Forum

Unburnable Fossil Fuels and Climate Finance: Compensation for Rights Holders

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Abstract

To limit the increase in global mean temperature to 1.5°C, CO_2 emissions should be capped at 440 gigatons. To achieve this, about 89 percent, 59 percent, and 58 percent of existing coal and conventional gas and oil reserves, respectively, need to remain unburned. This implies an economic cost for fossil fuel rights owners, and any successful climate policy will rely on resolving the distributional challenge of how to allocate the right to use the remaining burnable reserves. We discuss the possibility of compensating rights holders of unburnable oil and gas reserves, producing the first estimates of the financial resources needed to secure full compensation. We estimate that approximately US$ 5,400 billion (10^9) would be needed. Despite the vast amounts required, compensation is nevertheless economically feasible. We suggest a Keynesian "whatever it takes" approach for climate action, combining partial compensation for unburnable fuels and investment in low-carbon technologies to drastically reduce emissions in the rapidly closing window of opportunity before 2030.

Moving Forward Debate on Unextractable Fossil Fuels

The Paris Agreement aims to limit global warming to well below 2°C, preferably to 1.5°C, compared to preindustrial levels. To limit the increase in global mean temperature, the future anthropogenic carbon dioxide (CO_2) emissions should not exceed a certain amount—the "remaining carbon budget" (Matthews et al.

* This work was supported by two grants from the Spanish Ministerio de Ciencia, Innovación y Universidades—RYC-2016–21366 (MCIU/AEI/FSE, UE) and RTI2018-095949-BI00 (MCIU/AEI/FEDER, UE)—and by the All Eyes on the Amazon program. We are thankful to the editors of Global Environmental Politics, Steven Bernstein, Matt Hoffmann, and Erika Weinthal, and to managing editor, Susan Altman, for their support and guidance.

Global Environmental Politics 22:4, November 2022, https://doi.org/10.1162/glep_a_00688

2021; Meinshausen et al. 2009). For a 50 percent probability of limiting warming to 1.5°C, the remaining carbon budget from 2020 onward has been estimated at 440 gigatons of CO_2 ($GtCO_2$) (Matthews et al. 2021). For a 2°C limit, the remaining carbon budget amounts to 1,370 $GtCO_2$ for a 50 percent probability (Matthews et al. 2021). However, the CO_2 potential emissions contained in present estimates of global fossil fuel reserves represent a staggering 2,900 $GtCO_2$, or approximately 2 times higher than the 2°C carbon budget and approximately 7 times higher for a 1.5°C limit (Matthews et al. 2021; McGlade and Ekins 2015; Welsby et al. 2021). Reserves are producible resources that are "commercially viable," and current estimates show that their extraction is incompatible with the commitments to limit average global warming (Matthews et al. 2021; McGlade and Ekins 2015; Welsby et al. 2021). In practice, and based on the opportunity costs of different fossil fuel reserves, about 89 percent, 59 percent, and 58 percent of existing coal, gas, and oil reserves, respectively, would need to remain under the soil to limit global warming to 1.5°C (for an extended explanation of the assumptions and associated uncertainties of these estimates and the risks from reserves accountability, see Green and Kuch 2022; Welsby et al. 2021).

Despite the urgency to limit global warming (Lenton et al. 2019), the clarity of the concepts of remaining carbon budget, and the associated fossil fuel extraction budget, climate change mitigation policies have so far failed to abate extraction (Höhne et al. 2020), and global demand for and consumption of fossil fuels are still ramping up, as are CO_2 emissions (International Energy Agency 2021). With global CO_2 emissions at 42 $GtCO_2$ per year and increasing, the remaining budget for 1.5°C warming (440 $GtCO_2$) could be completely exhausted by 2030. However, oil, gas, and coal reserves are worth approximately US$ 27,000 billion (10^9) (Jakob and Hilaire 2015), and most fossil fuel producers still push for increased extraction, including through emission-heavy fuels such as brown coal, bitumen, and shale gas, and invest in new infrastructure to expand fuel supply. By 2024, fossil fuel firms plan to invest a further US$ 1,400 billion in new projects (Global Gas and Oil Network 2019).

Climate change mitigation policies have so far largely focused on interventions to reduce the demand for fossil fuels (e.g., carbon taxes, cap-and-trade schemes, and energy efficiency standards), while policies aimed at restricting their supply (e.g., extraction taxes, fossil fuel subsidy removal, moratoria or quotas on extraction, tradable production allowances, and restrictions on the access to credit) have been largely neglected (Lazarus and van Asselt 2018; Pellegrini et al. 2021). However, there has been a recent surge in academic and sociopolitical interest in supply-side fossil fuel policies (Erickson et al. 2018; Lazarus and van Asselt 2018; Pellegrini and Arsel 2022; Piggot et al. 2020), spearheaded by social mobilizations (Martínez-Alier 2022). Leaving unburnable fuels untapped implies an economic cost for fossil fuel rights owners, and any successful climate policy will crucially hinge on resolving the distributional challenge of how to equitably and cost-efficiently allocate the right to extract the remaining burnable reserves (Jakob and Hilaire 2015; Kartha et al. 2018; Muttitt and Kartha 2020; Pye et al. 2020). In particular, the benefits of allocating a larger share of extraction rights to developing countries have been advocated based on ethical considerations but also questioned on efficiency, social, and environmental grounds (Pye et al. 2020). The question of how to share fairly the costs of leaving unburnable fuels untapped has been discussed in terms of historical responsibility for accumulated extraction and current capability to withstand the burden of the energy transition costs (Kartha et al. 2018). Ethical principles have been laid out for the need for international support that depend jointly on the social costs of transitioning away from fossil fuels and the capability to bear these costs for each country (Muttitt and Kartha 2020).

Our contribution is to bring to the fore the possibility of compensating rights holders of oil and gas reserves to keep them underground indefinitely, to produce the first estimate of the financial resources needed to secure compensation on a global scale, and to address the question of how to source such funds. Given the substantial amounts needed for full compensation of rights holders over oil and gas reserves, we also discuss the ethical dimension of the right to compensation that is contingent on responsibility and capability.

The Cost of Compensation

The economic cost of nonextraction for fossil fuel rights owners can be estimated by their opportunity cost, that is, the net benefit that could have been enjoyed if they had been extracted as compared to leaving them untouched. The total opportunity cost of the global unburnable fuels can be calculated per country as a function of the national reserves of the different fossil fuel categories, the production costs, the fossil fuel national royalty rates, the future fossil fuel prices, and future discount rates, among others. Reserves estimates are available per country, although they fluctuate over time (depending on prices, the cost of available technologies, and new discoveries), and rights holders have an incentive to overstate them (Green, this issue; Laherrère et al. 2022). Royalties are the main source of revenues from fossil fuel extraction for resource owners (Busby et al. 2011) and can be considered an appropriate (albeit imperfect) proxy to estimate the opportunity cost of leaving fossil fuels untapped. In the case of state-owned companies (national oil companies, or NOCs), the opportunity cost might be closer to the difference between the price and the cost of producing a barrel oil equivalent (BOE). NOCs' production represents 55 percent of total oil and gas production worldwide (Natural Resource Governance Institute 2019), and, for instance, the production cost of oil in the Middle East is just around US$ 10 per barrel (Rystad Energy 2020). Regarding future energy prices, since there is much uncertainty on long-term forecasts for the energy sector, a range of mid-term fossil fuel price scenarios could be used to assess the opportunity cost. However, future fossil fuel prices heavily depend on some key political choices, including the climate mitigation policies adopted by governments around the world. Therefore data from a concrete compensation proposal (the Yasuní-ITT Initiative from Ecuador) provide a useful basis to calculate a rough, but illustrative, estimate of the total opportunity cost of leaving the unburnable oil and gas in the ground.

In June 2007, the Ecuadorian government launched the Yasuní-ITT Initiative, a plan to leave oil reserves untapped in an area with outstanding socioenvironmental values, the Yasuní National Park and Biosphere Reserve, one of the most biodiverse regions of the Amazon and home to some of the last Indigenous groups living in voluntary isolation (Marx 2013). Ecuador, for US$ 3.6 billion of compensation from the international community, which was to be paid over a period of ten years, agreed to keep 0.85 billion barrels of heavy crude oil (14.7° API) in the soil of the Yasuní National Park and prevent the release of 0.41 $GtCO_2$ into the atmosphere (Larrea and Warnars 2009). A trust fund managed by the United Nations Development Program was established in 2010 to collect these contributions (Pellegrini et al. 2014). In 2013, approximately US$ 0.34 billion had been committed (and only a fraction had actually been deposited) to the Yasuní-ITT trust fund, and the initiative was cancelled because of the disappointing level of international donations (Marx 2013).

The US$ 3.6 billion asked by the Ecuadorian government was approximately half of the total royalties that would have been generated by extracting ITT's crude oil. The revenues were calculated based on the benchmark price of US$ 72.34 per barrel of WTI crude in mid-2007, assuming a joint venture to extract the oil, a state share of the revenues of 65 percent, an initial capital investment of US$ 3.5 billion, an operating cost of US$ 12.32 per barrel, and a transportation cost of US$ 2.60 per barrel (Finer et al. 2009; Larrea and Warnars 2009). The Ecuadorian government was willing to accept US$ 4.20 per barrel, or 50 percent of the expected oil revenues at that time, to keep the Yasuní-ITT oil reserves underground (Larrea and Warnars 2009). We use this figure (i.e., US$ 4.20 per barrel) as the basis of our estimate of global compensation.

Since more than 736 gigabarrels (Gbl) of oil and 92 cubic terameters (Tm^3) of gas currently classified as reserves should remain unburned to limit global warming to 1.5°C (Welsby et al. 2021), about US$ 5,400 billion (10^9) would be required to compensate the rights holders of oil and gas reserves (see Table 1). Moreover, new unproven reserves are being and will be discovered and developed. Global oil and gas nonreserves resource estimates are 3,336 Gbl of oil and 625 Tm^3 of gas (Welsby et al. 2021). Furthermore, coal reserves and resources estimates are 826 Gt and 3,960 Gt, respectively (Welsby et al. 2021). Hence, even the already impressive figure of US$ 5,400 billion is likely to be an underestimation of the opportunity cost for constructing an effective global supply-side climate mitigation policy. Several uncertainties are associated with these calculations (i.e., estimates of fossil fuel reserves and resources, long-term forecasts of energy prices, adoption of demand-side climate mitigation policies, the compensation value at US$ 4.20 per barrel, the equivalence of compensation between oil and gas reserves based on Barrel Oil Equivalents -BOE-, etc.).

Table 1
Cost of Compensation for Unburnable Fuels

	Burnable			*Unburnable*			*Compensation cost (billion US$)*
	Volume	*Percentage*	*GBOE*	*Volume*	*Percentage*	*GBOE*	
Reserves							
Oil (Gbl)	539	42	539	744	58	744	3,125
Gas (Tm^3)	64	41	376	92	59	541	2,274
Total			915			1,285	5,399
Resources							
Oil (Gbl)	783	19	783	3,336	81	3,336	14,011
Gas (Tm^3)	102	14	599	625	86	3,679	15,450
Total			1,381			7,015	29,462

Authors' elaboration based on Welsby et al. (2021; cf. Laherrère et al. 2022). To estimate the compensation cost, we multiply the compensation value (i.e., US$ 4.20/barrel) for the global oil and gas reserves (as defined by Welsby et al. 2021) in BOE. Conversion factors used from the US Geological Survey: 6,000 cubic feet of gas equals 1 BOE. Coal has been excluded from the calculations because the attempts to phase out coal consumption have so far followed a different (and arguably more effective) path than they have for oil and gas.

As a consequence, our figures are meant to be illustrative of the financial challenges ahead.

Several conundrums remain to be solved to make an agreement on compensation viable. Following the example of the Yasuní-ITT Initiative, and considering that the remaining budget for 1.5 °C warming could be completely exhausted by 2030, the compensation disbursements could take place on a yearly basis over the course of ten years (i.e., US$ 540 billion per year). However, different schedules could be devised to increase the feasibility of the initiative, in terms of being able both to raise the necessary funds and to entice rights holders to join it. Moreover, given the interdependence of reserves, regulation, and compensation, it would be appropriate for an agreement to compensate forgone production to foresee a benchmark in terms of total reserves available for each party. Additionally, arbitration clauses would also allow enforcing the commitments made and recouping of compensation expenses in case rights holders would renege on their commitments.

The Cost of Unburnable Fossil Fuels and Climate Finance

To discuss the feasibility and strategies to mobilize the required financial resources, it is productive to put these resources in the context of some recent experience with climate finance. The Green Climate Fund (GCF), the United Nations' financial mechanism to assist developing countries in climate adaptation and mitigation practices, for instance, has had very limited success. The GCF, set up at the COP 16 in 2010, has so far managed to raise only US$ 18 billion between 2010 and 2022 (Green Climate Fund 2022).

By far the most realistic approach might be to levy a tax on oil production and/or exports, epitomized by the Daly–Correa tax (Martínez-Alier et al. 2009). To this date, this remains the most ambitious international proposal to raise substantial amounts of funds to support climate action. The tax was first mooted by Herman Daly in a speech to the Organization of Petroleum Exporting Countries (OPEC) in 2001 and tabled by the then president of Ecuador Rafael Correa at the III Summit of OPEC in 2007 (Martínez-Alier et al. 2009). The Daly–Correa tax proposal suggested levying on every oil barrel the cost of the CO_2 emission rights from burning a barrel of petroleum. According to the United Nations Economic Commission for Latin America and the Caribbean, the Daly–Correa tax could generate between US$ 11 billion and 130 billion per year between 2020 and 2030, depending on the tax rate (from 1.5% to 10%), oil price, and the forecast oil production per year (Antón 2017). The rents collected were proposed to be used to promote sustainable development in low- and middle-income countries, mainly to assist adaptation and mitigation strategies for climate change and develop renewable energies. Furthermore, OPEC's oil exports account for an important share of the total petroleum traded worldwide, attenuating the opportunity for other producers to increase supply by becoming more competitive, and OPEC's actions influence international oil prices. OPEC could also act as a fiduciary authority for distributing those rents in the interest of sustainable development, but it was also suggested that these rents could be channeled to the GCF (Organization of Petroleum Exporting Countries 2011).

While the Daly–Correa tax was not established, the idea of taxing oil production and export continues to have traction in policy debates. In fact, a carbon tax to help developing countries adapt to climate change and prevent deforestation has been implemented by Norway since 2007. Norway's International Climate and Forest Initiative was launched at the COP 13 in 2008, and since then, it has allocated US$ 0.3 billion annually from Norway's carbon tax on offshore oil companies for climate change mitigation, renewable energy, food security, and conversion to low-carbon energy sources in developing countries (Røttereng 2018). More recently, the formation of a voluntary "Oil and Climate Club" has been proposed (Antón 2020). Club members that are oil exporters would set a tax on their own oil exports, and oil-importing members would tax oil imports from nonmember countries. A US$ 5 tax per barrel on only 25 percent of global oil exports would result in US$ 18–32 billion annual total revenue (Antón 2020).

These policy proposals, which are insufficient to secure full compensation, are likely to face significant opposition, as has been the case with initiatives to establish a global carbon tax that never came to fruition. Similarly, the recent US climate legislation, which includes nearly US$ 370 billion in climate and clean energy investments, contains no carbon taxes (Rhodium Group 2022). In fact, supply-side climate action is likely to face opposition by fossil fuel interests and by other parties negatively affected by the induced scarcity of fossil fuels. The construction of coalitions supporting supply-side climate policies, including taxation at extraction or export points, is an urgent and challenging task for social movements, concerned citizens, academics, and politicians.

Unburnable Fuels, Unrealistic Expectations?

As the climate finance record suggests, the burden of raising US$ 5,400 billion to compensate rights holders forgoing their rights to extract oil and gas seems insurmountable at first blush. Furthermore, some authors have suggested that part of what needs to be earmarked as unburnable fuel resources will be left untapped even in the absence of the impetus of a compensation mechanism because of already ongoing investment in low-carbon technologies and changing social preferences (Ansar et al. 2013; Mercure et al. 2018). Similarly, the burgeoning environmental justice social movement focused on constraining fossil fuel supply ("Keep It in the Ground") and the fossil fuel divestment campaigns have been argued to play a role in effectively curbing fossil fuel production (Ayling and Gunningham 2015; Piggot 2018). Thus, to fully compensate owners of unburnable fuels might not only be an implausible solution to limit global warming but also a non-cost-effective one. Climate action might get better or least-cost results allocating climate funds to increase investment in alternative energy sources or applying alternative demand and supply-side policies (e.g., credit restrictions to fossil fuel exploration and extraction activities, degrowth). Furthermore, investment in alternative energy sources is key to securing future energy demands if fossil fuels need to be phased out. However, given the urgency and magnitude of the challenge of climate change, an "either–or" approach between unburnable fuels and investing in alternative visions and technologies might be shortsighted. Climate action might not aim at the full compensation for resource owners to effectively curb fossil fuel production. Nevertheless, to compensate owners of those specific reserves that overlap with highly biodiverse regions and/or coincide with outstanding socioenvironmental values (Harfoot et al. 2018) might be instrumental to protecting these areas from imminent threat, guiding divestment strategies to maximize the collateral benefits of climate policies. Moreover, while compensation might be needed to overcome the resistance of fossil fuel interests in these specific reserves, climate ethics principles could be followed to prioritize compensation based on dependence on fossil fuel (i.e., on the social costs of transitioning to renewables) and the capability to face these costs at the country level. Thus compensation would be needed only for developing countries whose economies depend on fossil fuels.

Ultimately, as the impacts of climate change become increasingly manifest, a "whatever it takes" approach, guided by Keynes' famous dictum (which referred to high-quality public and private projects) that "anything we can actually *do* we can afford," might gain traction in the global public sphere (Keynes 2012, 270). Lest this seem unrealistic, it is worth recalling the (ongoing) efforts to respond to the COVID-19 pandemic. The stimulus package of the European Union, "Recovery Plan Europe," exceeds the €2,000 billion for the 2021–2027 budgeting period, not including the financial packages put together by individual member countries (European Commission 2022). Similarly, the United States passed multi-trillion-dollar stimulus packages—with the single Coronavirus Aid, Relief, and Economic Security (CARES) Act estimated at US$ 2,300 billion (US Department of the Treasury 2022). At the level of intergovernmental organizations, the International Monetary Fund allocated approximately US$ 650 billion of special drawing rights to member countries (International Monetary Fund 2021).

The resources raised in response to the COVID-19 pandemic ultimately show that the main shortcoming in mobilizing seemingly impossible sums is the availability of political will rather than financial resources. As the gravity of the latest Intergovernmental Panel on Climate Change report's warning that "any further delay in concerted anticipatory action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a livable and sustainable future for all" (Intergovernmental Panel on Climate Change, forthcoming) becomes internalized by policy makers and citizens around the world, a global initiative to leave a substantial portion of fossil fuel resources under the ground with partial compensation for rights holders to drastically reduce emissions before 2030 might become more feasible (van Asselt and Newell, this issue). However, major political challenges remain, including hurdles in international diplomacy and cooperation (e.g., differentiated responsibilities, confidence and credibility of the governing multilateral institution, enforcement mechanisms) to come to an agreement as well as the imperatives to increase investment in alternative energy sources and improve technology transfer to meet global energy demand.

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