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**The Sunshine Problem**

Climate Change and Managed Decline  
in the European Union

Timur Ergen and Luuk Schmitz



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## Abstract

Decarbonization requires the winding down of – economically – fully viable, if not highly prosperous, lines of economic activity. Different from past episodes of industrial restructuring revolving around the managed decline of sunset industries, accelerating climate change requires reallocation away from economic activities where the metaphorical sun is still shining. Firms, owners, workers, regions, and polities structurally rely on these sources of prosperity and have interwoven their past and future lives with them. We argue that this problem has created a space for state actors to experiment with vertical industrial policies to manage the reallocation of resources from polluting to non-polluting activities. We illustrate this dynamic by investigating the least-likely case of the European Union, a polity heavily tilted towards market governance. European climate policymakers, we argue, have incrementally moved away from the primacy of regulatory, market-making tools and have introduced a plethora of vertical instruments to shift resources away from climate-harming fields. This experimentation with vertical policies unfolds against the backdrop of a thirty-year institutional legacy of single market-oriented policy in the energy field.

**Keywords:** climate change, cohesion policy, European Union, green transition, industrial policy, regional restructuring

## Zusammenfassung

Dekarbonisierung erfordert die Abwicklung und Restrukturierung von – wirtschaftlich – überlebensfähigen, wenn nicht sogar prosperierenden Wirtschaftszweigen. Anders als in früheren industriellen Restrukturierungsprozessen, bei denen es um die kontrollierte Herunterskalierung von „Sunset-“ oder „Problemindustrien“ ging, macht die Beschleunigung des Klimawandels eine Umverteilung weg von wirtschaftlichen Aktivitäten erforderlich, über denen die metaphorische Sonne noch scheint. Unternehmen, Kapitaleignerninnen und Kapitaleigner, Arbeitnehmerinnen und Arbeitnehmer, Regionen und Staaten bleiben strukturell auf diese Aktivitäten angewiesen und haben ihr Leben mit ihnen verwoben. Wir argumentieren, dass dieses Problem einen Raum für staatliche Akteure geschaffen hat, mit vertikalen industriepolitischen Maßnahmen zu experimentieren, um die Umverteilung von Ressourcen von umweltverschmutzenden zu nicht umweltverschmutzenden Aktivitäten zu befördern. Wir veranschaulichen diese Dynamik anhand einer Fallstudie der Europäischen Union, ein institutionelles Gefüge, das traditionell stark auf marktwirtschaftliche Steuerung ausgerichtet ist. Wir argumentieren, dass sich die europäische Klimapolitik schrittweise vom Primat der regulatorischen, marktwirtschaftlichen Instrumente entfernt und eine Fülle von vertikalen Instrumenten eingeführt hat, um den Ressourcenentzug aus klimaschädlichen Bereichen zu ermöglichen. Dieses Experimentieren mit vertikalen Politikinstrumenten vollzieht sich vor dem Hintergrund eines 30-jährigen institutionellen Erbes marktorientierter Politik im Energiesektor.

**Schlagwörter:** Energiewende, Europäische Union, Industriepolitik, Klimawandel, Kohäsionspolitik, regionaler Strukturwandel

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# The Sunshine Problem: Climate Change and Managed Decline in the European Union

## 1 Introduction

In political economy terms, accelerating climate change is an unprecedented problem of reallocation. Irrespective of the ultimate success of efforts to contain or revert temperature rises, preventive and adaptive measures will entail the – preemptive, incremental, or catastrophe-induced – shifting of vast quantities of capital, labor, technology, and natural resources to alternative uses (Albert, Ponticelli, and Bustos 2021; Paprocki 2019). In this sense, Elliott has pointedly referred to a sociology of climate change as a sociology of loss (Elliott 2018). Besides the challenge of its gigantic proportions, climate change-induced reallocation cannot be mediated by the market to any significant extent. Orderly adaptation and the mitigation of further heating requires creative destruction in economically viable – if not highly prosperous – fields. Important cases are the unwinding of value chains for fossil fuel extraction and combustion and associated regional restructuring (van der Ploeg and Rezai 2020; Hansen 2022), or the problem of the resettlement of still viable regional communities (de Sherbinin 2011). Hence, different from industrial transformations of the past that challenged societies to organize the unwinding of ailing *sunset* industries, accelerating climate change challenges them to organize the restructuring of industries in which the metaphorical sun is still shining. To capture both the similarities of this constellation to declining industry restructuring and its differences due to continued viability, we suggest referring to the resulting industrial policy difficulty as the *sunshine problem*.

Treating climate change as an ongoing challenge of reallocation is not new. Nor has the unbroken stream of evidence for carbon-intensive prosperity escaped notice – particularly in the context of the record-breaking fossil fuel profits of the early 2020s. Where we try to add a slightly different twist to the debate is with regard to the characterization of the associated industrial policy challenges. Much of the debate about climate change-related reallocation is based on a vision of the carbon economy as being locked in place by an unfavorable set of relative prices. Shifting relative prices in favor of green uses then promises to incrementally “wring” carbon-intensive activities out of the economy. Relative prices are at the core of currently dominant policy approaches to the green transition. On the one hand, states have increasingly resorted to subsidies, tax breaks, incentives, and interventions in financial markets to benefit the production and use of green energy (Gabor 2023; Larsen et al. 2022). In the United States, the Inflation Reduction Act is discussed as a potential tipping point in fostering a low-carbon economy on the basis of subsidies for investment in production capacity for green technologies. On the other, cost-imposing policy approaches have tried to make carbon-intensive activities less attractive through pollution-tied taxes or cap-and-trade schemes. Given

its strict state aid regime and market-making bent, the European Union has figured prominently in this field – since the early 2000s particularly through its Emissions Trading System (ETS) (Jevnaker and Wettestad 2017).

We argue that the view of decarbonization through the administrative manipulation of relative prices underestimates the political and social resilience of the carbon economy (Beckert 2024). As repeatedly stressed by transnational governance bodies, not one major political economy has yet managed to implement decarbonization programs in line with ambitious agreed-upon mitigation targets (IPCC 2023). In the quest for political maneuvering room to decarbonize, *sunshine* unwinding, we argue, pushes governments into similar meso-level problems with managing structural change as *sunset* unwinding has since the 1970s. The classic industrial policy literature of the 1980s has documented that actors, firms, sectors, and regions had tremendous difficulty restructuring and unwinding even in the face of unambiguous decline (Katzenstein 1985). Across rich countries, the practical sunsetting and restructuring of declining industries was a decades-long political process of dissociating societies from structures of economic activity – fraught with misled approaches, inefficiencies, and half-baked solutions, many of which plague post-Fordist societies well into the present (Ergen 2023). The role of state agents in these dissociation processes went well beyond both liberal and Keynesian modes of economic governance in that governments managed supply-side change on a much more granular level. Sunsetting interventions included retraining initiatives for specific affected workers, sector-specific restructuring initiatives, sweeping changes to social, tax, and trade policies, and the large-scale retirement of whole segments of production factors. We submit that this granular approach to state-mediated economic restructuring (re-)emerges as a policy challenge under conditions of accelerating climate change – with the added complication that states have to retire prosperous, rather than declining, lines of activity.

The main empirical case we rely on for illustration is the European Union since the late 1990s. We document an incremental shift in emphasis from regulatory price-manipulating initiatives towards meso-level interventionist policy toolkits. The European ETS – long heralded as an institutionally elegant and efficient way to phase out carbon emissions – has increasingly been punctuated by transfer programs targeted at the decarbonization of specific industries or regions since the middle of the 2010s. Importantly, such granular policy toolkits to effect transitions in specific communities, industries, and regions emerged as part of settlements meant to overcome political resistance to increases in the price of carbon. We discuss the EU as a least-likely case of picking up more interventionist, granular toolkits to phase out the carbon economy. The bloc has undoubtedly had extensive policy experience with declining industries and regional restructuring and hence with industrial policies seeking to meso- and micromanage the reallocation of resources (Warloutzet 2019). Nevertheless, many of the post-1990s' common policies in the energy arena were motivated by the goal to roll back (member-) state interference and create a single market in energy – not least because of the EU's constitutional bent (Scharpf 1995).

This paper makes two contributions. First, it relates to the international political economy of climate change by developing an industrial policy angle on the challenges of organizing the reallocation away from profitable lines of business. While political economists have increasingly moved away from describing climate change as a simple international common pool problem (Aklin and Mildenerger 2020), the associated problem of micromanaging field-specific reallocation has received comparatively little attention (Allan, Lewis, and Oatley 2021; Meckling 2021; Nahm and Meckling 2022). This is particularly true for research on transnational institutions in the climate field.

Second, we aim to bring industrial decline back into the study of industrial policy. Reflecting policy priorities of the 1990s and 2000s (Ergen and Rademacher 2021), much of recent industrial policy scholarship has focused on how governments aim to support sunrise industries and breakthrough technologies (Block 2008; Mazzucato 2013). While we do not want to belittle the many fields in which technological innovations push governments to support new industries, a major concern of climate change adaptation and prevention today is the question of how to scale down or remodel economic structures that are deemed outmoded.

Our paper is structured in two major parts. Section 2 spells out what we call the sunshine problem in climate-related industrial policy – the large-scale re-emergence of the political problem of how to wind down economic structures. Section 3 illustrates our argument based on a case study of the EU ETS. We demonstrate how the market-oriented institutional regime for emissions trading was incrementally punctuated by industrial and regional policies seeking to enable green restructuring in specific regions and sectors.

## 2 The sunshine problem

The industrial policy challenges around climate change have mostly been discussed in relation to the problem of getting new industries off the ground. Green industrial policies have been emerging around the world as governments seek to develop technologies to combat climate change and vie for position in emerging industries (Allan, Lewis, and Oatley 2021; Meckling 2021; Rodrik 2014). It is not our intention to cast doubt on the role of policies aimed at green sunrise industries in climate change mitigation. Rather, we build on the insight that new technology development is only one of the political economic challenges of green transitions – one that becomes less important as efforts to decarbonize become more serious and invasive (Thurbon et al. 2023).

There are multiple theoretical arguments as to why it may be naive to expect green transitions to proceed automatically once technology policies have shifted relative prices sufficiently. In political economy, Breetz and colleagues have suggested that efforts to introduce already commercialized green technologies into energy systems shift the pol-

Table 1 Profit shares of oil firms among large multinational enterprises, 2005–2022

| N of firms, % of total   |                    | Profits, % of total |       |
|--------------------------|--------------------|---------------------|-------|
| Forbes 2000 <sup>1</sup> | Orbis <sup>2</sup> | Forbes 2000         | Orbis |
| 5.5%                     | 7%                 | 10.8%               | 11.5% |

1 All oil firms out of approximately 4,400 firms between 2005 and 2022.

2 Oil firms among 20,114 out of 30,000 firms with annual sales of over 100 million US dollars in any given year between 2010 and 2018; 10,000 firms dropped for missing data.

Note: These numbers most likely underestimate the true degree of oil firms' profitability given the manifest lack of national oil company data. The figures should therefore serve as a baseline estimate.

Source: Forbes (2022) and Bureau van Dijk (2023).

itics of transitions towards conflicts over administrative and institutional reform and the redesign of large technological systems (Breetz, Mildenerger, and Stokes 2018). Similar arguments about a distinct “late-stage” politics of green energy transformations have been developed in the specialized energy transition literature (Geels 2014; Isoaho and Markard 2020; Turnheim and Sovacool 2020). We suggest that an industrial policy correlate of this problem exists: the challenge of how to organize the winding down of perfectly viable, if not highly prosperous, lines of economic activity.

Viewed as a deep transformation of society, the scale and pace necessary to decarbonize the global economy are unprecedented (Newell 2021). In any realistic scenario, it requires a comprehensive overhaul of energy generation and use, industrial production, and transportation infrastructure. For the period in which climate policy is of critical importance, extracting, processing, and using fossil fuels will in all likelihood remain highly profitable. Company-level data from international databases (Table 1) shows that oil businesses consistently capture around 11 percent of all profits among large multinational firms. This red-hot core of global fossil-heavy business activity will in one way or another have to be dismantled. What is more, it is far from clear that renewables offer similarly stable profits as fossil fuels (Christophers 2022; Copley 2022). Thus, on top of the massive investment needed to restructure energy, industry, and transportation, established sectors and natural resource-rich nations will have to forfeit significant profits and wind down significant industrial structures (Welsby et al. 2021).<sup>1</sup> Hansen (2022) estimates the value of those stranded assets that are directly linked to fossil fuel value chains to be in the range of 15 to 17 trillion US dollars up to 2050. In political economy terms, these directly related assets must be understood as just the tip of the iceberg, given that climate-harming practices permeate large swaths of the “ordinary” economy and many of the economic benefits of fossil fuel usage are not linked to actual property rights (such as the regional prosperity and employment opportunities afforded by related value chains).

One of the weaknesses of viewing climate change-related industrial policy as administrative price-shifting is that it tends to portray the politics of climate change as a game of fluid responses to altered incentives. From a sociological perspective, the assumption

1 Recent IPCC estimates put the necessary investments at between 1 and 4 trillion US dollars annually up to 2050 for a 2°C scenario (IPCC 2022).

that societies would transform radically in response to altered relative prices of technologies seems vastly unrealistic (Beckert 2024). By now there exists a rich research literature documenting resistance to deep green transitions, even under conditions of highly attractive and fully commercialized technological alternatives. Drawing from this literature, we see two major mechanisms of structural resilience that prevent societies from reacting to altered prices in a fluid and straightforward fashion.

First, in spite of their increasing legitimacy and initial successes, climate policies often meet with resistance and backlash – especially when they impose clear costs on societies, such as through regulation or taxation (Patterson 2022; Beckert 2022; Finnegan 2022). Concerns over increases in fuel prices co-sparked the nationwide Yellow Vests protests in France (Kinniburgh 2019). Carbon-pricing schemes have been rolled back at the national level in Australia (Crowley 2017; 2021) and at the subnational level in Canada (Macneil 2020; Raymond 2020). Lockwood (2018) and Mildenerger (2021) have shown the proclivity for right-wing politics, and especially right-wing populism, to oppose climate mitigation policy. Stokes (2020) has demonstrated how the losers of climate protection push for policies supporting renewables to be rolled back after they have passed through various administrative and political channels. Similarly, Colantone et al. (2023) and Schaffer (2023) find a negative link between climate-induced distributive losses and individual support for such policies. Finally, Brauers, Oei, and Walk (2020) have documented the political challenges involved in phasing out coal in Germany and the United Kingdom. Like any attempt at organized large-scale institutional change, climate policy-making as a deep socioeconomic transformation tends to turn “noisy” even after initial advances and beyond individual cost calculations (Patterson 2022).

Second, the centrality of fossil fuels in the global economy puts companies and stakeholders of fossil fuel use at the center of global as well as regional quiet politics (Finnegan 2022; Nahm and Meckling 2022).<sup>2</sup> The continued profitability of the fossil industry sustains business models that have proven resilient against activist, political, and even shareholder pressure to adapt to climate protection (Verbruggen 2022). Indeed, energy companies lobby governments to stall or prevent climate regulation (McCarthy 2019; Brulle 2018; Brulle, Aronczyk, and Carmichael 2020; Stoddard et al. 2021). Moreover, they devise corporate strategies to insulate themselves from pressures to decarbonize (Newell and Paterson 1998; Wright and Nyberg 2015). The fossil industry participates in transnational climate negotiations to delay or prevent climate action (Boon 2019), as exemplified by the omission of fossil fuel phase-out from the Paris Agreement (Piggot et al. 2018). This instrumental use of power (Hacker and Pierson 2010; Young and Pagliari 2017) is complemented by the structural power (Lindblom 1980; Strange 1996) of fossil-intensive industries – at both the national and subnational levels. In climate change and environmental governance scholarship, we find examples of structural power – even if the concept itself is not often invoked directly (Gerlak et

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2 For a good overview of the IPE of climate change, see Paterson and P-Laberge (2018) and Paterson (2021).

al. 2020, 67–70). Authors have focused on the threat of exit power around tax regulation (Babic et al. 2022, 143–46), on how the network effects of a “regime” of energy companies constrain government policy (Lockwood, Mitchell, and Hoggett 2019), and on how control over investable resources structures state-business relations, especially in a North-South perspective (Dafe 2019; Oppong, Patey, and Soares de Oliveira 2020). In many global energy industries, the state-market dichotomy at the core of structural power arguments breaks down entirely, as a large share of assets are direct or indirect public property. Such entanglements create even more direct motives for policymakers to preserve sources of profit (Jaffe 2020). While there have been initiatives among rich countries’ central banks to stimulate and supervise the incremental divestment of financial markets from carbon-intensive assets, deep decarbonization has increasingly come to be understood as a wellspring of systemic risks (Battiston, Dafermos, and Monasterolo 2021; Semieniuk et al. 2021). As is well-established in research on financial market policy since the 1980s, systemic risks can be a major origin of structural power, as regulators hesitate to force large-scale losses on firms perceived as critical conduits (Chwioroth and Walter 2019; Özgöde 2022).

Both the noisy and the quiet varieties of political economic resilience make transition policies aimed at price-shifting difficult to implement. To effect deep decarbonization, governments and regulators would have to devise policies that alter relative prices to degrees that credibly render some of the world’s most profitable industries economically unviable. From an industrial policy perspective, decarbonization therefore cannot be understood as an automatic reaction to innovation and price manipulation (cf. Allan, Lewis, and Oatley 2021). Although the massive reduction in the cost of renewables that has been achieved over the last decades goes an important part of the way to rendering decarbonization politically and economically viable, concentrated losses in specific regions and industries continue to threaten ambitious policies (Crowley 2017; 2021; Stokes 2020). The burden of adjustment is a question of distribution between sectors, between regions, and between present and future (Colgan, Green, and Hale 2021).

Historically, the role of industrial or “structural” policy in advanced economies has largely been to manage exactly this type of restructuring transformation. Across the OECD, the decline of sunset industries such as textiles since the 1950s or shipbuilding since the 1960s required large-scale reallocation between industries and regions (Uriu 1996; Warloutzet 2019; Moraitis 2020). Such transitions were costly and met significant resistance, even when the moribund state of certain industries was clear to most relevant societal groups (Zysman 1994, 11–14). The successes and failures surrounding sunset industries have arguably spawned a research field on the domestic political economy of economic restructuring and globalization (Katzenstein 1985; Evans 1995; Strange 1996; Hall and Soskice 2001).

Concerns about the climate change-related phasing-out of industries have risen markedly in recent years – particularly after the Paris Agreement of 2015. In rich Western nations this is especially true for clusters related to coal mining, processing, and use.

There are transnational as well as national aspects to debates about the organized winding down of coal power generation. In the realm of transnational climate change governance, a major concern is how to compensate poorer and medium-income nations for forgoing the developmental potential of continued (if not expanded) fossil fuel usage and how to rewire exporting nations' growth models (Edwards 2019). Within nations, a major problem is that climate policy-related losses are heavily concentrated in specific regions and industries (Jakob et al. 2020). In political economy terms, both problems imply major – quiet and noisy – roadblocks to ambitious climate policies, as they threaten clearly defined interests, whole socioeconomic orders, and sources of prosperity and profit. Put differently, in contrast to the industrial policy problems related to sunset industries, climate-harming industries exist in a curious split. While environmental policies demand the imminent phase-out of climate-harming industries and develop roadmaps to script the ultimate economic death of those industries, a range of important actors tie their economic livelihoods and futures to them.

How do states navigate the countervailing pressures around decarbonization and enable green transitions in political economy terms? Scholarship on the political economy of climate change offers two major accounts that in our view are only parts of the puzzle as to how states intervene in greening fossil economies. On the one hand, industrial policy scholars have described the state's role in getting green industries off the ground (Allan, Lewis, and Oatley 2021; Finnegan 2022; Nahm and Meckling 2022). The basic assumption is that “winning coalitions” of capital owners, social movements, workers, and political actors will form around growing green industries, which will then increasingly marginalize fossil interest blocs (Meckling et al. 2015). Through the logic of positive policy feedback (Béland, Campbell, and Weaver 2022), green growth would subsequently buy political room for maneuver to scale down polluting industries.

On the other hand, Daniela Gabor (2020) has argued that states are captured in macro-financial arrangements that force them to create attractive assets in the green economy. Shadowing her earlier work on the structural dominance of financial interests in development policy, Gabor (2023) argues that the “small green state” primarily de-risks investments to create profitable business assets for large financial pools. Critical macro-finance places the locus of state action at the level of macro-financial institutions seeking to carve pathways for money and credit to flow in strategic directions. Under extant macro-financial arrangements, the primacy of de-risking is concentrating transition benefits among transnational asset owners and implies that societies will tend to “over-pay” for climate protection as compared to more heavy-handed programs (Gabor and Braun 2023). Described in this way, the recent expansion of green industrial policies would represent little more than continued financial dominance, expanding into yet another field of state-sponsored rent extraction (Gabor 2023).

While both perspectives of the political economy of green state intervention cover crucial logics, we argue that they miss a range of policies with which states aim to bring about the winding down of fossil-based economic structures. The green industrial

policy literature has rightly pointed out that contemporary states engage in the micro-management of green transitions, but it has theoretically focused on the “creative side” of green creative destruction. And while the macro-financial literature likewise rightly points out how states have begun to take over transition costs on a gigantic scale, it misses the emerging micro-oriented policy repertoires with which states try to bribe targeted firms, groups, regions, and sectors away from fossil pathways.

In contrast to purely market-based approaches to the problem, today’s green states target regions and industries, develop intricate roadmaps for resource and workplace shifts, and try both to establish expertise in the micromanagement of transitions at various levels and craft coalitions in favor of green transitions. Thus, rather than states being “victims of the market” (Strange 1996, 14), climate change policy *does* indeed put them in a more interventionist political economic role. Nevertheless, we caution against characterizing this as a “return” to a situation of full-fledged dirigisme. As the literature on the small green state correctly says, the actual tools used in industrial liquidation are rarely disciplinary. States entice and service transition pathways through a variety of incentives and side-payments.

In the following sections, we exemplify the gradual exhaustion of pure price-shifting solutions to the sunshine problem on the basis of a case study of the European emissions trading scheme. The EU, we posit, is a least-likely place for more micro-oriented climate policies to arise due to its early attempts at market-based solutions for decarbonization and relatively limited capacity to implement transnational industrial policies. These very limitations have now made it a breeding ground for policy experimentation to overcome the sunshine problem.

### **3 Sunshine unwinding and ETS reform**

For a number of years, the EU’s climate policies have increasingly strayed away from a purely price-focused approach and adopted more micro- and meso-oriented policy repertoires. Traditionally, like in other policy fields, the EU’s climate policies consistently aimed for single market-wide harmonization and the primacy of regulatory policy instruments. The crucial instrument with which the EU bureaucracy sought to harmonize green energy transition efforts across the continent was the European ETS – a cap-and-trade system initiated in 2003 and operational since 2005. This section traces how the economic logic behind the decade-long push for regulatory harmonization through the ETS met the political limitations of the sunshine problem. Over time, the market-based logic of EU climate policies has gradually given way to experiments with industrial policy initiatives in multiple efforts to dissociate European societies from carbon-intensive economic activities.

## The ETS and the regulatory state in European climate policies

The dominance of the regulatory state in EU climate action rests on three pillars: the Commission's long-standing concern about cost efficiency and harmonization in the environmental field, the complex and extensive system of European emissions trading, and the bloc's legacy of rolling back member state interference in the energy sector and beyond. We reconstruct milestones in these three fields in an attempt to understand the path-breaking characteristics of the EU's recent climate policies, which culminated in the European Green Deal.

The European Union has been a key actor in international initiatives to mitigate climate change (Bäckstrand and Elgström 2013). At the same time, bloc-wide policies to meet international commitments seemed for many years to fail. The European Commission had been pushing for a centralized European carbon tax since the early 1990s (called an "energy tax" in 1997). Besides the goals of expanding the EU's reach in environmental and fiscal terms, the early proposals for a carbon tax were motivated by the idea of establishing "efficient" and "coherent" instruments to combat climate change (van Eijndthoven 2011). Historiographies of the 1990s' push for European carbon taxes share the assessment that the proposal failed in the European Council due to heavy business lobbying against fiscal autonomy being granted to the Commission and similar reservations among member states (Newell and Paterson 1998; Skjaerseth 1994). Notwithstanding the defeat of tax-based proposals, the concerns about efficiency and harmonization strongly shaped future policy rounds in the field.

The major follow-up project to the European carbon tax was the European system for emissions trading. Since its initiation in 2005, the European ETS has grown into the global front-runner experiment with cap-and-trade to combat climate change, and it remains the world's largest artificial market for trading environmental damages. In 2021, the ETS volume reached almost 11 billion emissions allowances (EUAs, representing the imaginary "right" to emit a ton of CO<sub>2</sub>), which traded at an average spot market price of around 40 euros (Marcu et al. 2022). As an evolving policy, the ETS has been devised in four "phases," through which the EU has tried to expand, adjust, and reorient the regime over time. We discuss the major policy moves in each of the phases to make the case that the regime moved from failed attempts at pure regulatory price-shifting towards a creative repurposing of existing institutions for industrial dissociation policies.

Phase 1 of the ETS, from 2005 to 2007, has been called the trial or experimental phase. The ETS was the first major EU-led intervention in European energy systems after the coordinated deregulation of the electricity and gas sectors that began in 1996. A crucial starting point for understanding the spirit of the ETS as an energy policy is the liberalization process. Indeed, liberalization and emerging centralized emissions allocation have been discussed as the major successive landmarks of European state-building in the energy domain (Jegen and Mérand 2014).

Still in the 1990s, energy generation and distribution were among the major fields of state intervention and non-market coordination in the EU's member countries. National and regional monopolies, extensive state ownership, deeply interwoven cross-ownership across the sector, and routine interest-group bargaining were the norm across much of the continent (Matlár 1997). Historical accounts of energy market liberalization have usually portrayed it as the result of member state bargaining – particularly between France, Germany, and Great Britain (Matlár 1997; McGowan 1993). As illustrated by Eising and Jabko (2001), EU electricity market liberalization was embedded in a larger normative shift across the continent, which redefined common notions of good governance towards transnational market organization. This has not ruled out attempts by member states and dominant firms to use deregulatory tools as a basis for hidden industrial policy measures, particularly through national champion policies and forms of pseudo-privatization with continued state influence (Bulfone 2019). Notwithstanding such “hidden” deviations, public utility notions of energy provision, as well as the plethora of traditional member state interventions in the sector, were redefined as “barriers” to a single market for energy enabled by transnational regulatory frameworks. As in other domains, European state-building in the energy sector had a dominant “negative” tilt (Scharpf 1995), in that it consisted in the institutionalization of regulatory powers with the explicit purpose of *rolling back* member state interference in energy.

This tilt has also influenced the EU's policy styles in the climate arena. The bloc's translation of international climate accords into EU directives (such as the Kyoto 2020 goals into 2001/77/EG) expressly left space for member states to implement their own instruments in pursuit of decarbonizing the energy sector. The Commission nevertheless tried for years to roll back subsidy schemes for renewable energy sources in favor of a harmonized reliance on the ETS (Leiren and Reimer 2018). Complementing the spirit of the 1990s' plans for the institutionalization of a single market for energy, selective benefits for renewable sources were routinely framed as “distortions” (Gawel and Strunz 2014; Lehmann and Gawel 2014). To take the influential case of German feed-in tariffs for renewables, the European Commission at multiple points tried to challenge the system as illegal state aid. Often supported by German domestic interests seeking to limit targeted support for the alternative energy sources (Jacobsson and Lauber 2006), attempts to strike down the 1990 *Stromeinspeisungsgesetz* and its 2000 successor, the *Erneuerbare Energien Gesetz* (EEG), began as early as 1996 (Vogelpohl et al. 2017). These early attempts to bring down decarbonization policies in the name of the single market subsided after a 2001 European Court of Justice (ECJ) judgment in favor of the proponents of the schemes. However, the ECJ judgment was predicated on the fact that German subsidies were designed “outside” of the state budget – formally, they forced renewable surcharges onto electricity consumers, rather than working through public funds. While there has been some accommodation with regard to member state greening schemes after the ECJ decision, DG Competition and DG Energy continued to put pressure on them to limit “distortions” (good insight into the spirit of these interventions can be found in the 2014 Commission state aid guidelines for green energy sup-

port, 2014/C 200/01). When a series of reforms made the German scheme sufficiently different to allow for renewed state aid scrutiny, a further attempt to challenge the law was arguably only avoided by the German government preemptively downsizing and transforming it into an auction system (Leiren and Reimer 2018).

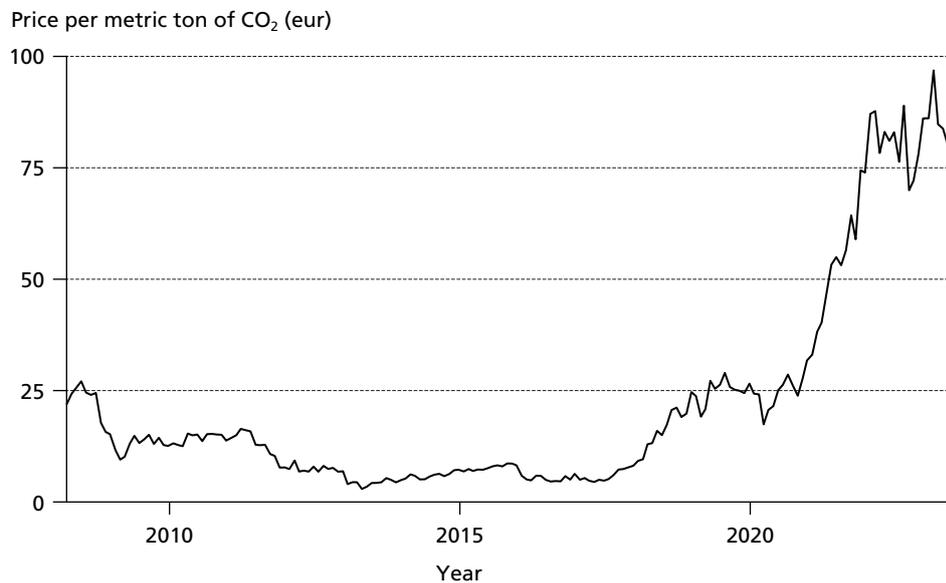
As a “single market-compatible” countermodel to national greening policies, the ETS was meant to achieve compliance with transnational greenhouse gas reduction commitments by raising the cost of carbon throughout the Union. While the ETS would in theory bring carbon shock therapy to the Union’s economy, phases 1 and 2 of the regime have been kept decidedly leaky. The ETS has traditionally excluded important sectors such as aviation, it issued extensive free emission allowances based on historical levels of pollution (and hence historical levels of technology), and it has for a long time been very slow in making good on the “cap aspect” of cap-and-trade systems (Skjaereth and Wettestad 2016). At times, the “economic growth-compatible” implementation of the ETS has been decried as a form of hidden industrial policy, particularly for energy-intensive sectors. Emissions rights that were overallocated during phase 2 of the system after 2008 have not been revoked and have remained redeemable and tradeable. By some estimates, the over-allocation to industry between 2008 and 2020 amounted to around 1.1 billion EUAs, representing a potential net transfer of up to around 90 billion euros at current ETS prices (Pellerin-Carlin et al. 2022).

To summarize, European state-building in the energy arena was based on the paradigm of single market-enabling regulatory harmonization and above all on the idea of centrally orchestrated price-shifting. Vertical policy measures, such as public ownership, sectoral subsidization, regional policies, and sectoral targeting, were reclassified as obstacles to a functioning single market as well as to a cost-effective climate policy. However, already in its early phases, the ETS as a harmonized policy prism had political difficulties evolving into an effective instrument of climate change mitigation.

### ETS reform and the European rediscovery of vertical policies

Particularly in the years after the Global Financial Crisis and the Eurozone Crisis, the ETS slid into a deep crisis. Initial over-allocation paired with the massive decrease in demand for emission allowances due to the recession led to a collapse in prices for EUAs (see Figure 1). Observers pronounced the ETS dead when a Commission proposal to reduce the number of certificates in circulation failed to pass the European Parliament in early 2013, not even reaching the Council for deliberation (Wettestad 2014). At its lowest level, the price of emission certificates had hit 2.50 euros. It was arguably this state of blocked reform, coupled with a changing geoeconomic environment, that gradually gave way to more interventionist transition policy repertoires – European-orchestrated industrial policies aimed at the restructuring of specific regions and economic sectors.

Figure 1 European Union Emissions Trading System spot prices



Source: International Carbon Action Partnership (2023).

Ongoing negotiations between the European institutions and member states brought minimal reform of the system in late 2013 with the previously rejected “backloading” (a postponement of further certificate auctioning). The Commission launched a two-year negotiation process for meaningful ETS reform in January 2014 (Fitch-Roy, Fairbrass, and Benson 2020; Jevnaker and Wettestad 2017). The core provision for the revival of the ETS consisted of the introduction of a *market stability reserve* that would stabilize prices within a certain corridor, beginning in 2020. This process, which was partially successful, resulted in the 2015 ETS reform, which stabilized the system at slightly higher prices. Besides the mobilization of business support for the survival of centralized emissions trading in Europe (Fitch-Roy, Fairbrass, and Benson 2020), the 2015 reform for the first time included significant instances of side-payments for the structural losers of ratcheted-up carbon prices. Eastern European low-income member states received additional allowances for electricity generators, as well as a provision called solidarity allowances, which shielded an amount of certificates from the Market Stability Reserve.

During the 2015 negotiations, the European Parliament brought up a different type of side-payment that had not been included in the original ETS: the European Innovation Fund. The ETS since 2010 included a small program called NER 300, which repurposed a minor share of the revenues from auctioned-off certificates to fund demonstration projects for low-carbon technologies. During two selection stages, NER 300 funded thirty-nine projects with a total of 2.1 billion euros (Marcantonini et al. 2017). The Innovation Fund was meant to significantly scale up this model, by providing greater funding and by propagating the use of more diverse financing instruments. It signified a spirit that deviated from the price-shifting vision underlying the single European price for carbon.

In the latter, increased costs for carbon would – through market-led adjustment – induce low-carbon innovation and the reallocation of resources. In the realm of the European Innovation Fund, European institutions would (directly or indirectly) fund green industrial activities in member states. We argue that this rediscovery of industrial policies in pragmatic attempts to overcome the sunshine problem by extending regulatory climate instruments has been an essential component of ETS reform since 2015.

The Commission touted proposals for a further tightening of the ETS after 2015 and started to actively promote the Innovation Fund with a focus on industrial transition (450 million certificates) and a Modernisation Fund focused on regional restructuring away from coal (310 million certificates). In a two-year conflict over the reform, policymakers made significant concessions to struggling business interests and member states to achieve a level of planned tightening compatible with the 2015 Paris Agreement (Wettestad and Jevnaker 2019). Eastern European states – chief among them Poland – kept in place the free allowances granted in previous policy rounds.

At the same time, the Innovation Fund and the Modernisation Fund were institutionalized with the envisioned size. The final implementation of both funds was subject to intense political negotiation. Debate about the Modernisation Fund, targeted at poorer Eastern European member states, centered on the question of to what extent funds would be allowed to be spent on coal power plants and gas generators. The final agreement contained language limiting the fund's purpose to the modernization of energy systems and precluding primary generators burning fossil fuels (Wettestad and Jevnaker 2019). The structure of the Innovation Fund was subject to broad consultations with business sectors and other societal groups. The summary report hinted at the overarching logic of European vertical policies: given the task at hand and the limited budget, businesses pleaded for the inclusion of financial instruments to “leverage the overall funds available in the Innovation Fund allowing them to ‘go further’” (Climate Strategy & Partners 2017).

Importantly, both the Innovation and the Modernisation Fund did not just represent rule-based reallocations of ETS revenues to member state governments but also forced interested states into a micro- and meso-planning logic if they wanted to receive transfers. Both instruments disbursed funds based on centralized project evaluations. They both forced member states to monitor the implementation of investments and – in the case of the Modernisation Fund – to submit annual reports to the Commission. Innovation Fund projects were tendered, evaluated, and managed by the European Climate Infrastructure and Environment Executive Agency, while the European Investment Bank and member states were meant to encourage and assist applicants with proposal development (European Commission 2022). Modernisation Fund project proposals were evaluated by a newly founded Investment Committee, composed of representatives of member states and of European institutions (Investment Committee of the Modernisation Fund 2020). Financial incentives for member states, regions, and firms to develop project-based planning for decarbonization has been complemented in recent years

by direct Commission planning aid for states having difficulties developing successful projects. The ETS funds' logic of inducing and aiding member states to plan decarbonization "on the ground" has recently been expanded in the context of the "Just Transition Mechanism." The EU has been repurposing institutions that were put in place in the eurozone crisis to police structural reform plans to co-develop regional transition plans in coal-intensive regions in Slovakia, Greece, and Romania since 2018.<sup>3</sup> These restructuring planning activities include consultation with businesses and stakeholders and the development of retraining plans and plans for economic and industrial development. In a bid to expand on the logic of financially induced indicative planning, the Commission made cohesion policy payouts from the Just Transition Fund contingent on member states' Territorial Just Transition Plans.

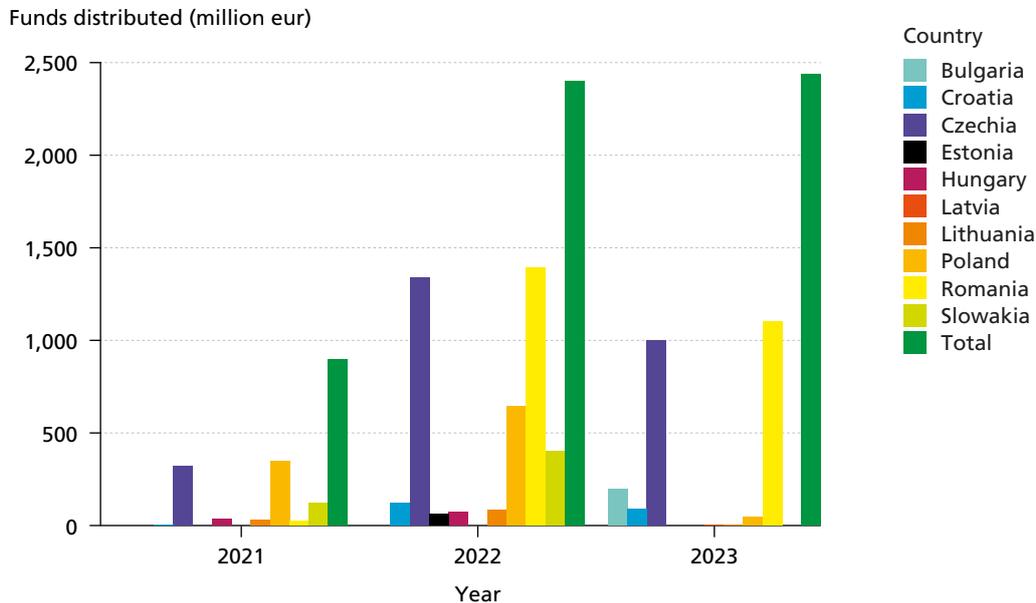
To return to what we call the sunshine problem, these induced restructuring policies concern working socioeconomic systems. Notwithstanding common economic restructuring pressures on heavy industry and mining centers across the OECD, transition planning concerns the winding down of economically operational structures. To be clear, re-emerging state planning capacities in the service of green restructuring must still be seen against the backdrop of the European Union being an exceptionally weak state (Kelemen and McNamara 2022), with very limited knowledge and personnel resources for industrial planning. That notwithstanding, financial inducements and project-based allocation and monitoring do go beyond the merely regulatory, market-based model of governance typical for earlier years of the ETS. From a political economy perspective, co-financing and project-based policy tools are part of an increasingly prominent breed of hybrids – signifying increasing interventionist ambitions on the one hand and limited options to influence business conduct on the other. The types of instruments flourishing in the EU may indicate the broader point that post-neoliberal state intervention does not imply a return to pre-neoliberal policy styles. In historical institutionalist fashion (Mahoney and Thelen 2012), what we observe is a repurposing of institutional remnants, ideas, and policy styles for new problems.

The Innovation Fund and the Modernisation Fund have massively expanded in size and sophistication since their installation. The Innovation Fund's net assets grew from 1.33 billion euros (50 million allowances) at the end of 2020 to 4.14 billion euros (40 million allowances) by the end of 2021 and 5.43 billion euros (15 million allowances) by mid-2022 (European Commission 2022). Recent Commission proposals aim to endow the Innovation Fund with 43 billion euros by 2030 (European Commission 2023b, 3). The Modernisation Fund has seen a similarly rapid growth. Revenue from earmarked

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3 For details of the provisions in the respective countries, see: [https://reform-support.ec.europa.eu/what-we-do/green-transition/supporting-just-climate-transition-slovakia\\_en](https://reform-support.ec.europa.eu/what-we-do/green-transition/supporting-just-climate-transition-slovakia_en); [https://reform-support.ec.europa.eu/what-we-do/green-transition/preparing-managed-transition-coal-dependent-regions-western-macedonia\\_en](https://reform-support.ec.europa.eu/what-we-do/green-transition/preparing-managed-transition-coal-dependent-regions-western-macedonia_en); and [https://reform-support.ec.europa.eu/what-we-do/green-transition/strategy-economic-and-social-development-jiu-valley-coal-region-transition-romania\\_en](https://reform-support.ec.europa.eu/what-we-do/green-transition/strategy-economic-and-social-development-jiu-valley-coal-region-transition-romania_en).

Figure 2 Modernisation Fund disbursement per country



Source: Modernisation Fund Annual Reports. 2023 figures are for the June cut-off published on [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_3126](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3126).

allowances has grown from 3.75 billion euros in 2021 to 5.44 billion euros in 2022 and has a planned volume of 60 billion euros up to 2030 (European Commission 2023b, 3; Modernisation Fund Investment Committee 2022; 2023). By 2024, Modernisation Fund eligibility will be expanded to include Portugal, Greece, and Slovenia. Most recent Commission comments on the Modernisation Fund emphasize European ambitions to expand assistance to member states to develop eligible projects.

Like with many recent centrally administered transfer programs, absorption of the Modernisation Fund has been lacking. Based on the Fund Committee's annual reports, roughly a third of available revenue was absorbed into member state projects in 2021 and 2022, with gravely unequal capabilities between states to develop successful projects. Figure 2 gives an overview of reported disbursements to recipient states since 2021.

Shadowing what scholars have called the European Investment State (Mertens and Thiemann 2017), these massive expansions of centrally administered, project-based greening transfers are planned to be complemented with further "green transition-enabling" cohesion policy instruments. As suggested in a recent Commission proposal, a Social Climate Fund would be endowed with 86 billion euros for member states to organize assistance to vulnerable households in green transitions and 110 billion euros of general European cohesion policy funds would be tied to yet-unspecified green conditionalities (European Commission 2023b).

In addition to such centralized sources of transfers towards transition policies, the EU has begun to revise its traditionally market-oriented state aid regime towards green restructuring. There has been a general loosening of the regime in recent years, signaling an incrementally more permissible stance towards managing vertical policies (Verschuur and Sbrolli 2020). After the invasion of Ukraine, the European Union substantially eased member state intervention in energy supply restructuring through what it called the Temporary Crisis Framework. The block exemptions from state aid policing that were designed to allow states to govern dissociation from Russian gas were repurposed in 2022 for greening. States were able to intervene much deeper in domestic industries through direct grants, loans, and other advantages if their interventions served a variety of greening purposes, ranging from the decarbonization of production processes and the production of green technologies to investments in energy efficiency. Again, the EU made these industrial policy capabilities partially conditional on project-based state planning, including benchmarks for greening schemes and specific technological features (European Commission 2023a). In a latest move, the Commission has nudged member states towards more active industrial policies by increasing the share they can take up to subsidize green technology production to up to 60 percent of total investments (European Commission 2023c). The thresholds for state co-financing are stacked by firm size as well as by regional features, persuading developmental coalitions to locate new production facilities in challenged and relatively backward regions.

The logic of the vertical policies the EU developed in the context of the ETS has been the basis of a series of follow-up policies that massively extended the reach of the approach to climate change policy. InvestEU – the follow-up program to the Juncker Plan – provides budget guarantees for investments that are deemed strategic, while the European Investment Bank is shaping up to become the EU's climate bank (Mertens and Thiemann 2017). These investment-based instruments have been complemented with programs for technical transition assistance and strategic technology platforms. More recently, the EU Commission has also signaled its willingness to support national schemes to further support green transitions (Oberthür and Von Homeyer 2023). In the face of rising energy costs after Russia's invasion of Ukraine, Germany has announced a 50 billion euro scheme to de-risk investments for decarbonization to “give companies the investment security they now need,” in the words of economy minister Habeck (Amelang 2023). While less overt expressions of these schemes have previously been defeated at the EU level, their manifestation now illustrates how far the European Union has deviated from the early ETS days.

To summarize, after years of focus on regulatory state action, the EU has institutionalized a series of measures that aim to restructure economic sectors and specific regions in the name of climate change mitigation. In line with classic literatures on industrial policy, states can create the acceptance conditions for individuals, firms, and regions to exit from sunshine sectors. The EU's Green Deal policies in recent years can be understood as pragmatic attempts to ensure the acceptance of climate change-related restructuring. All of this happens under conditions of the bloc's uniquely weak state capacities

for vertical industrial policies and hence often takes the form of project-based inducements to develop decentral planning capacities. Moreover, recent research suggests that even under conditions of an emerging recognition of managed decline, a vast gap between supply of funds and actual need for transition assistance remains (Rodríguez-Pose and Bartalucci 2023).

#### 4 Conclusion

With this paper, we have aimed to contribute to the political economy of climate change by viewing it as an industrial policy problem. Contrary to previous episodes of industrial restructuring that dealt with declining sunset industries, contemporary states are now challenged to wind down fully viable and at times highly profitable lines of business – a situation we call the sunshine problem. With the sunshine problem, we add to the broader observation that redistributive conflicts – rather than common pool problems – are the core driver of climate change politics (Aklin and Mildenerger 2020; Colgan, Green, and Hale 2021; Nahm and Meckling 2022). More specifically, we call for the role of industrial decline and deindustrialization to be brought back into the much-discussed return of industrial policy (Aiginger and Rodrik 2020; Chang and Andreoni 2020). To begin the creative destruction that is necessary to go from pollution-intensive to low-polluting economies, it is crucial to understand the state's ability to manipulate market dynamics, shift resources, and (dis)incentivize forms of economic activity. To build a green economy, we submit, the state has not just to become “entrepreneurial” (Mazzucato 2013) but must also deploy its liquidating power to entice industries, sectors, workers, and countries to forfeit economically viable polluting industries.

Our analysis complements the emerging literature on green industrial policy, which has mainly focused on feedback loops connected to coalition-building (Meckling et al. 2015). Subsidy programs such as the US Inflation Reduction Act and the EU Green Deal Industrial Plan are examples of how the academic consensus on the green transition has trickled down to policymakers. But while carrots may be politically more appealing than sticks, we caution against underestimating the political costs attached to liquidating economically viable structures that thrive on carbon emissions, especially given the pace necessary for any realistic 1.5°C scenario. Taking a step back, we have seen that the idea of political economies “following the money” has indeed underpinned the recent proliferation of proposals to tackle the climate crisis through technical interventions in financial markets – such as the greening of central banking policies, the European sustainable finance strategy, or the COP21 financial strategy negotiations.

Our paper challenges this view by arguing that stable political support for green transition frameworks is contingent not only on the growth of green industries but also on the managed decline of polluting industries. It suggests that current green transition

frameworks – such as public de-risking and financial underwriting – may be bound to remain politically fragile – especially as a vast gap remains between regions facing climate-related deindustrialization and their eligibility for the EU’s just transition funds (Rogríguez-Pose and Bartalucci 2023, 8–10). Therefore, we reiterate that the death of sunshine industries is not only economic but also political. If prior episodes of industrial restructuring are anything to go by, the promise of growth in sunrise sectors alone cannot address the fallout from sunshine unwinding. Some observers have suggested that – complementary to green industrial policy – limiting the access of critical actors to the policymaking process may open pathways to overcoming carbon lock-in (Finnegan 2022; Nahm and Meckling 2022). We argue that for politically workable green transitions, the problem of sunshine unwinding and the need to deeply restructure industries, sectors, and growth models should be put on an equal footing with the state’s capacity to support green industries.

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