Revoking Coal Extraction Rights: An Economic and Legal Analysis

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Abstract
To mitigate climate change impacts as agreed under the Paris Agreement, the world needs to rapidly transition away from coal-fired power generation. However, governments in numerous coal-producing jurisdictions have in recent years prolonged coal development with supply-side permitting decisions that contradict Paris commitments. We assess the economic rationales and legal avenues for implementing a restrictive supply-side climate measure—specifically, the revocation of active coal extraction permits. Taking the illustrative case of permits granted by the German government to RWE Power AG to deforest more than 40 km² and mine from the 1.4 billion tonnes of lignite remaining in the 12,000-year-old Hambach Forest, we estimate that halting planned operations at the Hambach opencast mine alone would reduce Germany’s total CO₂ emissions by up to 7 percent and avoid approximately €326 billion in health-related air pollution costs, €34 billion in CO₂ emission costs, and €19 million in lost carbon sequestration over a 35-year period, assuming a constant discount rate of 3 percent. Assessing the legal avenues through which active lignite extraction and power plant permits may be revoked in Germany, we find that German law does not necessarily pose a barrier to the proposed measure; the legal case is in fact bolstered when going beyond arguments that strictly relate to global climate change and taking into account the localized air pollution damages and losses to ecosystem services resulting from mining and deforestation. Our findings indicate that revoking coal extraction rights is a legally plausible and economically sound means of expediting the coal phaseout and may be more efficacious than alternative demand-side policies. This is an especially compelling result when one considers that Germany has recourse to other energy sources that are significantly less emissions-intensive than lignite.
Coal in place is land; and the right of the owner to use his land is not absolute. He may not so use it as to create a public nuisance; and uses, once harmless, may, owing to changed conditions, seriously threaten the public welfare.

Justice Louis Brandeis, dissenting opinion in Pennsylvania Coal Company v. Mahon, 260 US 393 (1922)

1. Introduction

To mitigate the impacts of climate change, the world is undergoing a once-in-a-civilization transition away from a carbon-based energy system. 179 national governments representing 89 percent of global greenhouse gas emissions have hitherto ratified the Paris Agreement, committing to limit the rise in global mean surface temperature to “well below 2°C above pre-industrial levels” while “pursuing efforts” to stay below 1.5°C (UNFCCC 2015). Although the legal text of the Paris Agreement does not include the words “fossil fuel”, “coal”, “oil”, or “gas”, having a >66% chance of limiting warming to below 2°C implies a global budget in the range of 590 to 1,240 GT of CO₂ that can be emitted during the remainder of the 21st century, in the absence of large-scale and expeditious deployment of hitherto unproven carbon capture and storage (CCS) technologies (Rogelj et al. 2016; McGlade and Ekins 2015; Johnson et al. 2015; Carbon Tracker 2013). More specifically, the 2°C budget requires leaving approximately one-third of proven oil reserves, half of natural gas reserves, and over 80 percent of coal reserves in the ground (McGlade and Ekins 2015).

The scale and speed of the post-carbon transition will depend in the first instance on how well governments manage the diminution of coal, the most carbon-intensive and environmentally hazardous of fossil fuels. On the one hand, there are propitious signs indicating that coal’s decline has entered a self-reinforcing stage: (1) in China, the internal rate of return for coal power in most provinces is expected to be very low or even negative by 2020, and in the European Union (EU), 54 percent of coal-fired power generation is now cash-flow negative, with projections that this figure could reach 97 percent by 2030; (2) coal’s operating costs could be higher than building onshore wind and solar within the next decade, as the levelized costs of renewable energy sources continue to decline; (3) 11 EU countries accounting for 22 percent of EU coal-fired
power generation have either closed all coal fleets or announced dates by which all coal plants will be shut down, including France (by 2023), Italy and the United Kingdom (by 2025), and the Netherlands (by 2030); and (4) regulations governing power plant emission standards have added billions of dollars in compliance costs cross-jurisdictionally, affecting 82 percent of coal capacity in the EU alone (Zhao et al. 2017; Carbon Tracker Initiative 2017). Coal’s terminal decline is not a matter of ‘if’, but ‘at what speed’.

On the other hand, forecasts of coal’s terminal decline should be tempered by a healthy dose of realism. Given high upfront capital costs, long capital stock lifetimes, infrastructural lock-in, the survival strategies of incumbent energy companies, and other sources of inertia, energy system transformations commensurate with the scale of the climate challenge have historically taken a minimum of 30-40 years, implying that price or regulatory “shocks” need to drive investments sooner than later (Sovacool 2016; Fouquet 2016; Grubb et al. 2018; Covert et al. 2016). In the electricity sector alone, current and planned fossil fuel-fired power plants have already “locked in” enough global cumulative emissions to overshoot the 2°C target considerably, assuming these plants remain operational until the end of their economic life (Pfeiffer et al. 2016; Pfeiffer et al. 2018; Edenhofer et al. 2018). In short, the world’s carbon-based capital stock already faces overcapacity from a carbon budget perspective. At the same time, ‘negative emissions technologies’ (NETs) are, given their plausible scales and current costs, best understood as a necessary complement rather than substitute to curtailment of fossil fuel production and consumption (Fuss et al. 2014; Gasser et al. 2015; Rogelj et al. 2015; Larkin et al. 2017; Griscom et al. 2017). This leaves two possibilities for achieving 2°C-compatible climate mitigation: (1) the intentional stranding of fossil fuel assets in certain high-impact jurisdictions, through an expeditious, managed decline in current levels of fossil fuel production to minimize sunk costs and accelerate investments in substitutes; or (2) the unintentional stranding of fossil fuel assets, whereby current investment patterns will persist in the short-term but a future decline in fossil fuel consumption will entail the early retirement of global carbon assets valued at trillions of dollars (Millar et al. 2017; Mercure et al. 2018; Johnsson 2018). Importantly, the former (better managed) route necessitates strategic and foresighted supply-side policy interventions that are only recently receiving sustained attention in the scholarly literature (Lazarus et al. 2015; Green and Denniss 2018; Erickson and Lazarus 2018).
In this article, we assess an underexplored supply-side climate policy intervention that could catalyze the post-carbon transition: namely, for governments in select jurisdictions to revoke active coal extraction permits previously granted to fossil fuel companies. We begin by reviewing four key motivations for exploring permit revocation in Section 2. In Section 3, we adopt relevant economic and political criteria to identify a high-impact case study through which we assess the prospects of this intervention: the German government’s granting of permits to RWE Power AG to mine from the 1.4 billion tonnes of lignite remaining in the 12,000-year-old Hambach Forest in North Rhine-Westphalia. We then conduct two complementary analyses: (1) natural capital accounting to estimate the ecosystem damages associated with continued lignite extraction in the Hambach opencast mine (Section 4); and (2) an assessment of the legal avenues available under German law to revoke RWE’s lignite mining permits (Section 5). Our main findings are twofold. First, revoking rights to extract lignite at Hambach alone would reduce Germany’s CO\textsubscript{2} emissions by up to 7 percent while avoiding approximately €326 billion in health-related air pollution costs, €34 billion in CO\textsubscript{2} emission costs, and €19 million in lost carbon sequestration over a 35-year period. Second, although fossil fuel permitting laws predate contemporary climate concerns, German law (as well as relevant statutes of other fuel-producing jurisdictions) do not preclude the revocation of active permits; the legal case is in fact bolstered by accounting for a larger spectrum of losses to natural capital and local ecosystem services. Based on these assessments, we conclude that revoking coal extraction permits is a legally plausible and economically sound means of expediting coal’s decline consistent with the world’s climate objectives. The plausibility of revoking permits to extract lignite and operate lignite-fired power plants in Germany may serve as a model for restrictive supply-side climate policies in other jurisdictions.

2. Motivations for Revoking Permits

In addition to the aforementioned time-sensitivities of the coal phaseout from a climate perspective, our study is motivated by four core considerations: (1) the compelling rationales for restrictive supply-side policies; (2) current contradictions in real-world climate policies; (3) oft-forgotten aspects of the history of fossil fuel permitting; and (4) the ecological co-benefits and positive feedback dynamics of unilateral climate action.
that are often ignored in the common caricature of the climate challenge as a ‘Prisoner’s Dilemma’.

Following Green and Denniss (2018), climate change mitigation policies can be broadly categorized into four quadrants (see Table 1).¹

### Table 1: Quadrants of Climate Change Mitigation Policies

<table>
<thead>
<tr>
<th>Supply-side</th>
<th>Demand-side</th>
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| Restrictive | **Restrictive supply-side climate policies**  
Examples:  
- Eliminate fuel production subsidies or tax deductions  
- Zoning ordinances  
- Product bans, moratoria, and phase-outs  
- Purchase reserves for purpose of conservation  
- **Cease issuing, renegotiate, or revoke fossil fuel permits and leases**  
| Restrictive demand-side climate policies  
Examples:  
- Carbon pricing  
- Emission standards  
- Fossil fuel severance tax  
- Emissions-intensive materials charge  
- Congestion charge  
- Building codes  
- Performance-based billing  
| Supportive | **Supportive supply-side climate policies**  
Examples:  
- RD&D spending (solar, EVs, grid, storage, efficiency, CCS, NETs, etc.)  
- Green infrastructure spending  
- Low-emission manufacturing subsidies  
- Renewable portfolio standards  
- Renewable energy feed-in tariffs  
| Supportive demand-side climate policies  
Examples:  
- Public procurement of green energy technology and infrastructure  
- Consumer tax incentives or subsidies for energy-efficiency measures and substitutes  
- Energy or carbon efficiency product labeling requirements  

Table 1: Adapted from Green and Denniss (2018). The shaded quadrant represents the broad focus of this article, with the particular policy focal point in bold font. ‘CCS’ denotes carbon capture and storage and ‘NETs’ denotes negative emission technologies.

Recent scholarship has highlighted the paucity of extant climate policies in the first quadrant—restrictive supply-side climate policies—and the relative focus of

¹ Certain policies such as deposit-refund schemes or “feebates” that follow a “stick and carrot” logic may apply to more than one quadrant.
governments on the other three quadrants (Sinn 2012; Lazarus et al. 2015; Green and Denniss 2018). But restrictive supply-side policies boast numerous advantageous properties: low administrative costs and relative ease of implementation, minimization of stranded assets and sunk costs, environmental synergies with other climate policies, and consistency with mainstream public views regarding equity and fairness embodied in the ‘polluter pays’ principle (Green and Denniss 2018). Restrictive supply-side environmental policies also have a foundation in classical economic theory (Mill 1848). Even Pigou (1920), who pioneered the theoretical foundations of demand-side environmental policies such as ‘corrective’ taxation, suggested that the outright prohibition of the production or consumption of certain products might be justified in certain cases (Sandmo 2015). Restrictive supply-side policies can yield considerable additional emission reductions (Erickson and Lazarus 2018), counteract counterproductive fossil fuel subsidies (Metcalf 2018), and are bolstered by numerous other economic and ethical considerations (Collier and Venables 2014). Of particular relevance to our inquiry herein are recent studies exploring the positive environmental impacts of phasing out fossil fuel leases in the United States and Canada (Erickson and Lazarus 2018; Erickson 2018). We contribute to this literature by expanding the geographical purview to Europe and identifying conditions under which revoking active extraction permits, rather than merely phasing out the issuance of new permits, may be justified in certain countries from a mitigation perspective.

Second, climate policy frameworks in numerous fuel-producing countries are currently shrouded in contradiction. Fuel-producing jurisdictions face a unique political tension when drafting climate change mitigation policies. There is the risk that the jurisdiction’s demand-side policies to reduce emissions-intensive consumption will be partly or wholly counteracted by supply-side policies that prolong fossil fuel production. In the absence of a globally harmonized carbon price, it is possible for a country to price CO₂ emissions domestically while still profiting from the extraction and export of fossil fuels internationally. This is particularly the case since most of the world’s carbon prices are levied midstream (at power plants and industrial facilities) and fail to capture upstream extraction-related emissions. This tension has become acute in recent years as governments have been under pressure to augment the ambition of emission reduction plans, consistent with Articles 4.3 and 4.9 of the Paris Agreement (UNFCCC 2015), without entirely disrupting the operations of domestic producers in the process. The
tension manifests itself across multiple regimes: the Trudeau administration’s adoption of the Pan-Canadian Climate Framework and its simultaneous attempted public purchase of the Kinder Morgan pipeline to accelerate oil sands exports to Asian economies, expected to counteract much of the emission reductions from the framework (Erickson 2018); California’s passage of stringent demand-side climate policies, such as the extension of its cap-and-trade program to 2030, while simultaneously issuing more than 20,000 new permits for oil and gas extraction under Governor Jerry Brown’s administration (Oil Change International 2018); Norway’s pursuit of stringent demand-side climate policies alongside its expansion of offshore oil and gas production and exports, which has weakened the global mitigation impact of its policies by an estimated 30-40 percent (Fæhn et al. 2017; Oil Change International 2017); Australia’s state-level renewable energy targets that diverge starkly from the federal government’s support for expanding coal production, exemplified by the contentious approval of the Carmichael coal mine in Queensland; and Germany’s longstanding policy support for renewable energy having been overshadowed by the government’s approval of additional coal mining projects, its acknowledgment that it will fail to meet the national 2020 emissions target, and the announced reduction of the 2030 renewable energy target. Such chasms between demand-side and supply-side climate policies have partly motivated the proliferation of climate-related lawsuits brought forth by NGOs and other plaintiffs to challenge numerous fossil fuel mining and infrastructure permitting decisions cross-nationally, including at least 175 US cases and 140 non-US cases (Sabin Center for Climate Change Law 2018). The proliferation of climate-related litigation is partly a symptom of weak supply-side policies, which have undermined public confidence in national climate policy frameworks.

Third, current laws governing fossil fuel permitting are an anachronism in the era of anthropogenic climate change. Globally, most fossil fuel is situated on public lands owned by governments, who grant concessions in the form of leases, permits, licenses, or production-sharing agreements that impart exploration and extraction rights (typically lasting for 5 to 20 years) to companies that are liable for paying contractually defined royalties (Weaver and Asmus 2006). In a ‘first-best’ policy scenario, it would have been optimal for governments to have not granted extraction rights that contradict Paris climate targets. However, these administrative decisions, typically carried out by competent authorities such as ministries of the interior, have in most cases been made
on the basis of fossil fuel permitting statutes that governments inherited from the heyday of carbon-intensive industrialism in the late 19th and early 20th centuries (Caney 2006). The history of fossil fuel development since the 19th century is replete with examples of state-sponsored land grants, subsidies, and regulatory capture, in many cases involving the exercise of eminent domain powers2 to forcibly transfer land rights from private households and farmers to private companies for the ‘public use’ of economic development (Meidinger 1980; Squillace 2012). In almost all cases, the laws governing fossil fuel permitting decisions predate and collide with contemporary public concerns about climate change, air pollution, and the disruption of critical ecosystem services (Hein 2018). Fortunately, there are potential solutions that do not require new statutory legislation. While relevant statutes and contractual terms vary cross-jurisdictionally, governments could not only refrain from granting new fossil fuel permits as some authors have proposed (Erickson and Lazarus 2018), but can also unilaterally renegotiate or revoke existing permits. The possibility of such unilateral actions are acknowledged, for example, in the annual 10K reports that fossil fuel companies operating in the US must submit to the Securities and Exchange Commission (Exxon Mobil Corporation 2016). Put in the historical context of the large fossil fuel production subsidies implicit in over a century of land grants and lax permitting, the reluctance to explore restrictive supply-side policies appears amnesiac and improvident.

Fourth, while the common framing of climate policy through the allegory of the ‘Prisoner’s Dilemma’ is highly pertinent to the question of fossil fuel permitting, it ignores the co-benefits and dynamic properties of unilateral supply-side interventions. In the ‘Prisoner’s Dilemma’, if all agents coordinate to halt the production of carbon-intensive assets and pursue 2°C-compatible (or 1.5°C-compatible) growth, they will experience short-term costs but move towards a long-term state that is resilient, sustainable, and more prosperous. This results in higher pay-offs for all (see Table 2a). However, the gains to any one agent from deviating are higher than the pay-offs in the coordinated equilibrium; hence, all actors are incentivized to deviate and continue the pursuit of carbon-intensive growth. This descends the whole system into an uncoordinated equilibrium wherein the pay-offs to each actor are significantly lower due

2 Eminent domain is the term used most commonly in the US for expropriation, or the constitutionally sanctioned right of government authorities to take away private property rights for public use.
to the expected damages from climate change (see Table 2a). Governor Jerry Brown of California and Prime Minister Trudeau of Canada, for example, have justified their respective policies prolonging oil and gas production by citing the risk of other jurisdictions deviating from a coordinated climate-policy equilibrium (Erickson 2018; Oil Change International 2017).

Table 2: Stylized Representation of the Prisoner’s Dilemma

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<tr>
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<td>X\text{exploit}</td>
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While this is a useful caricature of the challenge of coordinating climate change mitigation policy cross-nationally and one that reflects how many agents view the problem, it is riddled with several issues. First, it is a generalization that ignores situations in which the pay-offs to any one country from unilateral climate action exceed the benefits from carbon-intensive growth (see Table 2b). Such a situation may arise when mitigation not only addresses global climate change but also delivers localized co-benefits such as improved human health due to lower particulate air pollution, lower risk of disasters due to natural flood and landslide defense, and a host of ecosystem services such as food production and air and water purification, which are not captured by the market (Helm 2015). With air pollution becoming a growing problem in major cities around the world, it is increasingly important that this co-benefit is not ignored in climate policy considerations. As we demonstrate in Section 4, natural capital accounting can shed light on the value of these co-benefits and incentivize governments to adopt energy policies informed by a more encompassing view of the pay-offs and damages of alternative pathways (Costanza et al. 1997; Ekins et al. 2003). The second way in which the Prisoner’s Dilemma may misrepresent supply-side climate policy is that it ignores the possibility that unilateral climate action can spur other countries into taking similar action, through contagion effects or positive feedback loops. For example, a prominent case of government revocation of coal extraction permits may spook investors, lead to disinvestment, and increase insurance premiums and the cost of
capital internationally for coal production projects. This type of contagion effect will negatively impact the viability of upstream fossil fuel projects and could reduce their supply. Such a self-reinforcing dynamic alters the structure of the game from that of the Prisoner’s Dilemma, as described above, to one in which there are ‘bandwagon effects’ with dynamic pay-offs that increase with the number of participants that agree to adopt restrictive supply-side climate measures. Under this scenario, the incentive to unilaterally deviate from the coordinated equilibrium rapidly decreases (see Table 2b). Just as the era of globalization saw the creation of multilateral free trade agreements, the post-carbon era could see the creation of mutually-beneficial ‘carbon clubs’. Countries will be offered carrots to join these clubs but could face sticks if they choose not to. One such stick could be the idea that countries impose a carbon tax on imports—a so-called ‘border carbon adjustment’—from countries that do not adequately embrace climate policy (Helm et al. 2012).

3. Case Selection

Having specified the broader rationales for revoking fossil fuel permits, we now consider the practical challenges and prospects of such a policy intervention in a specific case: the rights granted to RWE Power AG to mine lignite in the Hambach opencast mine in northwestern Germany. There are tens of thousands of extant permits and leases for fossil fuel exploration and extraction internationally, any one of which could conceivably serve as the focal point of our analysis. There are several critical facts of the Hambach case, however, that make it an ideal case study for our purposes.

Why Germany?

Among the world’s fossil fuel-producing countries, Germany stands out as among the very few that has made concerted efforts to lead the world in climate change mitigation policy. With broad public support, the German government has committed to a fundamental shift in its energy supply – the Energiewende; “Energy Transition”; or “Energy Transformation” – that aims to reduce total annual GHG emissions by more than 80 percent by 2050. Numerous structural changes to Germany’s energy system
have set the stage for the Energiewende: conservation policies and the nuclear energy boom in the late 1970s and early 1980s, reunification and increased reliance on natural gas in the early 1990s, and the subsequent phase-out of nuclear energy and expansion of renewables (especially in the electricity supply) since 2000 (Hake et al. 2015). Every single sector of the German economy has reduced its CO₂ emissions since 1990, while the renewable energy shares of electricity and heating have increased steadily over the same period (Agora Energiewende 2018). Were any coal-producing country to unilaterally revoke extraction rights for climate-related reasons, we should expect Germany to be a most plausible contender.

Germany’s reputation as a climate leader is, however, under threat. The government has in recent years struggled to finance the growth in renewable energy capacity, resulting in the highest consumer energy bills in Europe. At the same time, the German government has prioritized the preservation of its status as an export-driven industrial powerhouse - including in carbon-intensive chemicals, metals, and cement - over expeditious decarbonization policies. Adhering closely to the economic ideologies of mercantilism and ordoliberalism, the German government under Chancellor Merkel’s leadership has largely shielded domestic energy-intensive industries from climate-related taxes and lobbied against a carbon price floor in the EU ETS (Lauber and Jacobsson 2016). State protection of domestic carbon-intensive industry from the costs of the energy transition depends crucially on cheap and abundant baseload power, and with the phaseout of nuclear power this has meant a counterproductive yet convenient reliance on coal-fired power generation supplied largely by native extraction.

Recognizing that these policy missteps will cause the country to fall short of its national 2020 emissions target, the German government initiated in June 2018 a multi-stakeholder commission tasked with establishing, by 2019, a date by which coal will be completely phased out of the national energy system (Wehrmann 2018). The fundamental disagreement that remains concerns the rapidity with which coal should be phased out and the appropriate policies through which this aim is to be achieved, not the long run emissions targets. Germany is therefore a prime candidate for investigating the practical feasibility of restrictive supply-side policies, including the possibility of revoking extant coal extraction permits.
Figure 1: The Value of Potential Stranded Assets
Among EU Countries and Utilities

Figure 1: Data on stranded coal asset values is derived from Carbon Tracker Initiative (2017). The size of the circles corresponds to the relative size of operating coal capacity (in GW) for each country and utility.

Perhaps most fundamentally, the decisions made by Germany’s coal commission will largely determine the speed of coal’s decline in Europe as a whole. With 50.4 GW of coal-fired power capacity, Germany is the single largest consumer of coal in Europe (Carbon Tracker Initiative 2017). Among EU countries, Germany also has the most to gain financially from the early retirement of coal capacity, with the potential to avoid
an estimated €12 billion in stranded assets (see Figure 1). Moreover, among European utilities, Germany’s RWE Power AG also has the greatest value of coal assets (€5.3 billion) at risk of being stranded in the post-carbon transition.

Why Lignite?

Among the various grades of coal, lignite has among the highest emission factors and is among the most carbon-intensive (Environmental Protection Agency 2014). Lignite power plants remain the single largest source of power in Germany, generating 134 TWh and emitting over 150 million tonnes of CO₂ in 2017 (Umweltbundesamt 2018). Since the late 19th century, Germany has been the single largest producer of lignite in the world (Federal Institute for Geosciences and Natural Resources 2017). Nearly 5 GT of German lignite remains exploitable from current and planned opencast mines, with remaining (economically viable) reserves totaling approximately 31 GT. Moreover, given its favorable geological conditions and competitiveness with imported energy even without subsidies, German lignite is relatively difficult to eliminate via demand-side policies alone (Federal Institute for Geosciences and Natural Resources 2017). Relative to natural gas, lignite is also inflexible to the ebb and flow of intermittent renewable energy.

Why Hambach?

Situated in the Lower Rhine Embayment near Cologne in northwestern Germany, the Hambach opencast lignite mine is located within the 12,000-year-old Hambach Forest. To excavate lignite at the mine, RWE Power AG must therefore extirpate the forest. In the Middle Ages the Hambach Forest stretched approximately 120 km² but had shrunk to approximately 55 km² by 1978, when Rheinbraun AG, RWE’s predecessor, first initiated operations at the mine (Janssen and Lohrmann 1983; BUND 2017). RWE has since removed over 40 km² of forest cover and is planning to remove around 10 km² for additional mining up until 2045, leaving only around 3 km² remaining (BUND 2017). This presents a double whammy of climate-related damages: CO₂ is emitted due to both lignite mining and deforestation. As part of its operating plan, RWE is engaged in an
ongoing forest restoration project to partly offset the deforestation at Hambach. According to the company itself, approximately one-fourth of the destroyed forest cover has hitherto been reforested at Sophienhöhe, an artificial hillside landscape north of the mine and formed on top of land previously used for agriculture (RWE Power AG 2013). But according to an assessment by Imboden and Moczek (2015), it could take over a century before the newly cultivated land approximates the rich biodiversity of Hambach’s primeval ecosystem. Similarly, Naaf and Kolk (2015) found that reforestation on former agricultural lands in Germany has yielded significantly less biodiversity than in preserved ancient forests, a disparity that may take several centuries to rectify. Although global tree cover has actually increased by 2,240,000 km² (7.1%) since 1982, atmospheric CO₂ concentrations have nevertheless rapidly increased during that same period (from 341 to 410 ppm) (Song et al. 2018). This suggests that, from a climate mitigation perspective, afforestation and reforestation need to complement forest preservation, rather than merely offset deforestation.

Deforestation at Hambach is a contentious, high-profile case in Germany. The government’s decision to permit continued deforestation for the purpose of lignite mining has provoked ongoing litigation initiated by BUND, the German conservation organization. In December 2017, an administrative court ruling in Cologne allowed for deforestation; but four days later, the higher administrative court granted intermediary relief and prohibited any removal of trees until it has fully dealt with the appeal. RWE’s operations at Hambach have also provoked protracted environmental protests since April 2012, with police and security personnel repeatedly clashing with activists who have camped out at the site ever since. These actions have garnered considerable media attention and shined a spotlight on the ostensible contradictions of Germany’s Energiewende. Tensions have culminated most recently within Germany’s coal commission, where some stakeholders, including BUND, have threatened to leave the commission if RWE continues expansion of the Hambach mine (Egenter 2018). The Hambach case is therefore particularly amenable to a retraction of government policy and the revocation of extraction permits, since doing so would be met with acclamation from Germany’s environmental movement and the broad public.

The revocation of extraction permits at Hambach could single-handedly put a sizable dent in Germany’s lignite-related emissions (see Section 4). Virtually all of Germany’s lignite is consumed domestically for power generation, with only half of 1
percent of production exported annually (International Energy Agency 2018). The Hambach opencast mine is one of three lignite mines located at Germany’s single largest lignite field, the Rhenish lignite field, which is operated solely by RWE Power AG. Together with the Garzweiler opencast mine, the Hambach mine supplies lignite by rail to four power plants in Germany: Frimmersdorf, Goldenberg, Neurath, and Niederaussem (Federal Institute for Geosciences and Natural Resources 2017). Taken together, these four lignite power plants account for more than one-third of all CO₂ emissions from lignite plants in Germany (see Figure 2).

![Figure 2: CO₂ Emissions from Lignite Power Plants in Germany](image)

**Figure 2: CO₂ Emissions from Lignite Power Plants in Germany**

*Figure 2: Data on emissions from lignite power plants is derived from Umweltbundesamt (Federal Environment Agency) (2018).*

4. The True Cost of the Hambach Mine: Natural Capital Accounts

RWE Power AG extracts an average of 40 million tonnes of lignite per year at the Hambach opencast mine. Up until 2045, RWE Power AG intends to deracinate an additional 10 km² of forest cover to mine from the approximately 1.4 billion tonnes of remaining lignite (RWE Power AG 2013). Before assessing the legal avenues through
which it may be possible to revoke the extraction rights previously granted to RWE at Hambach, it is useful to quantify the ecosystem damages resulting from the project. To that end, in this section we present the results of a natural capital-based assessment estimating the monetary damages imposed by continued operations at the Hambach opencast mine.

Before describing the methodology and results, a few background points are in order. Natural capital such as forests, lakes and lagoons provide fundamental services that are not priced by the market. These ecosystem services include flood and landslide defense, carbon sequestration, food provision, air and water purification, recreation, and visual amenity, among many others (Costanza et al. 1997; Foley et al. 2005). The motivation to undertake ‘natural capital accounting’, that is, the process of assigning a monetary value to ecosystem services, stems from the recognition that destroying natural assets comes at a cost to society that is left unaccounted for in markets (Helm 2015). Any such exercise is bound to be imperfect due to reasonable epistemological disagreements over appropriate monetary attribution and discounting. But in the context of assessing the value of revoking fossil fuel extraction rights, natural capital accounting can significantly bolster the evidentiary base by estimating the benefits accrued to the public from preserving the flow of ecosystem services. Some argue that the destruction of natural capital is not an issue as it can be substituted out by physical capital (Beckerman 1994; Markandya and Pedroso-Galinato 2007). Evidence of this form of substitution is generally poor due to data limitations and the absence of market prices for most forms of natural capital. Substitutability is itself an assumption loaded with ideological presuppositions related to risk perception and the discounting of the future (Neumayer 2003). But importantly, studies from the agriculture and energy sectors show that in the short- to medium-term, the substitutability between natural and physical capital is quite low (Cohen et al. 2017). While natural and physical capital may be substitutable at the margin in very specific contexts such as flood defense, it is likely that there are strong complementarities when the stock of natural capital depletes down to the point of ecosystem collapse (Farley 2008). Beyond a critical threshold of soil degradation, for example, there may be limits to what additional fertilizer and restoration techniques can do to revive productivity. Moreover, natural and physical capital are intrinsically different: a forest provides a host of services that include not
only flood defense but also biodiversity and visual amenity (De Groot et al. 2003). It is implausible that these features can be entirely replaced by physical infrastructure.

Natural assets have two types of values: ‘existence value’ and ‘use value’ (Ekins et al. 2003). *Existence value* relates to the value derived from knowing the natural asset exists. It captures the heritage or bequest value of the asset. *Use value* denotes the ecosystem services from which society directly benefits. This includes the purification of air and water, and the provision of food or genetic resources that can be used for medicinal or scientific purposes. We measure the ‘use value’ of select ecosystem services of the Hambach forest and show that they depreciate in value after the planned deforestation and mine extension. We make no attempt at measuring the existence or bequest value of the Hambach forest, which is likely to be substantial as it one of Europe’s most ancient forests and hosts unique biodiversity.

Our analysis calculates the natural capital accounts for three scenarios of the Hambach forest. For a detailed, step-by-step overview of the methodology employed, see Appendix 1. The scenarios selected in the analysis include:

1. **Scenario 1**: The historical scenario where the Hambach forest is at its historical size of 120 km$^2$ and there is no mining activity.
2. **Scenario 2**: The Hambach forest is at its current size of 42 km$^2$; although there has been deforestation, all mining activity has ceased.
3. **Scenario 3**: RWE continues with its current plans, reduces the size of the Hambach forest to only 3 km$^2$, and continues to mine 40 million tonnes of lignite per year for the next 34 years until all known reserves are exhausted.

Scenario 1 represents a hypothetical ecological optimum. Scenario 2 represents a state where climate change mitigation policy succeeds in blocking further mining activity in the region and preserves the existing forest. Scenario 3 is the worst case ecologically and represents current plans, which entail near-total deforestation and mining up to full capacity. We compare each Hambach scenario to a baseline counterfactual under which Germany compensates for the lignite that would have been used as an input in primary energy supply with a combination of renewable energy sources, nuclear power, increased
electricity imports from neighbouring countries, and demand-side management strategies.³

The results in Table 3 show that the value of scenario 1 is the highest at a positive €156 million in net present value (NPV) over 35 years. The value of scenario 2 is a positive €55 million. The value of scenario 3 is negative €345 billion EUR.

**Table 3: Natural Capital Accounts Under Three Scenarios at the Hambach Mine**

<table>
<thead>
<tr>
<th>Service/Scenario</th>
<th>Historical forest with no lignite mining</th>
<th>Current forest with no lignite mining</th>
<th>Deforestation scenario with lignite mining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values shown in Euro millions, NPV 35 years, 3.5% constant discount rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon sequestration*</td>
<td>57.3 €</td>
<td>20.1 €</td>
<td>1.4 €</td>
</tr>
<tr>
<td>Pollution*</td>
<td>88.7 €</td>
<td>31.0 €</td>
<td>2.2 €</td>
</tr>
<tr>
<td>Genetic resources*</td>
<td>7.7 €</td>
<td>2.7 €</td>
<td>0.2 €</td>
</tr>
<tr>
<td>Recreation*</td>
<td>2.1 €</td>
<td>0.7 €</td>
<td>0.1 €</td>
</tr>
<tr>
<td>Revenue from lignite sale</td>
<td>0 €</td>
<td>0 €</td>
<td>14,556 €</td>
</tr>
<tr>
<td>Air pollution costs from lignite mining</td>
<td>0 €</td>
<td>0 €</td>
<td>-326,327 €</td>
</tr>
<tr>
<td>Social cost of carbon</td>
<td>0 €</td>
<td>0 €</td>
<td>-33,986 €</td>
</tr>
<tr>
<td>Sum of assets</td>
<td>156 €</td>
<td>55 €</td>
<td>-345,753 €</td>
</tr>
</tbody>
</table>

Table 3: The assumption that the social cost of carbon is €30/tCO₂e captures the economic damages due to climate change. The list of assets and liabilities may not be exhaustive but is used to illustrate the relative magnitude of the damages due to CO₂ emissions. Services with a star (*) accrue in perpetuity; therefore, while the 35-year NPV values are relatively small, it must be remembered that these services last beyond the lifetime of coal production.

CO₂ emissions impose a cost on society that, absent policy, is not captured by the market. In the three modelled scenarios, we use a range of commonly accepted values for the ‘social cost of carbon’. The social cost of carbon measures the economic damages that accrue from the increased risk of dangerous climatic events. The economic

³ An alternative specification of the baseline scenario is of course possible, such as one that compensates with natural gas rather than nuclear power. Estimates of the social cost of carbon (SCC) in Table 3 are sensitive to the counterfactual specification, and thus in future iterations we intend to formulate additional counterfactuals. For now, it may be said that our final SCC estimates are towards the upper bound, but this may itself be offset by our choice of a very conservative SCC input value of €30/tCO₂e.
damages include the destruction of physical assets and loss of human life due to extreme weather events, higher temperatures, and other climate impacts. The social cost of carbon is commonly employed by the Intergovernmental Panel on Climate Change (IPCC) in its Integrated Assessment Models (IAMs), which simulate the economic costs of future climate scenarios. There is a wide range of estimates for the social cost of carbon but Pindyck (2016) has shown it can be as high as €80/tCO₂.

Many of the co-benefits from abating emissions are large, immediate and concentrated locally. The cost of air pollution due to lignite mining, for example, greatly exceeds the revenue from lignite sales. Hamilton et al. (2017) show that in Germany the benefit per tonne of reduced CO₂ emissions is worth €230-330/tCO₂e. Air pollution from burning the lignite mined at Hambach will result in increased PM2.5 levels, which are known to increase human morbidity and mortality, imposing additional healthcare costs on society. Hamilton et al. (2017) account for these costs and we apply them to case of the Hambach mine to approximate the monetary value of avoided air pollution damages.

Figure 3: CO₂ Emission Coefficients by Fuel

Figure 3: Data derived from Energy Information Administration (2016).
Germany has alternatives for securing its energy capacity. Lignite is among the ‘costliest’ options since it is one of the dirtiest and most ecologically disruptive fuels (see Table 3 and Figure 3). Technological alternatives include natural gas, which pairs well with the intermittency of renewables, increased electricity imports from the EU, nuclear power, demand-side energy management strategies, and smart grid technologies. Broader political considerations will influence Germany’s strategy but relying on lignite as a default ignores the immense costs it imposes by destroying natural assets and increasing human mortality. Prolonged lignite production is, moreover, inconsistent with Germany’s espoused climate change commitments.

5. Legal Avenues for Combating Lignite Extraction and Combustion in Germany

We have shown that it would be economically beneficial to prevent the removal of the Hambach forest, the further exploitation of its lignite reserves, and the combustion of lignite for power generation. The next question we explore is whether German law would stand in the way of halting the exploitation of the lignite reserves on climate-related or other ecological grounds. The following in-depth analysis of German statutes governing the right to extract lignite and run a lignite-fired power plant demonstrates that the law need not necessarily pose an obstacle. It rather depends upon the political will of the competent authorities whether such restrictive supply-side measures are actually taken.

As an accompaniment to the assessment of German law below, Appendix 2 provides a compact comparative overview of the relevant mining laws of Alberta, Germany, the Netherlands, and Wyoming. We selected Alberta and Wyoming because they are home to the largest coal mines in North America, and we selected the Netherlands since it is home to the single largest natural gas field in Europe (Federal Institute for Geosciences and Natural Resources 2017). The comparison is of course not exhaustive but is meant for illustrative purposes. Appendix 2 shows that, from a purely legal perspective, it would be easier in the other jurisdictions to take measures to revoke concessions for fossil fuel extraction and the operation of fossil fuel-fired power plants
than under German law. This suggests that globally, in many jurisdictions the law need not pose as a barrier to retroactive measures limiting fossil fuel supply. It also suggests that, were the intervention to be successfully implemented in Germany, it could serve as a model for other countries.

5.1 Two Legal Avenues

There are two possible legal avenues for persons wishing to combat climate change and interested in preventing the lignite mine in Germany from operating and expediting the closure of coal-fired power plants in Germany. As the lignite mine and relevant power plants in our case study are located in Germany, German law governs the rights to extract the lignite and to run a lignite-fired power plant. In Germany, these rights are contingent upon public law permits granted by administrative authorities. The first avenue (the “administrative law route”) would thus be for persons with a legitimate interest in the matter (e.g., the mining company, persons living in the vicinity of the mine, but also environmental NGOs) to participate in the administrative decision-making process and, once the permit is granted, to challenge it before the German administrative courts.

The second avenue is the private law route. The route is open for persons whose property has been adversely affected by climate change. They may sue emitters of greenhouse gas emissions for damages or to obtain a court order prohibiting the emitter from operating the source of the emissions. Such lawsuits should thus be primarily directed against the operator of the lignite-fired power plant because the power plants emit a far greater amount of greenhouse gas emissions than the lignite mine itself. The basis of their claim would be tort law (the law of delict). An emitter who lives or whose seat is in Germany may be sued before the German civil courts.4 The next question is which state’s law is applicable. The person who has sustained damage and sues a German emitter (the plaintiff) may choose the law of either Germany or the state where the damage occurred.5

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4 Art. 4(1) of Regulation (EU) No. 1215/2012.
5 Art. 4(1) and 7 of Regulation (EC) No. 864/2007.
If German law is applicable, the plaintiff may base their claim to damages upon § 823(1) of the German Civil Code (Bürgerliches Gesetzbuch; BGB). It is uncertain whether or not such a claim for damages will be successful. The Court of Appeal (Oberlandesgericht) in Hamm is currently considering the lawsuit of a Peruvian farmer, who suffered climate change-related damage, against RWE. The proceedings suggest that the court will hold that RWE is liable for damage caused by its greenhouse gas emissions (in spite of its public law permits to run its power plants).

A lawsuit based upon tort law, however, cannot lead to a court order prohibiting the operator of a power plant from running it. Generally, the plaintiff can apply for such an injunction under § 1004(1) BGB. However, if the operator does not emit more than what the operating permit allows it to emit, § 906 BGB will stand in the way of an injunction.

As the private law route cannot result in a court order prohibiting the operations of either the lignite mine or a lignite-fired power plant, the following sub-sections only deal in detail with the administrative law route.

5.2 The Mining Permit and the Operation Plan

Land ownership under German law does not include the ownership of lignite (and certain other natural mineral resources) situated under the surface. Lignite under the land’s surface is owned by nobody. Land owners and non-owners alike need the state to confer upon them the right to extract the lignite (hereinafter: the mining permit), and to approve an operation plan in order to do so at a commercial scale.

The Federal Mining Act (Bundesberggesetz) governs mining permits, the approval of operation plans, and the applicable administrative procedures. The mining authorities of the German federated states (Länder) are competent to grant mining permits and to approve operation plans. They are accountable to a state ministry, which is, in turn, accountable to the respective state’s legislature. When a mining

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8 § 3(2) and (3) of the Federal Mining Act (Bundesberggesetz: BBergG).
9 §§ 8, 9, and 50 BBergG.
The mining authority must reject the application on one of the grounds of rejection enumerated in the Federal Mining Act. After the mining permit has been granted or the operation plan has been approved, the mining authority can revoke the permit if the factual situation has changed and the new circumstances would have required the mining authority to deny the permit.

The essential question for persons who wish to combat climate change is whether the prevention of greenhouse gas emissions qualifies as one of the grounds on which a mining authority may reject an application for a mining permit or decline to approve an operation plan. There are three grounds in the Act that could be conceivably applicable:

1. The mining authority must deny the mining permit if the extraction at the location in question cannot be reconciled with a public interest that outweighs the (private or public) interest in extracting the lignite;
2. the mining authority must reject the operation plan if the mining operations are harmful to society;
3. or the mining authority may prohibit (or restrict) extraction or decline to approve the operation plan if there is a public interest that outweighs the interest in extracting the lignite.

The original interpretation of the first ground of rejection does not seem to allow the mining authority to deny the mining permit for the purpose of combating climate change. Parliamentary history indicates that the public interest must have a connection with the specific location where the applicant wishes to extract the lignite. As examples of public interests the explanatory memorandum mentions environmental protection, the preservation of the landscape, spatial planning, infrastructure, and water protection. The authority could thus, for instance, deny the permit due to the localized damages caused to natural capital, for instance through deforestation and the losses to ecosystem services detailed in the previous section. But with respect to climate protection as the chief concern, it seems unlikely that the legislature had the purpose of...
preventing climate change in mind when it drafted this ground of rejection. The emissions caused by burning lignite do not have a stronger connection to this specific mining site than to other sources of greenhouse gas emissions.

The prevailing interpretation of the second ground of rejection is also rather narrow. According to this interpretation, the extraction will only be harmful to society if the extraction itself is so dangerous that it directly threatens the public good. As climate change is only an indirect consequence of the mining operations and the contribution of these mining operations to climate change is fairly limited, this ground of rejection will not apply under this interpretation. It would apply, for instance, if there were evidence of a dangerous rise in local air pollution due to the mining operations, as detailed in the previous section.

The third ground, based upon § 48(2) BBergG, requires a balancing of the interest in extraction against the private and public interests adversely affected by the extraction. ‘Public interests’ is an open category that includes a variety of interests, including the preservation of the landscape, monument protection, water protection, spatial planning, and urban development. The status of the prevention of greenhouse gas emissions is unclear.

These grounds, in particular the third one, offer room for departing from the prevailing narrow interpretation and for developing a progressive interpretation that would compel mining authorities to prevent the mining operations for the purpose of combating climate change.

There are persuasive reasons for why a more progressive interpretation should be adopted. The historical reason is that the Mining Act was adopted in 1980 and climate change was not a significant political issue at the time. Nowadays, the majority of the German public considers climate change a pressing concern, and as previously noted, the federal government recently convened a commission to prepare a plan for abandoning coal as a source of energy. A more progressive interpretation would also seem appropriate from a constitutional perspective. The German Basic Law, which also guides the interpretation of statutes, commands that the state protect the

environment,\textsuperscript{19} and protects the right to life.\textsuperscript{20} This constitutional dimension may increasingly gain importance as ten families are suing the EU for more ambitious emissions reduction targets on the basis of the Charter of Fundamental Rights of the EU.\textsuperscript{21}

Institutionally, the mining authorities neither have leeway (or: a margin of appreciation) in balancing the involved interests nor discretion in taking its decision.\textsuperscript{22} Environmental associations\textsuperscript{23} and anyone who establishes that an administrative decision has infringed their rights have the right to file an action for annulment of that decision.\textsuperscript{24} It is then for the courts to rule on whether the grounds of rejection apply and which decision had to be taken. The courts tend to be reluctant to deviate from the legislature’s intention due to the separation of powers. As the prevailing interpretation of the law would have to change, it is anything but certain that the courts will follow an interpretation conducive to the cause of climate protection without any guidance from the legislature.

Procedurally, the mining authority will be more likely to take account of the interest in combating climate change if it receives information on this matter. In a normal administrative procedure, the authority is obliged to gather all relevant information.\textsuperscript{25} It must hear from persons who are directly affected by the project, such as owners of land in the vicinity of the project.\textsuperscript{26}

If the lignite mine covers 25 hectares (61.78 acres) or more, the mining authority will have to follow a special procedure.\textsuperscript{27} All persons whose interests are affected by the mining project may submit written comments to the competent authority.\textsuperscript{28} NGOs that

\textsuperscript{19} Art. 20a of the German Basic Law (Grundgesetz; GG).
\textsuperscript{20} Art. 2(2) GG.
\textsuperscript{21} https://www.tagesspiegel.de/politik/klimawandel-klimaklage-gegen-die-eu-zugelassen/22911610.html.
\textsuperscript{22} Bundesverwaltungsgericht, Judgment of 29 June 2006, NVwZ 2006, 1173, 1175.
\textsuperscript{23} §§ 1, 2 of the Environmental Law Remedies Act (Umwelt-Rechtsbehelfsgesetz; UmwRG).
\textsuperscript{24} § 42(2) of the Administrative Court Procedure Code (Verwaltungsgerichtsordnung; VwGO).
\textsuperscript{25} § 24 of the Administrative Procedure Code (Verwaltungsverfahrensgesetz; VwVfG).
\textsuperscript{26} §§ 28 and 13 VwVfG.
\textsuperscript{27} § 52(2a) BBergG and § 1(1) lit. b of the Regulation on the environmental impact assessment of mining projects (Verordnung über die Umweltverträglichkeitsprüfung bergbaulicher Vorhaben).
\textsuperscript{28} § 73(4) VwVfG.
advocate for stronger environmental protection may also send their written comments. After the deadline for written submissions has passed, the authority has to arrange for meeting at which the affected parties will discuss their concerns with the authority.

The special procedure also includes an environmental impact assessment that covers, among other concerns, environmental pollution and nuisance. In practice, the mining authority has to identify the greenhouse gas emissions that would be caused by the mining project, in a similar vein as the natural capital accounting in the previous section.

5.3 The Permit to Run a Power Plant

Aside from the question of the mine itself, it is relevant to consider whether rights previously granted to run a lignite-fired power plant may be revoked. The owner of a lignite-fired power plant requires a permit under the terms specified in the Federal Emissions Protection Act (Bundes-Immissionsschutzgesetz; BImSchG). The competent authority is a state authority, which is accountable to a state ministry. The authority must issue the permit if the power plant meets certain standards. It does not have any discretion. The authority may, however, revoke the permit after its decision if the factual situation has changed and the new circumstances would have required the authority to deny the permit, or if revoking the permit is necessary to prevent damage to the public good.

The standards may leave some room for climate change-related considerations. The power plant must not cause damage to the environment and substantial

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30 § 73(6) VwVfG.
31 Appendix 3, 1.5, to the Environmental Impact Assessment Act (Gesetz über die Umweltverträglichkeitsprüfung).
33 § 1(1) and No. 1.1 in the Appendix to the Fourth Regulation on the Implementation of the Federal Emissions Protection Act (Vierte Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes).
34 § 6 BImSchG.
35 § 21(1) BImSchG.
disadvantages for society. The operator must also take measures in line with the technological state of the art to prevent damage to the environment and substantial disadvantages to society.

A regulation concretizes the first standard by fixing maximum amounts of harmful substances in the air. Unfortunately, this regulation does not include any emission limits for CO₂. Persons interested in combating climate change could nevertheless, with a limited chance of success, try to argue that CO₂ would bring about substantial environmental damage and disadvantages for society. The legal argument would resemble the argument made in the previous sub-section. As the Federal Emissions Protection Act was only refurbished in 2013, the justification for deviating from the legislator’s intention and the prevailing interpretation would be weaker.

The second standard will not stand in the way of new lignite-fired power plants because the authority can only require measures that limit emissions according to the latest technological developments of that type of power plant. It is not possible to require the power plants not to emit any carbon dioxide and, thereby, to stop the project.

Revoking the permit to prevent damage to the public good will only be possible if the public or a private person would otherwise sustain severe damage. This ground would in particular be applicable if life, health, or valuable property were at stake. If the power plant causes any threats to health, for instance through toxins released during combustion, the authority will have to deny the permit. The climate, however, changes only gradually, and the power plant’s contribution will not have a substantial immediate effect. It is therefore doubtful whether climate change-related concerns would be enough to justify a revocation. A more progressive interpretation could, of course, be advocated.

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36 § 5(1) No. 1 BImSchG.
37 § 5(1) No. 2 BImSchG.
40 Jarass, in: Jarass, BImSchG, § 5, Nos. 52 et seq.
41 Jarass, in: Jarass, BImSchG, § 21, No. 17.
Again, the authority does not have any leeway in interpreting the analyzed standards. Environmental associations and anyone who establishes that an administrative decision has infringed their rights has the right to file an action for annulment of that decision. It is then exclusively for the courts to rule on the interpretation. The courts tend to refrain from changing the prevailing interpretation of the law. Even though the Constitution suggests the progressive interpretation advocated above, it is anything but certain that the courts will adopt this interpretation.

Procedurally, persons seeking to combat climate change have ample opportunity to give their input. Anyone can submit comments on the planned project. The authority has to gather all relevant information and discuss the received comments with all the persons who have submitted comments.

5.4 The Expropriation of Permits?

Persons following the aforementioned avenues may find legal obstacles in their way, but this will not necessarily be the case. It is rather the political will of the competent authorities (or the lack thereof) that will determine whether measures against the mining operations and the combustion of lignite will be taken.

One may also wonder whether the state could ‘expropriate’ the mining permit or the permit to run the lignite-fired power plant to circumvent the legal obstacles altogether. An expropriation under German law is defined as state action whereby the state acquires property, subject to equitable compensation, in order to use it for a specific project in the public interest. This definition clearly shows that the German state, unlike its counterparts in, for instance, Alberta and Wyoming, could not expropriate the permits. First, the permit does not constitute ‘property’ in terms of the German Basic Law because permits merely unmake a limitation to land ownership (which is, of course, protected as ‘property’). Secondly, the state would not acquire the

42 §§ 1, 2 UmwRG.
43 § 42(2) VwGO.
44 Art. 2(2) and 20a GG.
45 § 10(4) BImSchG; and Jarass, in: Jarass, BImSchG, § 10, No. 84.
46 § 24 VwVfG and § 10(6) BImSchG.
permit to use it for a specific project in the public interest. The state would only extinguish the permit.

The German legislature could, of course, authorize state organs through an Act of Parliament to revoke permits for climate-related public purposes. The legislature may act upon new insights and limit existing rights, and such regulation will generally not be subject to compensation.\(^{49}\) However, it may be disproportionate to impose a burden that should be borne by the entire society (like the fight against climate change) upon a small group of persons. If that were the case, the state would be liable to pay compensation.\(^{50}\) Given the damage caused by the mines and lignite-fired power plants, however, this burden should not be deemed disproportionate in most cases. The legislation should, however, include hardship clauses for cases where revoking permits would result in irreparable financial damage.\(^{51}\) But here again a healthy dose of realism is required. One may wonder whether the German legislature is actually obliged to take such measures in the light of the constitutional commandment to protect the environment\(^{52}\) and the constitutional right to life.\(^{53}\) As the Constitutional Court grants broad discretion to the legislature in designing the country’s economic structure in general and the sources of energy in particular,\(^{54}\) it is very doubtful that the Constitution would demand that the legislature end the use of certain energy sources.

### 6. Conclusions

The rights to extract fossil fuel granted by governments to companies are rather like entitlements to royal estates once bequeathed by kings to medieval squires. Coal, oil, and gas companies are like temporary squires, not sovereigns. Their stake in continued access to fuel-rich public lands is considerable; but their power to ensure unimpeded extraction is limited. Adhering to norms carried down from land laws of late 19th and

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\(^{52}\) Art. 20a GG.

\(^{53}\) Art. 2(2) GG.

early 20th century industrialism, ministers of the interior and other competent authorities have been slow to alter fossil fuel permitting decisions consistent with 21st century climate change mitigation targets. But just as there is nothing absolute about fossil fuel extraction rights, there is nothing absolute about past ministerial decisions. The permits to extract coal or operate coal-fired power plants can in many cases be revoked. The state retains such powers. Given the time-sensitivity of 2°C-consistent (let alone 1.5°C-consistent) mitigation and the laggard performance of less ‘heavy-handed’ measures, climate policymakers should not shy away from the possibility.

Our analysis provides several policy-relevant and actionable lessons. First, natural capital accounting can be a powerful tool employed to bolster the evidentiary base supporting restrictive supply-side climate policies. In our case study of the Hambach opencast mine, it was demonstrated that the revocation of lignite extraction permits previously granted to RWE would alone reduce Germany’s total CO2 emissions by up to 7 percent and avoid over €340 billion in ecosystem damages over a 35-year period. Leaving lignite in the ground at the Hambach Forest would provide ecosystem services that markets currently do not price, such as the value of carbon sequestration, lower particulate air pollution, pollination, and recreation. Viewed from the vantage point of natural capital accounts, continued lignite extraction represents among the costliest options to secure Germany’s energy supply. The ecological costs dwarf the market value of lignite. Moreover, viable alternatives are readily available, such as natural gas paired with intermittent renewable energy, increased electricity imports from the EU, demand-side management strategies, and smart grid and storage technologies.

We have additionally shown that under German law, ministers, environmental NGOs, and citizens retain the power to challenge and reverse previous permitting decisions. It is legally plausible that under changed circumstances wherein climate change mitigation is now widely considered a public good to be urgently pursued, active lignite extraction permits, including those at Hambach, may be revoked. But we have also shown that, under German law, the case for permit revocation is greatly strengthened when reference is made to the localized co-benefits of avoided mining and deforestation. Environmental protection under the Federal Mining Act was originally conceived as a largely local and provincial concern, and therefore exceptions to the norm of granting mining permits may arguably require evidence of profound impacts to the
local communities and ecosystem services. We therefore conclude that natural capital accounting may in Germany serve as a powerful means of measuring and valuing the co-benefits of climate change mitigation and facilitating a more expeditious coal phaseout by providing a plausible legal rationale for permit revocation.

Germany’s coal commission and government officials must henceforth confront a number of competing concerns as they determine the date by which, and the policies through which, domestic coal production and consumption is to be terminated. We have not herein addressed socioeconomic issues related to the struggling economies in Germany’s lignite-producing regions, or the geopolitical and security-related concerns of relying on greater natural gas imports from Russia. We only suggest that these issues are far from intractable. Rather, if the overarching policy goal really is to phase out coal expeditiously within the next five or so years (rather than $>10$ years), we have shown that revoking active coal mining permits would yield substantial ecological co-benefits and is a legally plausible intervention. The barriers are political rather than technical or legal.

The demonstrated viability of revoking lignite extraction permits in Germany may serve as a ‘proof of concept’ for other jurisdictions currently exploring measures to keep fossil fuel in the ground. As shown in the comparative legal overview in Appendix 2, fossil fuel permitting statutes in comparable fuel-producing jurisdictions including Alberta, the Netherlands, and Wyoming all indicate that permit revocation, or expropriation, is conceivable and even more legally defensible than in Germany. That the interventions have yet to be pursued is no argument against their potential appropriateness in the near future. Carbon pricing and other demand-side policy measures have been the preferred tools for hastening coal’s demise, but their efficacy thus far has been mixed and their speed has been unsatisfactory. It remains an open question whether the political economy constraints on demand-side carbon pricing are more or less severe than constraints on supply-side permit revocation. What may be said provisionally, however, is that confusion blossoms when ideas are not taken to their logical end; if the end goal is the expeditious decline of coal within several years, why use an indirect and uncertain tool like carbon pricing which requires drawn-out statutory reform within parliaments? If the end goal is the expeditious decline of coal, why not admit the aim and revoke the right to extract it?
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Appendix 1: Methodological note on constructing natural capital accounts for the Hambach opencast mine and forest

The analysis calculates the natural capital accounts for three scenarios of the Hambach forest.

Scenarios selected in analysis:

1. **Scenario 1**: The historical scenario where Hambach forest is at its historical size of 12,000 hectares and there is no mining activity.
2. **Scenario 2**: The Hambach forest is at its current size 4200 hectares; although there has been deforestation, all mining activity has ceased.
3. **Scenario 3**: RWE continues with its current plans, reduces the size of Hambach forest to only 3 hectares and continues to mine 40 million tonnes of lignite per year for the next 34 years till all known reserves are exhausted.

Scenario 1 represents a hypothetical ecological optimum. Scenario 2 represents a state where climate action succeeds in blocking further mining activity in the region and preserves the existing forest. Scenario 3 is the worst-case and unfortunately, represents the current plans: which is near complete deforestation and mining up to full capacity.

The results show that the value of scenario 1 is the highest at a positive €156 million in NPV over 35 years. The value of scenario 2 is €55 million in NPV over 35 years. The value of scenario 3 is negative €345 billion in NPV over 35 years.

**Carbon sequestration**

Step 1: Get data on type (species and spacing) and extent of woodland cover (hectares) in the forest of interest: \( \text{treecover}_{i, s, y, t} \) (ha), where \( i \) represents type of tree, \( s \) represents spacing, \( y \) is the yield class and \( t \) is the age in years. We obtained data on Hambach’s historical and current size from Janssen and Lohrmann (1983) and BUND (2017). In scenario 1, Hambach forest’s size is 120 km\(^2\). In scenario 2, it is 42 km\(^2\). In scenario 3, it is 3 km\(^2\).
Step 2: Use the Woodland Carbon Code to determine the rate of CO₂ sequestration: \( rate_{isyt} \) (tCO₂/ha/year). Since Hambach is an oak and hornbeam forest, we use oak as the representative species and assume the yield class is 4, the spacing is 1.2 m and the average tree is aged between 45-50 years.

Step 3: Determine annual carbon sequestration by multiplying hectares of woodland by the relevant carbon sequestration rate: \( rate_{isyt} \times treecover_{isyt} \) (tCO₂/year).

Step 4: Obtain data on the carbon price or social cost of carbon: \( price \) (€/tCO₂). We use a range of values for the social cost of carbon which include €70-88/tCO₂e (Pindyck, 2016), €32/tCO₂, the value used by the EPA and €15/tCO₂ which is the lower bound produced by a range of IAMs. This allows us to produce a range of results. Our central estimate is based on €30/tCO₂.

Step 5: Calculate the monetary value of carbon sequestration per year by performing the following calculation: \( carbon\_value_{isyt} = rate_{isyt} \times treecover_{isyt} \times price \times discount\_factor \). The discount rate used in this calculation is 3.5%, which is the social discount rate specified in the HRM Green Book.

Step 6: Calculate the net present value of carbon sequestration over 35 years by summing up all of the annual values as follows: \( carbon\_value_{syt} = \sum_{t}^{35} carbon\_value_{isyt} \) for each of the different scenarios.

Genetic resources

Step 1: Obtain data on the value of the ecosystem service per hectare of habitat (€): \( val_{i_b} \) (€/ha) where \( i \) represents the type of habitat and \( b \) is the ecosystem service, which in this case is the value of genetic resources. For this calculation, we used an estimate of \( val_{i_b} \) from Croitoru (2007), who estimated the genetic value per hectare of a Southern European forest.

Step 2: Obtain data on the extent of the habitat in hectares by scenario: \( habitat_i \) (ha). We obtained data on Hambach’s historical and current size from Janssen and Lohrmann (1983) and BUND (2017). In scenario 1, Hambach forest’s size is 120 km². In scenario 2, it is 42 km². In scenario 3, it is 3 km².

Step 3: Calculate value of genetic resources per year by performing the following calculation: \( val_{i_b} \times habitat_i \times discount\_factor \) (EUR).
Step 4: Calculate the net present value the ecosystem service over 35 years by summing up all of the annual values for each scenario.

Pollination services

Step 1: Obtain data on the value of the ecosystem service per hectare of habitat (€): \( val_i \) (€/ha) where \( i \) represents the type of habitat and \( b \) is the ecosystem service, which in this case is the value of pollination services. For this calculation, we derived an estimate of \( val_i \) from Brenner-Guillermo (2007), who estimated the pollination value per hectare of a temperate forest in Spain.

Step 2: Obtain data on the extent of the habitat in hectares by scenario: \( habitat_s \) (ha).

Step 3: Calculate value of pollination services by performing the following calculation: \( val_i \times habitat_s \times discount\_factor_t \) (€).

Step 4: Calculate the net present value the ecosystem service over 35 years by summing up all of the annual values for each scenario.

Recreation services

Step 1: Obtain data on the value of the ecosystem service per hectare of habitat (€): \( val_b \) (€/ha) where \( i \) represents the type of habitat and \( b \) is the ecosystem service, which in this case is the value of recreation services. For this calculation, we utilized an estimate of \( val_b \) from Cruz and Benedicto (2009), who estimated the recreation value per hectare of a forest in Portugal using the travel cost method.

Step 2: Obtain data on the extent of the habitat in hectares by scenario: \( habitat_s \) (ha).

Step 3: Calculate value of recreation services by performing the following calculation: \( val_b \times habitat_s \times discount\_factor_t \) (€).

Step 4: Calculate the net present value the ecosystem service over 35 years by summing up all of the annual values for each scenario.
Air pollution costs

Step 1: Obtain data on the cost of air pollution per tonne of emitted CO\(_2\) equivalent (€): \(\text{val}_i\) (€/tCO\(_2\)) where \(i\) represents the country. For this calculation, we got an estimate of \(\text{val}_i\) for Germany from Hamilton et al. (2017).

Step 2: Obtain data on the extent of emissions from the Hambach mine for each scenario: \(\text{emissions}_s\) (tonne of CO\(_2\)e). From RWE, we obtained the annual figure for metric tonnes of excavated lignite and multiplied this by the EPA emissions factor for lignite to calculate the amount of emissions that would arise when the lignite is combusted. We assume that the amount of lignite excavated in any given year is also combusted that year.

Step 3: Calculate the cost of air pollution by performing the following calculation: \(\text{val}_i \times \text{emissions}_s \times \text{discount\_factor}_t\) (€).

Step 4: Calculate the net present value the liability over 35 years by summing up all of the annual values for each scenario.

Social cost of carbon

Step 1: Obtain data on the social cost of carbon: \(\text{price}\) (€/tCO\(_2\)). We use a range of values for the social cost of carbon which include €70-88/tCO\(_2\)e (Pindyck, 2016), €32/tCO\(_2\), the value used by the EPA and €15/tCO\(_2\), which is the lower bound produced by a range of IAMs. This allows us to produce a range of results. Our central estimate is based on €30/tCO\(_2\).

Step 2: Obtain data on the extent of emissions from the Hambach mine for each scenario: \(\text{emissions}_s\) (tonne of CO\(_2\)e). From RWE, we obtained the annual figure for metric tonnes of excavated lignite and multiplied this by the EPA emissions factor for lignite to calculate the amount of emissions that would arise when the lignite is combusted. We assume that the amount of lignite excavated in any given year is also combusted that year.

Step 3: Calculate the social cost of carbon by performing the following calculation: \(\text{price} \times \text{emissions}_s \times \text{discount\_factor}_t\) (€).

Step 4: Calculate the net present value the liability over 35 years by summing up all of the annual values for each scenario.
Market value of lignite

Step 1: Obtain data on the price of lignite: \( \text{price} \) (€/tonne). This value was obtained from the US Energy Information Administration (EIA).

Step 2: Obtain data on the extent of lignite excavation from the Hambach mine: \( \text{lignite}_s \) (tonnes) per scenario. From RWE, we obtained the annual figure for metric tonnes of excavated lignite. We assume that the amount of lignite excavated in any given year is also sold that year.

Step 3: Calculate the revenue from lignite sales by performing the following calculation: \( \text{price} \times \text{lignite}_s \times \text{discount\_factor}_t \) (€).

Step 4: Calculate the net present value lignite sales over 34 years by summing up all of the annual values for each scenario. 34 years is the time at which all known reserves will be depleted.
Appendix 2: Comparative Overview of Legal Avenues in Other Jurisdictions

Relevant statutes governing the right to extract fossil fuel and run a fossil fuel-fired power plant are of national origin, and they may therefore vary considerably cross-jurisdictionally. As a supplement to Section 5, the following table summarizes the approaches of Alberta, Germany, the Netherlands, and Wyoming to the various questions raised in the detailed analysis of German law.
<table>
<thead>
<tr>
<th>Who owns the lignite in the ground?</th>
<th>Alberta in most cases; until 1887 title was granted to private entities.</th>
<th>Nobody.</th>
<th>The State[^56]</th>
<th>Landowner also holds mineral rights unless these were separated from the ownership of the surface.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the basis of the right to extract lignite?</td>
<td>A coal lease[^57] and a permit/license[^58] and approval of operation plan.</td>
<td>Mining permit and approval of operation plan.</td>
<td>Private law right to use the land; permit to extract lignite;[^59] permit to build mining facilities.</td>
<td>Mineral rights linked to, or separated from, land ownership; or, in most cases, a lease.</td>
</tr>
<tr>
<td>Can this right be denied or revoked on climate-related grounds?</td>
<td>Lease may be denied on any rational ground.[^61]</td>
<td>Activities are harmful to society, or there is a public interest (subject to compensation).[^62]</td>
<td>Permits may be denied due to detrimental effects upon the environment.[^66]</td>
<td>Any right in the lignite may be condemned if the public interest or necessity requires the exercise of the power of eminent domain (subject to compensation).[^69]</td>
</tr>
<tr>
<td>The Energy Regulator may make rules on activities that are harmful to society, or there is a public interest (subject to compensation).[^66]</td>
<td>Permits may be denied due to detrimental effects upon the environment.[^66]</td>
<td>Permit to mine may be revoked due to changed insights on the use of natural resources.[^67]</td>
<td>The permit to build the mining facilities must be revoked in Combating climate change is, without any doubt, in the public interest.</td>
<td></td>
</tr>
</tbody>
</table>

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[^56]: Art. 3(1) of the Dutch Mining Act (*Mijnbouwwet*).

[^57]: Sections 16, 68(1) of the Alberta Mines and Minerals Act.

[^58]: Sections 8, 10 and 11 of the Alberta Coal Conservation Act, 2000.

[^59]: Art. 6(1) lit. c of the Dutch Mining Act.

[^60]: Art. 2.1(1) lit. e of the General Environmental Law Act (*Wet algemene bepalingen omgevingsrecht*; Wabo).

[^61]: Section 18(1)(a) of the Alberta Mines and Minerals Act.

[^62]: Section 8(1)(b) and (c) of the Alberta Mines and Minerals Act.

[^63]: Section 8.1(1) of the Alberta Coal Conservation Act.
protection of air that will be applied to the application. The permit/license can be cancelled if the holder does not comply with the conditions of it.

<table>
<thead>
<tr>
<th>Which organ is competent?</th>
<th>Coal lease: Minister;</th>
<th>State ministry</th>
<th>The Minister of Economic Affairs(^{70})</th>
<th>State of Wyoming, a county, or a municipal corporation.(^{71})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permit/license</td>
<td>Alberta Energy regulator</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Does this organ have discretion and/or any leeway in interpreting the law? | Coal lease: the Minister has a discretionary power. ‘Public interest’ is so broad a term that the Minister will have some leeway in interpreting it. Permit/license: the energy regulator has a broad discretionary power. | No. | Courts have the last word on the interpretation of grounds; discretionary power to deny the permits or to revoke the mining permit if grounds are applicable; power to revoke permit to build facilities is not discretionary. | These organs have a discretionary power and courts generally defer to the interpretation of such broad terms as ‘public interest’\(^{72}\). |

<table>
<thead>
<tr>
<th>Can the public Coal Lease: directly and adversely affected</th>
<th>Affected persons may submit</th>
<th>Persons with a legitimate interest</th>
<th>Directly and adversely affected</th>
</tr>
</thead>
</table>

\(^{66}\) Art. 9(1) lit. f No. 3 of the Dutch Mining Act; and Art. 2.14(1) lit. a No. 2, (3) Wabo.

\(^{67}\) Art. 21(1) lit. j of the Dutch Mining Act.

\(^{69}\) § 1-26-504(a) of the 2017 Wyoming Statutes; and Sections 32 and 33 of the Wyoming Constitution.

\(^{64}\) Section 9(1)(q) and (2) of the Alberta Coal Conservation Act.

\(^{65}\) Section 20(1) of the Alberta Coal Conservation Act.

\(^{68}\) Art. 2.33(1) lit. d Wabo.

\(^{70}\) Art. 6(1) of the Dutch Mining Act; and Art. 3.3(4) of the Regulation on Environmental Law (Besluit omgevingsrecht; Bor).

\(^{71}\) § 1-26-801(a) of the 2017 Wyoming Statutes.

\(^{72}\) *Board of County Com’rs of Johnson County v. Atter*, 734 P.2d 549, 553 (Wyo. 1987); and *Associated Enterprises, Inc. v. Toltec Watershed Imp. Dist.*, 656 P.2d 1144, 1148 (Wyo. 1983). See also § 1-26-801(a) of the 2017 Wyoming Statutes.
<table>
<thead>
<tr>
<th><strong>influence the decision to</strong> grant or revoke that right?</th>
<th>people must be informed and heard.(^{73})</th>
<th>written comments and participation in a discussion.</th>
<th>(including NGOs) people must be notified and heard.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permit / License:</strong></td>
<td>Directly and adversely affected persons may successfully apply to participate in a hearing.(^{74})</td>
<td>Recognized environmental associations and any person whose rights have been infringed.</td>
<td>Persons with a legitimate interest who have submitted a comment (^{76})</td>
</tr>
<tr>
<td><strong>Who can challenge the decision in court?</strong></td>
<td>Directly and adversely affected entities; possibly public-interest standing for environmental organizations.</td>
<td>Persons with a legitimate interest who have submitted a comment (^{76})</td>
<td>Directly and adversely affected persons can challenge the condemnation in court.</td>
</tr>
<tr>
<td><strong>What is the basis of the right to run a lignite-fired power plant?</strong></td>
<td>Right to use the land; approval of construction and operation.(^{77})</td>
<td>Private law right to use the land; permit to run the power plant.</td>
<td>Right to use the land; operating permit.(^{79})</td>
</tr>
<tr>
<td><strong>Can this right be denied or revoked on climate change-related ground?</strong></td>
<td>Approval may be denied on any rational ground.(^{80})</td>
<td>To be denied if the power plant would cause damage to the environment and/or substantial detrimental effects upon the environment.(^{81}) The permit must be revoked in case of non-compliance with emission standards applicable under Wyoming statutes or the federal Clean Air Act.(^{83}) Without a legislative mandate,</td>
<td></td>
</tr>
</tbody>
</table>

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\(^{73}\) Sections 3 and 4 of the Alberta Administrative Procedures and Jurisdiction Act. See also more specific legislation, such as Sections 6 et seq of the Alberta Expropriation Act.

\(^{74}\) Sections 7 et seq of the Alberta Energy Regulator Rules of Practice.

\(^{75}\) With respect to the permit to build mining facilities: Art. 3.10(1) lit. c and 3.15 Wabo, 3:15(1) of the General Administrative Law Act (Algemene wet bestuursrecht; Awb). With respect to the mining permit and the revoking of the permit to build mining facilities: Art. 4:8 Awb.

\(^{76}\) Art. 8:1 and 6:13 Awb. The requirement of submitting a comment does not apply if the emitter applies for a mining permit or the competent authority wishes to revoke the permit to build mining facilities.

\(^{77}\) Section 11 of the Alberta Hydro and Electric Energy Act.

\(^{78}\) Art. 2.1(1) lit. e Wabo.

\(^{79}\) § 35-11-203 of the 2017 Wyoming Statutes.

\(^{80}\) Section 19(1) of the Alberta Hydro and Electric Energy Act.

\(^{81}\) Art. 2.14(1) lit. a No. 2, (3) Wabo.
| **grounds?** | disadvantages for society. To be revoked if damage is done to the public good. | unacceptable detrimental effects on the environment.\(^\text{82}\) | however, the competent organ may not set restrictive emission standards for greenhouse gas emissions.\(^\text{84}\) |

| **Which organ is competent?** | Alberta Utilities Commission | State authority | The executive organ of the province\(^\text{85}\) | Department of Environmental Quality |

| **Does this organ have any discretion and/or any leeway in interpreting the law?** | The Commission has a broad discretionary power. | No. | Courts have the last word on the interpretation of grounds; discretionary power to deny the permit if grounds are applicable; power to revoke permit is not discretionary. | General discretion in setting standards;\(^\text{86}\) not with respect to greenhouse gas emissions though.\(^\text{87}\) The Department has no discretion when applying these standards. |

| **Can the public influence the decision to grant or revoke that right?** | Directly and adversely affected people must be informed and heard.\(^\text{88}\) Anyone may submit comments and participate in discussions. | Persons with a legitimate interest (including NGOs) can submit their comments.\(^\text{89}\) | Public hearing must be held.\(^\text{90}\) |

| **Who can challenge the decision?** | Directly and adversely affected entities; Recognized environmental persons with a legitimate interest | Persons with a legitimate interest | Directly and adversely affected |

\(^{82}\) § 35-11-202, 205 and 206(f)(ii) of 2017 Wyoming Statutes.  
\(^{84}\) § 35-11-213 of 2017 Wyoming Statutes.  
\(^{85}\) Art. 3.3(1) Bor.  
\(^{86}\) § 35-11-202 of 2017 Wyoming Statutes.  
\(^{87}\) § 35-11-213 of 2017 Wyoming Statutes.  
\(^{88}\) Sections 3 and 4 of the Alberta Administrative Procedures and Jurisdiction Act.  
\(^{89}\) Art. 3.10(1) lit. c and 3.15 Wabo, 3:15(1) Awb.  
\(^{90}\) § 35-11-204 and 206(d) of the 2017 Wyoming Statutes.
possibly public-interest-standing for environmental organizations. associations and any person whose rights have been infringed. who have submitted comments.\textsuperscript{91} entities; possibly public-interest-standing for environmental organizations.

\textsuperscript{91} Art. 8:1, 6:13 Awb.