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To cite this article: Siddharth Sareen, Jakob Grandin & Håvard Haarstad (2022) Multiscalar Practices of Fossil Fuel Displacement, *Annals of the American Association of Geographers*, 112:3, 808-818, DOI: [10.1080/24694452.2021.2000850](https://doi.org/10.1080/24694452.2021.2000850)

To link to this article: <https://doi.org/10.1080/24694452.2021.2000850>



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Published online: 23 Feb 2022.



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Multiscalar Practices of Fossil Fuel Displacement

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As renewable energy sources increasingly outcompete fossil fuels on cost and efficiency, novel questions arise around how, when, and where renewables can displace fossil energy. We need to understand fossil fuel displacement as a sociopolitical and spatial process. In this article, we focus particularly on the scales and practices of legitimation through which fossil fuel displacement occurs. We advance an understanding of how such displacement is conditioned by incumbent multiscalar arrangements and of how these can be overcome. We suggest that there are different practices of displacement that operate across multiple scales—here conceptualized as discursive, financial, institutional, and infrastructural—and use them to develop an analysis of solar rollout and fossil phase-out in Portugal. Our analysis shows that although renewables have partially displaced fossil fuels both discursively and financially, they have not yet displaced the historically large-scale nature of energy generation. Rather, the persistence of fossil fuel geographies and sectoral institutional arrangements keeps the displacements of energy transition at a spatial remove from citizens. *Key Words:* destabilization, energy geographies, legitimation, multiscalar, practices of displacement, spatial.

Scholars and policy analysts have celebrated the massive increase in renewable energy the past decade. According to the *Renewables 2020 Global Status Report* (Ren21 Secretariat 2020), installed capacity of solar photovoltaic (PV) capacity globally in 2019 was 627 GW, twenty-seven times more than the 23 GW in 2009. This rapid growth of renewable energy can be seen in declining renewable energy prices, technological revolutions in electric cars, and an increasingly renewables-friendly policy landscape worldwide. The *Renewables 2020* report of the International Energy Agency (IEA 2020), whose estimates are historically conservative on renewables (Carrington and Stephenson 2018), forecast a doubling in wind and solar capacity by 2025—by 1,123 GW—surpassing gas and coal capacity in 2023 and 2024, respectively. Their 2021 roadmap for *Net Zero by 2050* marks a steep increase even from this ambition, calling for no new oil and gas field approvals after 2021 to limit global warming to 1.5°C (IEA 2021). These trends are highly encouraging from a sustainability perspective and drive great optimism that solutions to the climate crisis are within reach.

This optimism, however, overshadows a less encouraging fact: Consumption of fossil fuel-based energy has increased concurrently. Globally, consumption of fossil fuels continues to outpace renewables in absolute

terms (York and Bell 2019). We will not achieve climate mitigation targets if new renewables complement fossil energy sources. Rather, renewables must displace fossil fuels at scale. What does this displacement look like, and how do we understand it geographically?

Fossil fuel displacement is already a topic of scholarly debate, but this tends to understand displacement through econometrics—debating how many units of fossil fuel electricity are displaced by adding one unit of nonfossil fuel electricity (e.g., Jørgensen 2012; Liddle and Sadorsky 2017). We argue that fossil fuel displacement is better understood as a sociopolitical and explicitly spatial process. Geographers should have a lot to say about this, because interrelations between the material, the social, and the discursive are engrained in the disciplinary fabric (Bakker and Bridge 2006; Pasqualetti 2011; Zimmerer 2011). We therefore advance an understanding of fossil fuel displacement as a shift that is certainly technoeconomic but also simultaneously sociopolitical and spatial.

Notably, a scholarly focus on displacement in energy social science is timely because much of this literature has focused on the emergence and evolution of new sociotechnical configurations through innovation, competition, and diffusion (Köhler et al. 2019; Sovacool et al. 2020), rather than the disassembly and dissolution of the old regimes. As Bridge

(2018) wrote, “Less studied in the context of contemporary energy systems is the process by which dominant and seemingly-durable actors and institutions come into question and start being abandoned as the relations that have sustained an incumbent’s position begin to fray” (17–18). Our work remedies this by balancing the characterization of transitions to account for displacement.

Emergent energy geographies literature offers important cues to understand fossil fuel displacement. Human geography concepts have impregnated understandings of energy transitions as sociospatial, helping to theorize dynamics of power across space and in specific places of transition (Calvert 2016; Bouzarovski and Simcock 2017; Sareen and Haarstad 2018). Recent studies on the politics of oil, coal, and natural gas infrastructures have highlighted their sociospatial embeddedness (Mitchell 2011; Huber 2013; Watts 2013; Rutherford and Coutard 2014; Urry 2014). Thus, we know that the material characteristics of an energy resource inherently affect what politics can be generated around it (Burke and Stephens 2018); Mitchell’s (2011) analysis underscores the difficulty of effective labor organization around spatially dispersed oil infrastructures. Similarly, work on carbon lock-in has shown how the spatial embeddedness of carbon infrastructures serves to uphold fossil fuel-based regimes (Unruh 2002; Seto et al. 2016). There is emergent interest in the destabilization and failure of regimes among transitions researchers (David 2017; Haarstad and Wanvik 2017; Bridge 2018; Turnheim and Sovacool 2020).

Thus far, this literature shows us how the sociotechnical regime of fossil energy is engrained in society, but we know less about its displacement. The ongoing global rivalry of fossil and renewable energy presents novel questions around how, when, and where renewables will displace fossil energy. We must also consider how new energy sources layer atop or become imbricated in existing energy infrastructure (Silvast et al. 2018) and landscapes (Bouzarovski 2009), which condition and can potentially limit the nature of displacement. We therefore ask this question: How can we conceptualize fossil fuel displacement?

Our analysis focuses on scale as the dimension of spatiality that has particular importance. Scale is a key concept in human geographical debate and praxis, and although the subject of significant conceptual debate, it broadly refers to nested and interconnected sociospatial arenas. Although the typical

scalar register is local, national, and global, many different scales are in operation (Herod 2012). Arguably, a scalar perspective is essential to fossil fuel displacement because it can encompass the ways in which energy is embedded locally through infrastructure and place, as well as through broader political–economic processes of regional, national, and global energy systems. We understand displacement as the legitimation of emergent practices—discursive, financial, institutional, and infrastructural—that operate and become institutionalized across scales.

The article subsequently elaborates on an empirical case study of fossil fuel displacement. We analyze solar energy rollout and fossil fuel phase-out in Portugal between 2017 and 2020, by tracing how displacement is legitimated across these four practices. Our empirical analysis identifies scalar biases in the allocation of benefits and burdens to favor large-scale actors at the expense of small-scale ones. On this basis, we argue that fossil fuel displacement is taking place at a spatial remove from citizens, entangled with persistent fossil fuel geographies and sectoral institutional arrangements.

Conceptualizing Practices of Displacement across Scales

A geographical conceptualization recognizes fossil fuel displacement as conditioned by sociopolitical and spatial relationships. We employ a relational approach to spatiality, in line with Massey (2004) and others, meaning that we examine places and actors through their relationships with other actors and places. Fossil fuel displacement, we argue, must be understood in this light. As Coenen, Benneworth, and Truffer (2012) pointed out, both niches and regimes encompass local, national, and global scales: Niche actors can both align local resources and draw on broader global shifts. Thus, regimes are constituted by particular local and national pathways and by larger trends. This means recognizing that the energy system is at once local and global, so displacement in one locality is interrelated with trends elsewhere. This is obvious in economic markets; for example, the competitiveness of solar energy versus coal in Europe is conditioned by cheap solar module production in China. It also holds, though, for political–economic relationships. Hornborg (2020) argued that a “shift to sustainable solar energy in the most affluent nations ... may be

tantamount to displacing work and environmental loads to poorer countries” (9–10). Correspondingly, displacement occurs at different locations along the chains and networks of the global energy regime.

Furthermore, displacement involves both destabilizing the old regime and assembling the new. Incumbent regimes rely on a steady flow of resources, public legitimacy, and societal commitment to maintain viability (Smith and Stirling 2010; Turnheim and Geels 2012; Moss 2014). These “practices of legitimation” (Sareen 2020) serve to uphold the incumbent regimes and make existing regimes seem stable, natural, and everlasting. Conversely, other practices of legitimation are required to assemble, mobilize, and institutionalize the emergent regime that destabilizes the old.

The idea of practices of displacement suggests that both incumbent and emergent regimes need to be continuously produced and reproduced through legitimation across scales. Here, we propose that fossil fuel displacement operates with a particular directionality (i.e., toward decarbonization) but in potentially uneven ways at different scales. We specify four practices of displacement—discursive, financial, institutional, and infrastructural—and discuss these sequentially.

Discursive displacement concerns undermining and diverting the practices involved in legitimating the ideas, norms, and standards of the fossil fuel regime. As Lee and Hess (2019) observed, “An important dimension of political contention over sustainability transition policies involves the discursive work that different actors undertake in order to undermine or to defend policies” (184). Discursive critique of fossil energy systems undermines the cultural, ethical, and political legitimacy of incumbent industries, contributing to shifting “socio-technical imaginaries” of energy (Ballo 2015). For instance, British coal mining “was discursively framed as a ‘sick’ industry” (Turnheim and Geels 2012, 40) in the 1930s while new visions of household life engendered enthusiasm about electricity and gas. More recently, framings of distributed solar energy as a technologically disruptive force have prompted comparisons of incumbent energy utilities to once-dominant firms and industries like Kodak, Blackberry, and landline telephony that met a rapid demise (Lee and Hess 2019). Discursive displacement operates at multiple, interconnected scales, as global and regional discourses interpellate local discursive practices.

Financial displacement pertains to undermining and diverting the practices that ease economic resource

flows to the fossil fuel regime. As widely recognized, financial pressures have long been key to destabilization and transitions in energy systems. Turnheim and Geels (2012), for example, argued that economic pressures were “the direct causes of destabilization” (44) of the British coal industry. Recently, research has highlighted the increasing economic competitiveness of renewable energy sources (Jacobson 2020; Strauch 2020). Geographers have highlighted that the financial flows of energy transitions are highly uneven spatially (Bridge and Gailing 2020; Golubchikov and O’Sullivan 2020). Thus, examining financial displacement practices identifies how and where financial cases for renewables are constructed, how networks of financial interests can shift from fossil fuels to renewables (Blondeel 2019), what the entry barriers are for smaller actors (Sareen 2020), and how risks are reconfigured for high-carbon industries (Christophers, Bigger and Johnson 2020; Semieniuk and Yakovenko 2020). A key example is CarbonTracker’s (2013) reporting on “unburnable carbon,” which has amplified the perceived risk of stranded high-carbon assets. This highlights the scalar nature of financial displacement, where global market prices for renewable energy and the European Union’s regional taxonomy for green investments aimed at shifting financial flows toward renewables interplay with national and local investment decisions.

Institutional displacement relates to undermining and diverting the mechanisms that govern and maintain the social order that undergirds the fossil fuel regime. The energy sector is structured by various institutional settings at different scales, which partly explains why sociotechnical regimes are relatively stable (Fuenfschilling and Truffer 2014). This structure includes politically determined incentives for technological priority setting to modulate which new energy sources develop and proliferate, with necessarily limited knowledge (Kovacic and di Felice 2019). Singh (2012) compared institutional structures in Norway and Denmark to argue that oil-dependent Norway has built governmental institutions that suit its powerful oil regime but encumber it in timely stimulation of renewables. A central struggle for emergent energy actors is to gain legitimacy with national institutions such as government ministries, to be recognized as beneficiaries of innovation and rollout policies and incentives (Genus and Iskandarova 2020). Institutional displacement involves

changing rules, incentives, policy support, and more and can radically alter the abilities of energy sector actors to compete, particularly at regional and local scales where this has been historically constrained. As Ting and Byrne (2020) showed for ESKOM in South Africa, incumbent actors might strongly resist rule changes that affect them negatively.

Infrastructural displacement concerns the practices involved in reconfiguring, repurposing, or rendering obsolete the technological and material architecture of fossil fuel energy systems and accompanying social practices. Historical accounts identify the introduction, emergence, and eventual predominance of the fossil energy system as contingent on technological innovation and infrastructure construction, at scales ranging from household heating practices to international energy infrastructures (Allen 2012; Moss and Sareen 2020). The material predominance of this infrastructural system, and its embeddedness in social practices from the individual to the geopolitical, has been pointed to as a key factor behind what Unruh (2002) termed “carbon lock-in.” Displacement, then, sheds light on how to enable new infrastructures and sociospatial metabolisms for low-carbon transitions (Hui, Day, and Walker 2018; Blue, Shove, and Forman 2020) and on how to cultivate self-reinforcing mechanisms and navigate lock-ins (Garud, Kumaraswamy, and Karnøe 2010). This might erode or repurpose fossil fuel infrastructure or make fossil fuel infrastructures obsolete through the emergence of more competitive renewable infrastructures. The shift to renewables has involved legitimating infrastructural interventions at multiple scales (Burke and Stephens 2018), from community energy provision to revamping national grids and strengthening international electricity markets.

Together, the four practices of displacement provide an analytical basis to study discrete practices of fossil fuel displacement and identify situated sociospatial patterns based on empirical material for specific contexts. The next section introduces our case, describes our field data, and presents our analysis using the practices of displacement framework.

Practices of Displacement in Portugal, 2017 to 2020

Context, Methods, and Materials

Our empirical case is solar rollout and fossil phase-out in Portugal between 2017 and 2020, a

period when the fossil fuel import-reliant country went from skepticism of the affordability of solar energy to twice setting world records for the cheapest solar auction rates. Simultaneously, Portugal abandoned plans for offshore fossil fuel prospecting and launched ambitious low-carbon energy transition targets. Fieldwork provides rare insight into practices of fossil fuel displacement and reveals emergent sociospatial patterns and effects.

We draw from eighty expert interviews and multiscalar field observation of multiscalar solar energy rollout in Portugal, based on five months of fieldwork between 2017 and 2019 complemented by desk study between 2017 and 2021. Semistructured interviews were conducted with diverse actors, including national regulators, incumbent energy utility employees, energy ministry and national energy agency representatives, technical and social science energy researchers, solar developers, municipal and regional representatives, energy association representatives, energy-related civil society organizations and environmental activists, and energy investors. Site visits took the multiscalar nature of rollout into account and included observations at large rural solar plants and small solar projects and participation in multiple national and local energy sector events between 2017 and 2019 and online in 2020. Field data collection was complemented by secondary research using gray literature such as industry reports and official energy sector documents, and peer-reviewed scholarship.

Multiscalar Processes of Fossil Fuel Displacement in Portugal

In 2018, the battle lines for Portugal’s energy future were starkly drawn. On a beach off its west coast in Aljezur, hundreds gathered to protest proposed exploration of offshore fossil fuels,¹ marking what had become an annual event,² in a country grappling with frequent deadly wildfires due to climate change.³ Some protestors had spent months weaving and knitting a thick red textile line as part of the “linha vermelha” (“red line”) campaign.⁴ These campaigns, advancing discursive displacement of the fossil industry, had strong local and regional embeddedness, and as Fernandes and Magalhaes (2020) argued by analyzing national election 2019 results, climate change became “one of the most salient topics” (1046).

On 8 September that year, representatives from dozens of organizations took to the streets in Lisbon, Porto, and Faro during global climate protests, locally the “*Marcha Mundial do Clima*.”⁵ Around this time, local manifestations of the global Fridays for Future strikes emerged in countless cities, putting pressure on international leaders to realize the 2015 Paris Agreement. These strikes exemplify how actions elsewhere inspire and strategically inform place-based action within solidarity networks.

Concurrently, fossil fuel displacement in Portugal faced entrenched economic interests. Fossil majors Eni and Galp held three concessions for offshore deep-sea oil drilling and underwater fracking off the Alentejo and Algarve coast, and Australis held two for gas drilling on land in Leiria, all attempts to legitimate the continuity of large-scale ownership structures in fossil fuel–centric energy infrastructure expansion.

Efforts to maintain financial and institutional legitimation of fossil energy were increasingly brittle, however. Ten other Portuguese drilling concessions had been canceled in preceding years. Moreover, during March 2018, Portugal produced 104 percent renewable energy compared to domestic electricity demand, giving strong infrastructural legitimation to practices of displacement in the discursive domain by showcasing the existing ability to run a fully renewable energy–based system over extended periods at the national scale.

Transnational Pressures for Fossil Fuel Displacement. To explain the shift from fossil energy to solar in Portugal, one needs to account for processes and pressures across spatial scales, including transnational scales. All four practices of displacement we outlined earlier are governed in part by multiple actors above the national scale (Carrington and Stephenson 2018; Kovacic and di Felice 2019). Although these are too complex to account for in full, we highlight key examples.

First, the European political arena is an important transnational context. For example, the European Green Capital 2020 award boosted Lisbon’s legitimacy for its urban solar projects to lead by example and mainstream a social imaginary of Portugal as a solar energy nation.⁶ Second, the European Union, whose funding was key for strengthening transmission grid infrastructure, required the National Energy and Climate Plan 2030 from member states. These external impetuses meant that Portugal rapidly

concretized ambitious targets for solar rollout, providing credible alternative pathways to phase out fossil fuels and institutionalizing medium- and long-term measures to displace fossil fuels through specific commitments—for example, to exit coal, expand transmission grids for renewables, and decarbonize fossil-intensive sectors like transport—aligned with European Green Deal ambitions.

Third, the international scale also provides examples of multiscalar pressures. In 2017, Portugal entered the Powering Past Coal Alliance, an international partnership committed to phasing out coal by 2030. Portugal’s commitment strengthened the political legitimation of exiting coal before 2030 (Blondeel 2019). In terms of economic conditions, China’s manufacturing leadership in solar PV production and export created cost declines that enabled rapid economic competitiveness for solar entrants in the Portuguese energy sector (IEA 2020).

National Processes of Fossil Fuel Displacement. The local and transnational legitimation of fossil fuel displacement synergized with national political developments. In 2018, the government combined environment and energy portfolios under the new Ministry for Environment and Energy Transition (renamed the Ministry of Environment and Climate Action in 2019). This historic merger of portfolios marked institutional legitimation of a fossil fuel displacement agenda. This heralded a drastic policy shift away from fossil fuels and toward rapid renewable energy rollout, especially solar energy (wind energy had already expanded during the 2000s). Offshore fossil exploration concessions that social movements had mobilized against were canceled, a Roadmap for Carbon Neutrality 2050 was launched with a national road show, and Portugal’s National Energy and Climate Plan 2030 institutionalized ambitious decarbonization targets across sectors.

A predominant part of Portugal’s fossil fuel displacement consisted of replacing fossil energy through an aggressive strategy of solar rollout. By summer 2019, a set of twenty-four solar auctions had set a world record on low cost, bettered by twelve auctions in August 2020. By January 2020, legislative barriers to community solar energy projects were finally removed, paving the way for broader participation in Portugal’s energy transition. These institutional practices of displacement directly enabled financial and infrastructural displacement toward

large-scale solar PV: Compared to 585 MW in 2017, Portugal reached 1,035 MW of installed solar PV by 2020 (Directorate General for Energy and Geology 2020), with more than 2 GW under development, toward a target of 9 GW by 2027.

The solar rollout accelerated in clear discursive and institutional opposition to fossil fuel persistence. A notable example is how the government in 2018 stopped the €20 million in annual subsidies paid to fossil fuel plants to maintain standby generation capacity in Portugal's base-load electricity model. This move acknowledged a shift to a maturing market for electricity flexibility, in line with global trends, with increasing renewable energy penetration in electricity grid mixes (IEA 2020). Indeed, during an IEA event in Lisbon on 10 October 2017, an IEA representative declared, "We hear a lot of mistaken stories on system integration of renewables, but in Portugal you know it can work, it is not a technical issue but depends on the flexibility of the rest of the system: grid connections, existing power plants and substations, variability of supply mix and demand response." By 2021, Portugal was moving rapidly to in-build flexibility for greater renewables penetration, investing in energy storage and green hydrogen infrastructure to advance fossil fuel displacement (Partidário et al. 2020).

The Persistence of Large-Scale Energy Systems. Solar PV's economic competitiveness provided considerable financial and infrastructural legitimation for displacement. An energy consultant (interviewed 12 October 2017) explained, "Earlier, solar required 100 percent financing with banks and no risk, else 90 percent financing with a hiked capital expenditure shown with a money-back mechanism. Now 75 percent to 25 percent is typically required, so a solar project only needs €50 million in equity." This shows a shifting logic of financial legitimation.

New entrants led the solar rollout, rather than the incumbent energy major Energias de Portugal. Nevertheless, entrants reflected the persistence of large-scale financial practices as a legacy of a fossil fuel-based energy system. Attractive subsidized tariffs for small-scale solar plants were removed by 2014. Installed capacity increased through large-scale plants, first with heavy subvention through feed-in tariffs until 2017 and then through competitive auctions as undeniably competitive solar PV costs began to displace other energy sources globally.

Wildfires and floods brought climate change to the fore in the October 2019 national elections, opening up room for discursive legitimation to be backed by institutional and financial change. Simultaneously, there were signs of backlash in the national political and economic landscape. Controversial subsidies to wind energy and austerity politics between 2008 and 2015 had exhausted public appetite for renewable energy subsidies. The ministry tried to reposition solar energy in national discourse—with media statements and tweets by the then-Secretary of State for Energy emphasizing, for example, "construção de uma central solar sem subsídios pagos pelos consumidores" (construction of a solar plant without consumer-paid subsidies; @JorgeSeguro on Twitter, 15 September 2017). This exemplifies discursive legitimation.

The government was keen to defend its support for fossil fuel displacement without creating public backlash to costs linked with displacement. A Secretary of State for Energy office representative (interviewed 20 August 2018) explained, "On the side of changing investor mindset, the government has done exceptional work that has proven successful, but we still need decentralized solar and clear rollout of grid capacity to be sorted out. Everyone knows it, but in the political arena there are timings and things that are hard to control. Only the political decision makers and parties know how to do it."

Thus, from 2017 to 2019, energy sector regimes exhibited dynamic, heightened contestation. Although the government still entertained the idea of offshore fossil exploration consortia and supported long-running, import-fueled thermal plants, solar developers were hard-pressed to mobilize financial capital, as subsidized feed-in tariffs were removed on the premise that solar PV was now competitive. These predominantly large-scale actors had to legitimate solar projects to investors as sufficiently low-risk to access low interest rates and establish projects, by aligning with rather than reconfiguring the private-led, utility-scale wholesale energy generation market model. In 2019, the new ministry replicated international successes with an auction mechanism for solar installations. This market mechanism ensured electric grid access in predefined lots at the local scale (a key example of infrastructural legitimation) and then ran a national-scale competitive process premised on a fifteen-year revenue flow model to lower the cost of capital for solar

developers. These solar plants, though, were limited to over 10 MW in size, favoring large-scale production infrastructure like that of fossil fuel plants.

This institutional restructuring of the energy sector and attempts to rationalize the financial practices of displacement stopped short of displacing the dominance in the energy sector of large-scale companies and top-down technocratic control. To the contrary, the attempt to enable infrastructural displacement was arguably layered atop and thus locked in the large-scale organization of energy production. This lock-in effectively narrowed the scope for small-scale energy projects, despite the latter being key to democratizing energy ownership based on multiscale fossil fuel displacement. Institutional displacement through auctions shifted some solar rollout barriers from the local and regional scales to the national. For instance, the auctions made it easier for solar developers to select project sites and secure requisite approvals. Moreover, winning auctions provided national-scale legitimation for developers to negotiate local factors such as land leases and environmental impact approvals. Auctions enabled financial displacement for large solar projects by minimizing risk, which lowered the cost of finance. The auctions were widely considered successful, as they attracted competitive investment for 2 GW of solar projects during 2019 and 2020.

The rollout of solar that the auctions facilitated provided the ministry with discursive and financial legitimation for displacement of existing fossil fuel plants, exceeding commitments under the Powering Beyond Coal Alliance 2030. Citing lack of competitiveness against other sources, the incumbent *Energias de Portugal* itself filed for permission to close one of the two coal thermal plants two years earlier than planned and shut down the 1.2 GW Sines plant in January 2021. Portugal's last remaining coal plant, the 628 MW Pego plant, was scheduled to close in November 2021, with planned brownfield development of a 650 MW solar plant, battery storage, and solar-powered green hydrogen production at the same site, compounding existing infrastructural logics.⁷

Whereas an organized solar industry articulated its needs and gained political and policy traction for infrastructural displacement, the same did not hold for small-scale solar actors, both individuals and cooperatives. These changes are contingent on place-based dynamics: Small-scale solar has played a relatively outsized role in comparably solar-rich

countries such as Brazil and Australia (Best, Burke, and Nishitateno 2019; Rigo et al. 2019). In Portugal, legislation to enable community energy projects beyond self-consumption entered into force in January 2020 (Campos et al. 2020). Whether this institutional legitimation translates into infrastructural displacement, though, depends on the ability of local actors to mobilize financial capital. These actors, as private individuals and small-scale investors, were notably limited to well-off early adopters between 2017 and 2020. Lisbon-based solar energy cooperative *Coopérnico*, with a wider member base, found its options limited to single-entity solar prosumers until the new legislation opened up scope for community energy projects to get underway from 2020 onward.

Thus, although Portugal successfully displaced specific future imaginaries of offshore fossil fuel and existing support to coal plants while rapidly enabling economically competitive solar plants, it was slower to displace the historically large-scale, centrally controlled nature of energy generation. Energy infrastructure and ownership remained distant from ordinary citizens, both located and steered remotely through capital flows. Nonetheless, Portugal succeeded in accelerating large-scale solar rollout, fulfilling an essential component of displacement and enabling further fossil displacement, for example, through coal plant closures, albeit with the critical omission of more distributed, multiscale renewable energy generation.

In summary, our analysis illustrates the four practices of legitimation for fossil fuel displacement at work. We showed the discursive recognition of emerging solar and fading coal competitiveness, the selection of a financial auction mechanism in tune with ground realities of large-scale project developers, and stopping capacity payments to fossil energy. Also, we underlined institutional legitimation through the creation of a new ministry and the establishment of decarbonization pathways and infrastructural legitimation through the expansion and partially reconfigured allocation of electric grid capacity.

Figure 1 visually represents the key practices of displacement that advanced solar rollout and fossil phase-out in Portugal between 2017 and 2020.

Conclusion

The sustainability of our society depends on the displacement of fossil fuels by renewables. This is

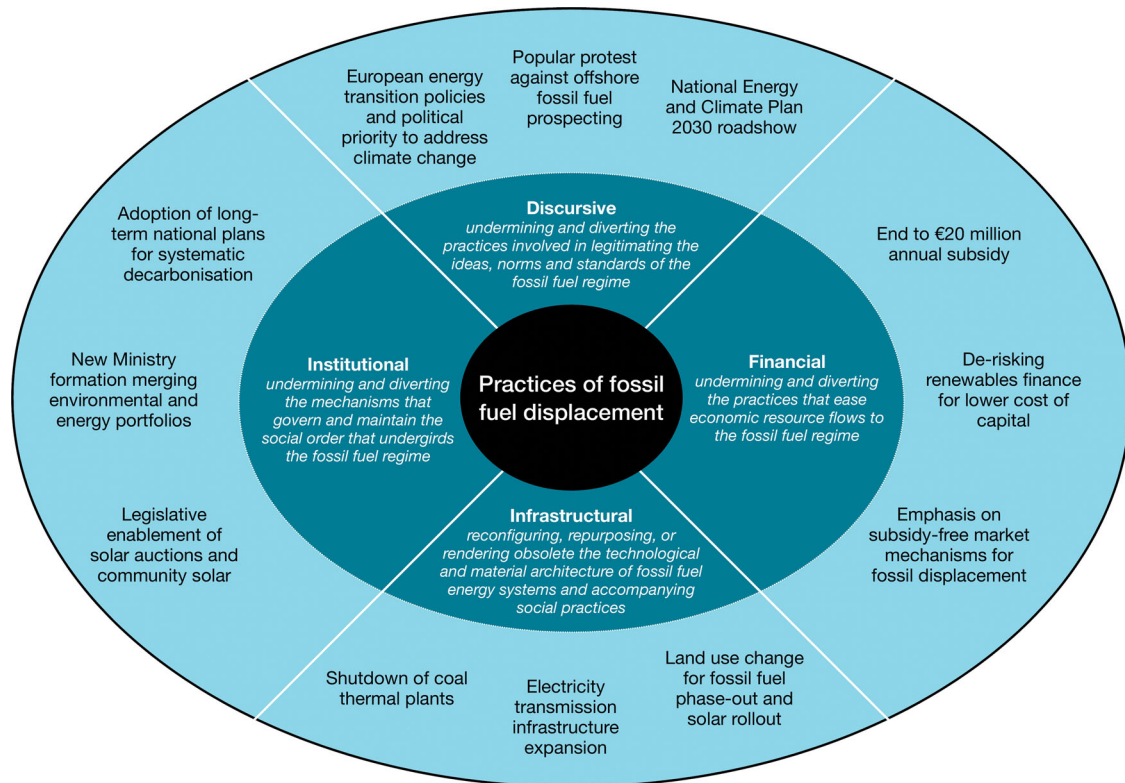


Figure 1. Practices of displacement in solar rollout and fossil phase-out in Portugal, 2017–2020.

increasingly recognized among human geographers and transition scholars (David 2017; Haarstad and Wanvik 2017; Bridge 2018; Turnheim and Sovacool 2020) and also in broader societal spheres. We have explicated that this displacement occurs through practices at the intersection of the discursive, financial, institutional, and infrastructural. A focus on practices of displacement can enable more engaged contributions from human geography to real-world displacement processes as they play out in situated ways. The practices and multiscalar networks that bring new regimes into being do so in incomplete ways. Analyzing the sociospatial patterning of these shifts tells us something vital about how fossil fuel displacement comes about or not, its multiscalar dynamics, and its situated effects.

Applying our practices of displacement framework to Portugal illustrates that numerous displacements are underway but have critical omissions. Although large-scale solar rollout has made global headlines and local-scale efforts have influenced national perspectives, the prospects of small-scale solar—and corresponding shifts in ownership and geographies of energy infrastructure—remain to be realized. Even as fossil fuels seem to be displaced, the large-scale,

private-led model of energy production and distribution endures. Tellingly, large utilities are now racing to take up competitive positions in the renewables markets, effectively displacing their own core business to not be completely displaced themselves.

Our perspective foregrounds fossil fuel displacement as an emergent and contested set of legitimation practices. It attends to the technoeconomic, sociopolitical, and, not least, spatial practices of dissolution and layering. Displacing fossil fuels is a project of ecological transformation that requires assembling particular sets of social relations and disassembling others, to reproduce it at multiple scales, across space, and in specific places. Although renewables have displaced fossil fuels in Portugal financially and discursively, they have yet to challenge the historically large-scale nature of energy generation that persists as the embodied legacy of fossil fuel energy geographies spatially and in terms of ownership.

In sum, displacement is underway, but so far it is neither citizen-led nor citizen-centric. We are reminded of Harvey (1993), who wrote that “One path towards consolidation of a particular set of social relations ... is to undertake an ecological

transformation which requires the reproduction of those social relations in order to sustain it” (27). In other words, we can question whether ongoing processes of fossil fuel displacement are sufficiently structurally transformative or whether they are strategically and performatively modulated by large companies’ desires to not be displaced but rather reinvent themselves in ways that retain their relevance and dominance in adjusted systemic logics.

Funding

The authors are grateful for support from the Research Council of Norway grant 314022 (ASSET project) and the Trond Mohn Foundation grant BFS2016REK04.

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Notes

1. See an event report and statement about the 2018 protest at <https://www.tamera.org/stop-the-drilling/>.
2. For an overview of the event in 2017, see <https://ecohustler.com/article/activists-from-40-countries-protest-offshore-oil-drilling-in-portugal/>.
3. Some of the most harrowing accounts come from 2017. See https://en.wikipedia.org/wiki/June_2017_Portugal_wildfires.
4. See <https://linhavermelha.org> for details and images.
5. For an overview of the call to action, see <https://www.tamera.org/rise-for-climate-2018/>.
6. Lisbon aims to install 8MW of solar PV within its territory and founded a Solar Cities mayors’ network and an urban solar platform, Solis, during 2019 (see <https://energy-cities.eu/lisbon-a-solar-city/>). This city has also hosted several major European solar energy conferences to institutionalize Portugal’s identification with solar transitions in and through its capital beyond the award year.
7. See <http://taiyangnews.info/markets/endesa-to-replace-coal-plant-in-portugal-with-solarstorage/>.

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