policy, we use the GEA *Baseline* scenario; for a scenario representing a future with a carbon constraint roughly consistent with a 2°C limit, we take the GEA *Mix* scenario. The GEA *Baseline* and *Mix* scenarios are similar to the IEA World Energy Outlook's *Current Policies* and *450* scenarios, respectively, but the IEA scenarios only extend to 2035; the GEA scenarios give a longer-term forecast and a richer regional breakdown. While no modelled projections can be taken as definitive, we take the GEA scenarios as plausible, representing future energy development paths characterized by the use of lowest-cost resources. The GEA model incorporates additional constraints reflecting specific criteria (e.g., air pollution benefits and energy supply security) beyond a strictly market efficiency approach in delivering lowest-cost fossil fuels based on static cost curves.<sup>40</sup>



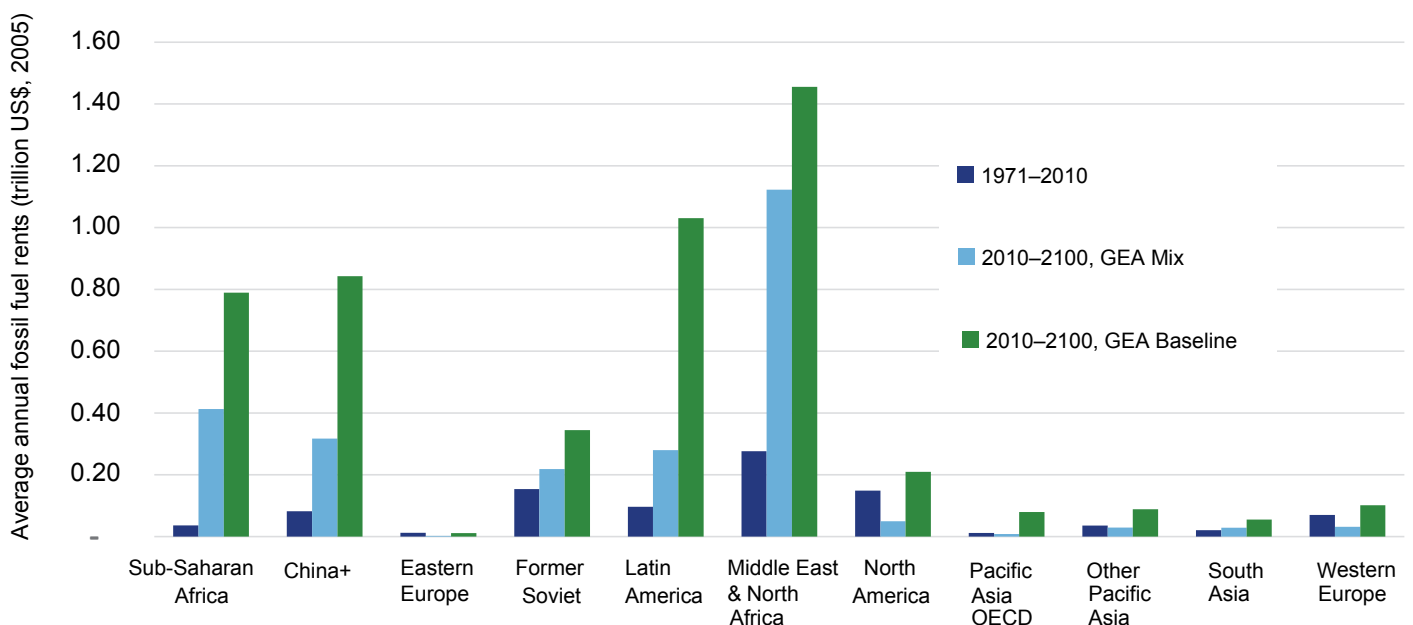
An aerial view of the Fort McMurray area in Alberta, Canada, where oil sands development has transformed the economy, but also raised many environmental concerns.

Figure 2 shows the total (not annualized) rents forgone (red bars) – i.e., the difference between the projections of rents in the GEA *Base* and *Mix*. (The orange bars, read against the right axis, show the forgone production across all fossil fuels, in Gt CO<sub>2</sub>.) As can be seen, the forgone rents are quite significant, adding up to tens of trillions of dollars.

It is worth noting that the scale of the forgone rents is somewhat larger in magnitude than what Edenhofer et al. (2013) call “climate rents” – the value of the GHG emission endowments that are created by establishing a cap-and-trade system (or other comparable system of carbon pricing), which has been estimated as on the order of US\$1 trillion per year.<sup>41</sup> Given the scale of the “climate rents”, they argue that “a major and so far perhaps underappreciated challenge of climate policy negotiations is to deal with what may be largest distributional negotiations the global community has ever engaged in”. The same could be said – only more so – about fossil fuel extraction rents.



**Figure 2: Cumulative decrease (2011–2100) in fossil fuel extraction (in Gt CO<sub>2</sub>, yellow bars) and rents (in 2005 USD, red bars) under a 2°C scenario based on the GEA *Mix* scenario, relative to the GEA *Baseline* scenario (as in Figure 3).**



**Figure 3: Annualized rents per capita shown for each of the 11 GEA regions, for the recent past (1971–2010), and the GEA *Baseline* and *Mix* scenarios.**

The differences between *Baseline* and *Mix* reflect the impact of a carbon-constrained future on anticipated rents.

Figure 3 shows both historical and projected per capita rents. The dark blue bars show the cumulative fossil fuel rents over the 1971–2010 period for the eleven GEA regions on a per capita basis.<sup>42</sup> (This based on the same data as Figure 1, aggregated to GEA regions for comparison to the projected scenarios.) The disparities are evident, with the highest-producing regions garnering 10–50 times more rents per capita than the lowest-producing regions. This reflects, at a regional level, the same wide disparities reflected at more disaggregated level in Figure 1.

Figure 3 also shows the annualized average rents per capita in the GEA *Baseline* (light blue bars) and *Mix* scenarios (green bars) projected to 2100. Rents are projected for the two GEA scenarios based on the projected production of each fossil fuel for each region, and assuming the average fossil fuel rent per unit fuel for each region remains consistent with the recent past (1998–2006), drawn from World Bank data. This is only a rough estimate, but sufficient to give a plausible projection of future rents at stake.

For the most part, current high rent-earners are projected to remain relatively high earners. This arises largely from the fact that, among the 11 GEA regions, 1971–2010 cumulative rents are strongly correlated to remaining resources (in Gt CO<sub>2</sub>), of conventional oil ( $r^2 = 0.86$ ) or conventional oil plus conventional gas ( $r^2 = 0.78$ ). Consequently, the top three projected rent-earners are among the top four historical rent-earners, and the bottom five rent-earners are among the seven lowest

historical rent-earners. Even in the *Mix* scenario, the Middle East and North Africa are projected to experience by far the largest leap in total per capita rents.

However, there are important and notable exceptions to the continuation of the status-quo distribution of rents. One is the ascendancy of sub-Saharan Africa to the fourth-highest position and the China+ region into the fifth-highest position, both surpassing North America in either scenario.

The socio-economic implications of the forgone rents are impossible to definitively assess; after all, as discussed above, the society-wide impacts of fossil fuel extraction are complex and multi-dimensional. However, in simple financial terms, the rents from fossil fuel production can be a significant proportion of the income of regions, particular in poorer regions. In order to quantify the rents that each region stands to sacrifice along a low-carbon pathway, we define an index that reflects the magnitude of the forgone rents relative to national GDP in 2010. We estimate forgone rents for each region as the difference between the *GEA Baseline* and *Mix* scenarios, as shown in Figures 2 and 3, aggregating across 2010–2050.

$$\text{Forgone Rents Contribution (FRC)} = (\text{Rents}_{\text{baseline}} - \text{Rents}_{\text{mix}}) / \text{GDP}$$

Figure 4 below shows this Forgone Rents Contribution index as defined above for the 11 GEA regions, presented relative to current (2010) incomes per capita in that region. Developing regions are shown to consistently forgo a larger portion of rents relative to income than industrialized regions. The forgone rents range from 0.3% to 1.7% for the four highest-income regions, and from 2.5% to 29% for the seven lowest-income regions.<sup>43</sup>

This result is driven in part by the fact that the higher income regions have already extracted a greater portion of their economically exploitable resources under the low-carbon

constraint than the lower income regions. The four higher income regions have already extracted roughly 60-85% of their resources that would be exploited under the low carbon (*GEA Mix*) future, whereas the corresponding percentage for the seven lower income regions ranges from 8 to 55%<sup>44</sup>. In aggregate, the four higher-income regions had, by 2010, exploited nearly three-quarters of their resources (in terms of rents), while the lower-income regions had exploited less than a quarter of theirs.

As can be seen, the forgone rents can be a significant percentage of GDP, specifically for the countries in the lower-income range (less than US\$7,500 per capita).

These observations hint at the magnitude of the impacts constraining fossil exploitation to keep within a 2°C budget, in terms of forgone revenue. In particular, they suggest the loss of a sizable revenue stream specifically for developing country regions, the magnitude of which can be a significant percentage of GDP. This is especially true of sub-Saharan Africa, the Middle East and North Africa, and Latin America.

Another, crucial consideration that is beyond the scope of this discussion brief, but should not be forgotten, is that forgoing a given share of GDP has different implications for a country that is already developed than for one that still lacks basic infrastructure and public services and has many people living in poverty. Just as higher levels of development are associated with greater capacity to adapt to climate change impacts,<sup>45</sup> it is reasonable to expect that a country with modern infrastructure, a diversified economy, and high living standards will find it easier to cope with the loss of fossil fuel rents than a country without such advantages. This means that any serious conversation about constraining fossil fuel extraction to protect the climate needs to consider the equity implications.

### Why aren't world leaders talking about equity and fossil fuel extraction?

Given the importance of addressing fossil fuel supply in the context of climate goals, the absence of these issues from the Paris Agreement and most countries' own climate policies is notable. Here we summarize several perspectives that may help explain why this is the case.

**“It’s a sovereign issue. Lay off.”** The argument can be made that decisions over natural resource exploitation are the sole domain of sovereign states, and should not even be considered within the domain of international policy. As Schrijver (1997) states, “in the context of discussions on sovereignty over natural resources, various adjectives have been used to emphasize its hard-core status: in addition to ‘permanent’, also ‘absolute’, ‘inalienable’, ‘free’, and ‘full’”<sup>46</sup>. There are counter-arguments, of course, such as that the use of fossil fuels requires the use of the atmospheric carbon sink, which is a global commons. A clause in the preamble of the climate convention concisely articulates this tension:

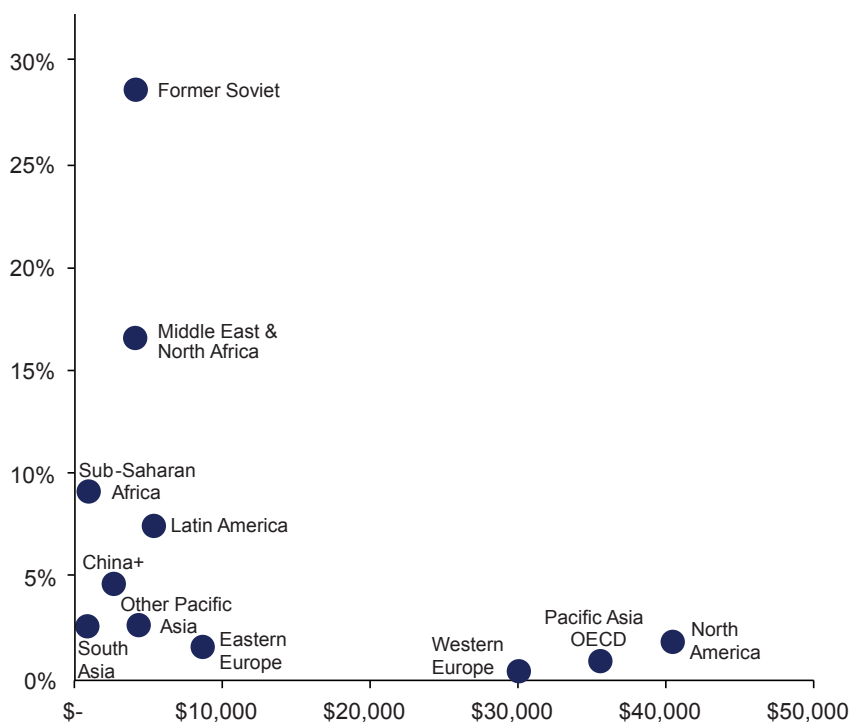


Figure 4: Average annualized forgone future (2010–2050) rents per capita as a share of current (2010) income per capita, versus current income per capita.

... States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction;

### **“Unfair? So what, life’s unfair.”**

The argument can be made that fossil fuels, like other natural resources, are inequitably distributed by virtue of geological fortune (and, in some cases, by territorial conquest). It is one of many inequities, and there is no reason why this particular inequity should get special attention. This claim can be questioned on the same grounds as above, that fossil resource extraction relies on the use of a global commons.

**“Leave the market alone!”** A free-trade approach would deem supply-side constraints too “inefficient” to warrant serious consideration, especially if it is based on production quotas or some other “market-distorting” mechanism. However, there are in principle ways to address the equity issues that need not be “inefficient” from an economic perspective. Just as emission allowances are distinct from actual physical emissions, one could consider “extraction allowances” which are distinct from actual physical extraction.

### **“It’s not really an issue of fairness. That’s just a ruse.”**

Politically and historically, these issues have been considered within the UNFCCC under “impacts of response measures”, as mentioned above. In this forum, the equity arguments have met with little sympathy, since some of the fossil fuel producers who have championed this cause are quite wealthy at this point. However, the circumstances are highly country-specific, and the underlying equity issues remain valid.

**“Third rail! Keep away!”** Some may argue that this issue is simply too politically contentious, not only because it is seen to undermine sovereignty, but also to threaten powerful political and economic interests. This is undoubtedly true, and political economy is an important consideration, but it does not constitute a principled argument that the status quo is normatively just.

### **Questions for the next level of analysis**

The purpose of this discussion brief has been to note the equity implications that arise when considering climate policy constraints on fossil fuel extraction. What our analysis suggests, at the very least, is that the stakes are quite high. Trillions of dollars may be at stake, constituting a substantial share of some countries’ GDP. This is comparable to or greater than the “climate rents” associated with the allocation of emission allowances that have been a main focus of climate equity discussions to date.



The Agbami oil field off the Niger Delta in Nigeria, operated by a Chevron affiliate, with involvement of Nigerian and international oil companies.

Photo © Chevron and Statoil photo collection

Yet the analysis presented here is only a first step. To advance understanding in a way that might help the Parties move past the current stalemate, we suggest exploring questions such as the following:

**Does fossil resource extraction really contribute to development?** The assumption that it does underpins the “extraction as development” perspective. As noted, commonly cited benefits include affordable energy, energy security, employment, foreign exchange, and geopolitical power. At the same time, while it is clear that there is not an unavoidable “resource curse”, it is also true that negative impacts have been well documented: environmental degradation, dispossessing of local communities and other human rights violations, concentration of wealth and power, “Dutch disease” and geopolitical instability. This gives rise to several research questions:

- Empirically, under what conditions does fossil extraction contribute to development?
- How equitably distributed are those developmental benefits?
- Given these empirical observations, how can the limited budget for future extraction (consistent with keeping warming below 1.5°C or 2°C) be distributed so as to maximize development benefits?

**What are the distributional impacts of fossil supply policies that constrain extraction?** Analyses of the implications of demand-side policies such as carbon taxes have found that the impacts are often (but not always) regressive. Analogous research on supply-side policies is limited. In particular, we need to know:

- In what cases are supply-side policies (or the equivalent) regressive? Are they regressive enough to significantly affect affordability and access?
- What steps can be taken to address the regressivity of supply-side policies? (Is there an analogue to the carbon “dividend” that is often cited as a measure for making carbon taxes neutral or progressive?)



- When are domestic steps sufficient, and when might international support be appropriate to help alleviate regressive impacts that affect poor households and communities?

**What “just transition” lessons can be learned from other threatened sectors?** The issue of livelihoods immediately comes up when supply-side policies are raised, yet relatively little work has been done to date to answer question such as:

- What are the analogous “just transition” situations, in which environmental policies, market forces, or other factors have rendered a sector obsolete (e.g. closing of declining fisheries, logging bans)?
- In addition to the loss of livelihoods, what other socio-economic hardships (e.g. forgone export revenue) are necessary to consider?
- What lessons are to be learned, and what compensating steps do they suggest for the case of the fossil fuels sector?
- What is the role for international institutions (specifically, the UNFCCC) in fostering or implementing such steps? What obligations may some nations bear to support just transitions in other nations, analogous to support for mitigation and adaptation?

**Is there a basis for moral or legal claims against fossil fuel extractors?** Efforts to date have focused on large corporations, but state-owned enterprises (or states) could face such claims in the future:

- Is there a robust ethical basis for such claims of moral responsibility, given that we all benefit from the use of fossil fuels?

- What would be the consequence of any such moral responsibility? Do any such claims provide a basis for compensation (i.e. loss and damage) from historical and ongoing fossil fuel extractors?

**Which countries get to exploit their fossil resources?** Given that fossil fuels are likely to be used (though in diminishing quantities) even in a 2°C-compatible future, *some* resources will still be extracted. Which countries’ resources should stay in the ground, and which should be exploited? Who gets to decide?

- What would be the basis for distributing a “right to extract”: economic efficiency, ethical principles, a combination of the two, mediated by tradeable “extraction rights”?
- What is the relevance to this question of stranded assets, and is there a distinction between stranded natural (fossil) assets and stranded capital (industrial and infrastructural) assets? Is there a difference between assets held by private companies vs. those held by states or state-owned companies?
- How does this interact with (or overlap with, or contradict) equity claims on the demand side – i.e., equity-based emission allocation approaches?
- Might fossil fuel cartels play a helpful role here? Could they develop and impose self-restriction measures?
- Is there a role for command-and-control approaches, such as a proposed “coal non-proliferation treaty”?<sup>47</sup>

We believe these questions are important for future research to explore, and that resolving the underlying societal challenges will make more tractable the challenge of addressing climate change.



The lignite mine Garzweiler, a 42km<sup>2</sup> surface mine in North-Rhine Westphalia, Germany. In 2014, Germany produced 178 million tonnes of lignite (brown coal).

## Endnotes

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With regard to carbon capture and storage (CCS), even techno-economic scenarios that assume the rapid and widespread deployment of CCS still assume a substantial reduction in overall fossil fuel use relative to business-as-usual scenarios. Energy efficiency and the shift to non-fossil energy sources (renewables and nuclear) reduce the demand for fossil fuels even if CCS or negative emission technologies are available. See:  
  
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- 37 Sources for national-level data are the IEA's World Energy Statistics and Balances database, the World Bank's The Changing Wealth of Nations database and GEM Commodities Database, and the International Institute for Applied Systems Analysis' GEA Scenarios database. The total of 141 countries includes separate classifications for the former Soviet Union and former Yugoslavia (pre-1990 totals for each), as distribution of pre-1990 production to the current countries that previously comprised these regions is not available. For this analysis, we allocate the pre-1990 rents of these two regions to the constituent countries pro rata with their post-1990 shares of the regional total.
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- 43 The four wealthiest GEA regions are North America, Pacific OECD, Western Europe, and Eastern Europe. The seven lower-income regions are sub-Saharan Africa, Other Pacific Asia, South Asia, China+, the former Soviet Union, Latin America, and the Middle East and North Africa. Given the diversity *within* regions in both income and resources, an analysis at the national level would be illuminating, if GEA projections were available at that level of disaggregation.
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IndoMei in the Heart of Borneo / Flickr

A coal barge on the Mahakam River, in Borneo, Indonesia.

**Published by:**  
 Stockholm Environment Institute  
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 2016

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This brief was written by Sivan Kartha, Michael Lazarus and Kevin Tempest. The authors would like to thank Harro van Asselt, Marion Davis, Ben Schreiber and Greg Muttiit for helpful comments. We would also like to dedicate this paper to the memory of Paul Baer, whose work has inspired many in the climate community to think more deeply about the challenges and possibilities of climate equity. This work is an output of the SEI Initiative on Fossil Fuels and Climate Change. To learn more, visit <http://www.sei-international.org/fossil-fuels-and-climate-change>.