

The Supply Side of Climate Policies: Keeping Unburnable Fossil Fuels in the Ground

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Abstract

As the urgency of responding to climate change and the insufficiency of current demand-side policies to mitigate greenhouse gas emissions become clearer, supply-side initiatives are beginning to gain prominence and acceptance globally. Policies such as moratoria and compensation for leaving fossil fuels unextracted in exchange for financial compensation of rights owners are likely to be effective and complementary to existing policies. A number of unknowns remain regarding the operationalization of supply-side policies, such as how to establish a binding international agreement and how to raise and allocate financial compensation for nonextraction. Nevertheless, the need for supply-side policies only emphasizes the importance of imaginative and bold initiatives within the current conjuncture of global environmental politics.

The idea of a “supply-side” approach to climate change mitigation has long been hiding in plain sight. Supply-side climate policies aim at mitigating greenhouse gas emissions through the reduction of fossil fuel supply and complement demand policies that reduce the consumption of fossil fuels. Indeed, in oil-rich developing countries, such as Ecuador, there were calls for a moratorium on exploration and extraction already in the 1990s. Nevertheless, the overwhelming majority of existing policies focus solely on diminishing the demand of fossil fuels. Yet, as the Cambridge economist Dennis Robertson had once argued, “highbrow opinion is like a hunted hare; if you stand in the same place, or nearly the same place, it can be relied upon to come round to you in a circle” (Harcourt 1991, 366). In fact, the idea of using supply-side initiatives has recently gained prominence and respectability.

Today, supply-side approaches to climate change mitigation are ubiquitous. From the *Economist* to the *Wall Street Journal*, the idea that policies to

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respond to human-induced climate change might render fossil fuel reserves “stranded assets” is squarely in the mainstream of global economic and energy policy debates. Much of this discussion seems more concerned with the implications of actively stranding fossil fuels in the ground for the financial standing of the rights owners rather than for the necessity to minimize catastrophic ecological changes. Even the usually rather conservative International Energy Agency has recognized that limiting the increase in global temperature to 1.5° would require that “no new oil and gas fields” and “no new coal mines or mine extensions” be greenlighted beyond those already committed to by 2021 (International Energy Agency 2021). Nor are supply-side initiatives and compensation of rights holders only in the domain of policy debates. Their arrival at the center of climate change discussions is perhaps best illustrated by their prominence in the widely popular science fiction novel *Ministry for the Future*. Capturing the emerging zeitgeist, United Nations secretary-general Antonio Guterres tweeted in April 2022 that “climate activists are sometimes depicted as dangerous radicals. But the truly dangerous radicals are the countries that are increasing the production of fossil fuels. Investing in new fossil fuels infrastructure is moral and economic madness” (United Nations 2022).

Nevertheless, there remains much work to be done in terms of understanding the conditions, challenges, and opportunities promised by supply-side climate policies. The contributions to this special issue push debates around supply-side initiatives further by investigating some key conundrums underpinning the design, operationalization, and implementation of supply-side climate policies. Specifically, outstanding questions regarding their design, institutionalization, and legitimization need to be answered before they can be expected to be operationalized. To begin with, van Asselt and Newell tackle the question of which form international agreements should take to lead to effective commitments to keep fossil fuels underground, considering alternatively a club arrangement and a multilateral environmental agreement. A related issue is the objective of such agreements; Green and Kuch consider the alternatives of focusing on reserve conservation, production management, and limits to infrastructure construction. As limiting extraction of fossil fuels implies that rights holders over fossil fuel stocks will have to forgo their rights to extract, Orta-Martínez and his colleagues explore and provide an estimate of the financial resources that would be needed to compensate rights holders of unburnable oil and gas reserves globally. Gard-Murray proposes an approach to generate the funding necessary to compensate developing countries for the fossil fuel reserves that cannot be extracted by way of loans whose repayment schedule will depend on the future wealth of the debtor country—an “income-adjusted guarantee.” Numerous initiatives to leave fossil fuel reserves unextracted have already been implemented in several countries, and Lujala et al. investigate the determinants of these initiatives. Also looking at past experience, but with a focus on the absence of substantial initiatives to keep fossil fuels under the ground, running in the face of the commitment to abate greenhouse gas emissions, Harrison and

Bang examine the way Norway and Canada accommodate their climate commitments with their positions as fossil fuel exporters.

In the rest of this introductory piece, we provide a brief overview of the process through which the unassailable logic of reducing the supply of fossil fuels percolated upward, from the Global South to the Global North, from the local to the global, and from environmental social movements to governmental cabinets and corporate boardrooms. We then further unpack the economic logic that long made it seem that changes in demand would necessarily be the precondition for the drop in supply. Before discussing the contributions of the articles in the collection further, this introduction discusses the political economy implications of supply-side initiatives, not just in terms of the relationship between developed and developing countries but also the dynamic between marginalized communities and nonstate actors, on one side, and nation-states, on the other. We conclude with a brief discussion of remaining challenges.

The Momentum of Supply-Side Climate Policies

Supply-side climate policies have long been neglected by both policy makers negotiating international agreements to abate greenhouse gas emissions and academics studying climate change. In fact, the first actors promoting initiatives to leave fossil fuels in the soil through various instruments and with various degrees of success are grassroots movements across the globe—supply-side climate policies are an instance of the many sustainability concepts coined by environmental justice organizations (Martinez-Alier et al. 2014). The slogan “Leave oil in the soil” was created in 2007 by Nigerian activist Nnimmo Bassey (founder and longtime executive director of Environmental Rights Action), who formulated a concrete policy proposal on unburnable oil in 2009 (Temper et al. 2013, 41). Also thanks to the organization Oilwatch, founded by social movements from Ecuador and Nigeria, the idea traveled back and forth between the countries through Acción Ecológica, an Ecuadorian environmental justice organization. The Yasuní-ITT initiative became the first proposal to have a large-scale extraction moratorium promoted by a national government; President Rafael Correa asked the international community to partially compensate the Ecuadorian state for keeping the reserves under the Yasuní-ITT park in the Ecuadorian Amazon (Arsel 2012; Espinosa 2013; Pellegrini et al. 2014). While the initiative did not flourish, it was an innovative proposal to solve the tension between contributing to global public goods (conservation of a biodiversity hot spot and mitigation of greenhouse gas emissions) and satisfying the need for generating revenues from natural resources for the state. The initiative of preserving specific oil reserves underground in a biodiversity hot spot inhabited also by Indigenous people in voluntary isolation offered a great opportunity to reap substantial collateral benefits of a climate policy initiative. The lukewarm reception that the initiative received internationally (in contrast to its strong domestic support)

was likely a function of the prevailing political contexts and its groundbreaking character, especially its strong equity component that sought to establish a precedent for the compensation of countries forgoing economic opportunities to provide global goods.

It is perhaps not surprising that locations where the socioenvironmental liabilities generated by fossil fuel extraction are most obvious, such as Nigeria and Ecuador, were the ones that experienced the rise of environmental justice mobilizing to stop extraction. In the meantime, the idea of enacting policies to decrease fossil fuel extraction has become more and more acceptable and even obvious. This morphosis is underpinned by the glaring contradiction between the projected extraction of fossil fuels (and investments thereof) and the remaining carbon budget associated with the increase in temperature that are embedded in commitments to limit the global long-term increase in average global temperatures to 1.5°C, or 2°C if compared to preindustrial times (Intergovernmental Panel on Climate Change [IPCC] 2022).

Most recently, an important role in unveiling the hypocrisy of current commitments to climate objectives and present and projected greenhouse gas emissions has been played by Greta Thunberg and the movement Fridays for Future. The movement began in August 2018 as a school strike of a pupil who protested the dire consequences of climate change for her generation and demonstrated consistently in front of the Swedish parliament against inaction on the climate. Specifically, on the topic of supply-side climate policies, Thunberg has taken advantage of her popularity to show that the emperor has no clothes and with striking clarity reiterated on several occasions the slogan “Keep fossil fuels in the ground.”

If belatedly, the International Energy Agency has reached the same conclusions in its road map toward net zero emissions by 2050. A coalition of diverse actors (including social movements, intellectuals, scientists, individuals, and local governments) has promoted and endorsed a proposal to establish a “Fossil Fuel Non-Proliferation Treaty” (Newell and Simms 2019). Furthermore, at the international level, the Beyond Oil and Gas Alliance (BOGA), with Costa Rica and Denmark as founding members, is promoting initiatives to set a date for the phaseout of oil and gas extraction.¹ The Lofoten Declaration, originating in a meeting at the eponymous Norwegian islands—a site where social movements have managed to halt fossil fuel extraction projects—and written by academics, analysts, and activists, calls for a managed decline in fossil fuel extraction.² The message resonates in the letter written by 101 Nobel Prize winners urging global leaders to “end the expansions of fossil fuel production; phase out current production; and invest in renewable energy” (Fossil Fuel Non-Proliferation Treaty 2021). In terms of concrete policies, countries are unilaterally enacting (partial) moratoria on fossil fuel projects, with Spain standing out for having enacted a

1. Beyond Oil and Gas Alliance, <https://beyondoilandgasalliance.com/>, last accessed October 18, 2022.

2. Lofoten Declaration, <https://www.lofotendeclaration.org/>, last accessed October 18, 2022.

moratorium on licensing of new oil and gas exploration and extraction projects (Higham and Koehl 2021; Tudela 2020).

Eventually, the issue of limiting fossil fuel extraction reached also the boardrooms of leading energy companies, in particular because of shareholder activism and legal mobilization to force companies to act in line with international agreements, such as the Paris Agreement. Most famously, a Dutch court has ruled that Royal Dutch Shell's climate strategy is not sufficiently concrete and that the company needs to cut its emissions by 45 percent, if compared to 2019 emissions, by 2030 (Raval 2021). These are consequential emission cuts that pushed the company to grudgingly announce plans to reduce emissions while appealing to the higher court against the ruling. Climate litigation has been ballooning as part of a broader trend toward the judicialization of environmental policies, the movement to halt corporate impunity, and increasing public concern over climate change. Major oil companies (such as Chevron, ConocoPhillips, and Shell) have started to disclose regularly climate lawsuits as a potential material risk (*Economist* 2022; Pellegrini et al. 2020). Moreover, lawsuits have also been started against governments based on the commitments they made in international climate agreements (including the Paris Agreement, although it is nonbinding), intergenerational justice, and the risks generated by climate change (Raval 2021). The Dutch and German governments have been forced, through independent court cases, to revise and reduce their emissions targets, while a number of cases are currently being litigated. There are also intersections between activist and corporate strategies, for example, when the threat of legal action contributes to divestment decisions. This is the case of the activist mobilization that threatened the Dutch pension fund ABP—one of the largest in the world—with legal action for continuing to invest in underperforming fossil fuel interests. The mobilization made a decisive contribution to the fund decision to divest from fossil fuels, making a dramatic U-turn on its previous investment decisions (FD 2022).

As this section demonstrates, supply-side climate policies moved from the fringes, where they were ridiculed as extremist and unrealistic, to become commonsensical and even obvious. This trajectory is not particular to these policies and is in fact shared by many other genuinely innovative ideas.

The Grounds for Supply-Side Climate Policies

In principle, supply- and demand-side climate policies are equivalent: both have the potential, independently from each other, to limit greenhouse gas emissions if effectively implemented at the global scale. However, pursuing supply and demand policies simultaneously would create complementarities and synergies (Lazarus and van Asselt 2018; Pellegrini et al. 2021). These policies pursued together would serve to strengthen and signal commitments to greenhouse gas emissions mitigation, act as an insurance (in case one set of policies fails, the other might still produce effects), and work on different political economy

dynamics (with respect to countries involved, the possibility to galvanize civil society initiatives, and prospects to disarticulate oil interests). Moreover, they would address some of the weaknesses of demand-side policies—the problems of intercountry and intertemporal leakage. Now, we turn to and expand on these motivations for adopting both supply- and demand-side policies.

The credibility of commitments to abate emissions is critical for economic agents because it drives the incentive structure and the response of stakeholders, including the fossil fuel industry. Projected emissions from existing and currently planned fossil fuel infrastructure will exceed the emission pathways limiting global warming to 1.5°C, making effective climate policy conducive to stranded assets (IPCC 2022, 19). To comply with the less ambitious goal of limiting global warming to 2°C, no new investment in fossil fuel infrastructure should be planned. A stronger commitment to climate policy would signal that further investments in exploration, production, transportation, and transformation of fossil fuels will become stranded assets and part of the current investment might have to be written off.

The political economy of demand and supply policies is quite distinct, and given the need to coordinate multifarious actors to achieve scale—for demand policies, almost all large emitting countries, and for supply policies, almost all large producers—these policies rest on different pathways to reach agreements and different likelihoods of success in mitigating greenhouse gas emissions. Apart from state actors, the political economic dynamic can also play out differently for civil society, and supply-side policies could provide an international platform to galvanize civil society initiatives opposing the construction of fossil fuel infrastructure at the local and global levels. These policies can also strengthen the international norms with respect to emissions by pairing the stigmatization of emissions associated with the consumption of fossil fuels (such as the case of “flight shaming” and the denunciation of other forms of conspicuous consumption, such as the use of private jets and space tourism) and the supply of fossil fuels, ultimately providing additional motivation for the opposition to fossil fuel projects (Green 2018). Finally, fossil fuel interests (most notably states, which in most jurisdictions are the rights holders over subsoil resources, and fossil fuel companies) will also be differentiated vis-à-vis supply-side climate policies, undermining their capabilities to lobby against and obstruct supply-side climate policies. Holders of rights over fossil fuels could benefit from constraints on the global supply of fossil fuels that would make their commodities scarcer and hence pricier, or if these policies would be voluntary and coupled with compensation, they could receive payment in exchange for renouncing their own extraction rights (Pellegrini et al. 2021).

Effective demand-side climate policies could give rise to intertemporal and intercountry leakage. Intertemporal leakage, or the “green paradox,” is a situation where fossil fuel producers act in anticipation of a global decline in the demand for fossil fuels. Since the decreased demand drives the value of reserves down, producers would attempt to increase and anticipate the extraction of

fossil fuels (Sinn 2009). Intercountry leakage is the effect associated with demand interventions that marginally depress prices of fossil fuels, leading to increased consumption by the countries that are not enacting effective policies to decrease the demand for fossil fuels. Thus policies that decrease demand in some countries would, in part, move consumption to other locations. Supply-side policies would generate precisely converse effects, decreasing the supply and hence increasing the prices of fossil fuels. Demand and supply policies enacted together would moderate the effects of the green paradox and leakages.

Environmental Justice and Supply-Side Policies

The question of compensation looms large in the discussion on how to leave fossil fuels in the soil. In fact, the establishment of an effective compensation scheme for (some of the) resource owners would be crucial to the operationalization of supply-side initiatives. How the massively large sum required could be raised is a question that is beginning to be addressed in the literature (e.g., Gard-Murray, this issue; Orta-Martínez et al., this issue) together with methodologies for allocating and distributing funds (e.g., Pellegrini et al. 2021). The issue of compensation raises the question of whether all countries—regardless of their overall international standing (e.g., Saudi Arabia, an immensely wealthy kingdom with a ghastly human rights record)—should be eligible for compensation. This is an issue that can be subject to a compromise based on political feasibility, which is continually shifting given the increasing awareness of the impacts of climate change and the continuing efforts of entrenched fossil fuel interests to continue with business as usual. While acknowledging the tensions between justice and *realpolitik*, this section focuses on aspects of environmental justice, especially within the context of state–society and North–South relationships.

There is, for instance, a potential mismatch between historical responsibility for bringing about climate change (which is largely concentrated on advanced, industrialized economies) and the ability to cope with the socioeconomic implications emerging from the restriction of the supply of fossil fuel resources. In the short term, one dimension of this would be experienced in the potential rise of fuel prices, which will have a disproportionate impact on poorer nations as well as those that are net importers of energy. In the medium to longer term, transition away from fossil fuels will, on one hand, create growth opportunities for countries that can produce the technology behind renewable energy generation. On the other, the rush to renewable energies will likely generate new conflicts between corporations and states versus local communities, as already demonstrated in the cases of wind power (Dunlap and Arce 2022), micro-hydro power generation (Akbulut et al. 2018), and solar power (Rignall 2016).

Supply-side initiatives limiting fossil fuel extraction would likely diminish, though not necessarily eliminate, resource curse outcomes. This is because of

the materiality of fossil fuel extraction, which results in a political economic infrastructure that props up extractivism—oil corporations, ministries of natural resources, and so on. Their declined power would translate to their diminished ability to shape national politics and policy making. However, the influx of resource rents from compensation for nonextraction would remain unchanged or could in certain cases be increased, potentially recreating the socioeconomic dynamics underpinning the resource curse. At the very local level, fossil fuel extraction is associated with resource curse effects, but also with the creation of direct and indirect employment. To the extent that the halting of negative environmental impacts associated with extractive industries might in certain contexts enable the development of alternative sectors, such as ecotourism, this is likely to be true only in very specific cases. In general, a history of fossil fuel extraction is likely to create dependency dynamics and to foreclose development alternatives (Arsel et al. 2019). The absence of effective strategies toward a just transition can have detrimental effects on vulnerable portions of the population, especially in terms of employment opportunities (Wang and Lo 2022). Revenues generated through compensation mechanisms for nonextraction could provide the necessary funding for employment and community-level interventions, as well as covering the costs associated with the transition to renewables. A corollary of this argument is that the potentially negative impacts of transitioning toward nonextraction would therefore be significantly easier to avoid in countries (or regions) where extraction has not gained a strong foothold. In other words, the possibility of implementing a supply-side solution would be greater in areas where extraction is not yet dominant in terms of political economy relationships.

Another issue that has so far received very little attention is the impact of compensation for nonextraction on state–society relationships. The point-source nature of fossil fuels means that their extraction gives the relationship between state and society a particular type of spatial dynamic. For extraction to be possible (either directly by the state or by private corporations), the state would require some presence in the area, both infrastructurally and administratively. This is required not only for functional purposes—to ensure that extraction and transport of resources can be carried out safely and predictively—but also to build the necessary political legitimacy with local communities. In other words, the process of extraction creates a concrete link between the state and local communities. Even if subsoil resources are most often owned by the state itself, local communities can still leverage the fact of their territories being on top of these resources to make certain claims on the state. These demands are often unmet or only partially met, and the spectrum of acceptable demands is effectively policed by nation-states, who can resort to the use of violence if local demands are seen as excessive (e.g., the Nigerian state cracking down on Ogoni activists; Agbonifo 2018). Nevertheless, the necessity to ensure the steady flow of revenue accruing from extraction creates a stable if uneven relationship between the state and local communities. Transitioning toward an order in

which nation-states are paid *not* to extract would likely weaken this link substantially. Although the state would still be compensated for natural resource wealth within the territorial boundaries of particular social groups, the act of nonextraction would take away the leverage of local communities. As such, the state's imperative to create and maintain legitimacy and compensate communities in resource-rich areas would be weakened.

Finally, it is important to acknowledge the potential problem associated with implementing a successful supply-side initiative. If such a success were to halt human-induced climate change, this could happen within the dominant political economy structure of global capitalism. Whereas climate change is arguably the most urgent and most catastrophic environmental effect of global capitalism, it is far from the only one. In fact, even within the context of climate change mitigation, elimination of fossil fuels is already being associated with the rise of other processes of environmental degradation, including the massively increased production of metals and minerals, such as copper and lithium. The same forces of overconsumption and ever-expanding accumulation that have resulted in the problem of climate change would remain in place and continue to create global environmental degradation in other ways. Just as importantly, while the impacts of climate change are experienced in deeply unequal and unjust ways (with marginalized communities who have the least responsibility for the creation of the problem paying the highest costs) and therefore can be improved by a global supply-side solution, other forms of inequality—especially, but not only, economic—would remain intact. It is therefore important that climate change mitigation efforts be accompanied by broader efforts to create an overall just and sustainable global economy.

Contributions to the Special Issue

One of the most important approaches to supply-side mitigation involves the compensation of rights owners of fossil fuels that remain unextracted. Before the feasibility of and mechanisms for compensation are debated, it would be important to have at least a preliminary estimate of the financial resources required. The forum by Martí Orta-Martínez and colleagues, "Unburnable Fossil Fuels and Climate Finance: Compensation for Rights Holders," tackles this challenge, calculating that US\$ 5.4 trillion would be necessary to compensate the rights owners of existing oil and gas reserves. Recognizing the vastness of this sum, they also consider the feasibility of raising the necessary funds and argue, after John Maynard Keynes, that "anything we can do, we can afford."

The article by Harro van Asselt and Peter Newell, "Pathways to an International Agreement to Leave Fossil Fuels in the Ground," is broadly concerned with the institutional arrangements that can help translate the notion that supply of fossil fuels needs to be restricted into concrete reality. Their article sees various economic, social, and legal dynamics, such as price and availability of

renewables, action by social movements, and environmental litigation, converging to prepare the ground for international action. They consider two “idealized pathways”: a club arrangement, as partly illustrated by the BOGA, and a multilateral environmental agreement. While both approaches have their strengths and weaknesses, the authors argue that in the short term, a club arrangement would be more likely but, in the longer term, it should evolve into a multilateral environmental treaty to achieve the necessary degree of efficacy to leave sufficient quantities of fossil fuels in the soil.

Any supply-side approach to international greenhouse gas mitigation would require an appropriate measuring/monitoring, reporting, and verification framework. In their article, “Counting Carbon or Counting Coal? Anchoring Climate Governance in Fossil Fuel–Based Accountability Frameworks,” Fergus Green and Declan Kuch argue that the currently dominant carbon-based accountability framework is not fit for the task at hand. They consider three different alternatives that can be the basis of a fossil fuel–based accountability framework: reserves, production, and infrastructure. Anchoring governance mechanisms in reserves, they argue, is too risky, as their volume can be manipulated. Instead, given their relative transparency, they argue that production and infrastructure data would be more productive and help hold nation-states accountable.

There are a number of existing suggestions in the literature on how the financial resources necessary for compensation can be mobilized. In “De-risking Decarbonization: Accelerating Fossil Fuel Retirement by Shifting Costs to Future Winners,” Alexander Gard-Murray develops a novel and provocative approach. Noting that rich countries of today are not willing to produce the funds necessary for international and intergenerational transfers, his model suggests that fossil fuel–rich developing countries can be encouraged to leave their resources unextracted with the help of loans whose repayment would be contingent on future wealth. This “income-adjusted guarantee” mechanism, argues Gard-Murray, could provide a realistic way to bridge the existing gap between rich country financing and the need to leave fossil fuel reserves untapped in a way that can respond to questions regarding the legitimacy and fairness associated with such a mechanism.

The final two articles of the special issue are located on an empirical terrain, exploring the conditions and structures that shape nation-states’ behavior with respect to supply-side initiatives. In “Determinants of Fossil Fuel Production Cuts and Implications for an International Supply-Side Agreement,” Päivi Lujala, Philippe Le Billon, and Nicolas Gaulin analyze data for 124 countries with fossil fuel reserves for 2016–2019 to identify factors influencing national decisions to leave fossil fuels underground. They show that dependence on fossil fuel revenues is inversely correlated with the likelihood of constraining extraction but that reserves and production do not have a meaningful influence. In addition, they find that whereas rich countries are more likely to resort to supply-side initiatives, membership in OPEC diminishes the likelihood of

moratoria on extraction. Finally, indebtedness and recent experience with armed conflict make it unlikely that supply-side initiatives will be enacted.

In “Supply-Side Climate Policies in Major Oil-Producing Countries: Norway’s and Canada’s Struggles to Align Climate Leadership with Fossil Fuel Extraction,” Kathryn Harrison and Guri Bang explore the ways in which these two countries reconcile their leadership in reducing domestic greenhouse gas emissions with their status as major fossil fuel exporters. They show that successes of social movements have largely been in terms of limiting the expansion of extraction, while the reduction of production remains unlikely in either country. As Norway and Canada have been successful in translating their fossil fuel wealth into overall prosperity, citizens in both countries are reluctant to abandon fossil fuel exports. They show that the arguments that unilateral production restrictions are ineffective, that the exports of these countries are cleaner than their alternatives, and that the revenues from exports are necessary to finance domestic efforts to reduce greenhouse gases are powerful in continuing these countries’ patterns of fossil fuel extraction.

Conclusions

Any discussion of climate change politics and policies needs to depart from two concrete facts. First, climate change is no longer a future threat but one that is already causing extensive and unpredictable damage to ecosystem health and human welfare across the planet. Second, existing demand-side approaches to carbon mitigation have been insufficient at best, and greenhouse gas emissions are on course to further exacerbate climate change. Within this context, the growing prominence of supply-side initiatives is a welcome development. Nevertheless, it is also crucial to recognize that the novelty of such policies brings with it uncertainties and challenges. The failure to address these could potentially not only hamper efforts to mitigate climate change but also exacerbate existing inequalities and injustices and create novel social conflicts (Arsel 2022). To avoid both the ecological impacts of climate change and the socio-economic impacts they will engender, there is therefore an urgent need for the type of bold and imaginative policy responses represented by supply-side restrictions like moratoria and compensation mechanisms.

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