

Research Articles

Green Industrial Policy and the Global Transformation of Climate Politics

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Abstract

The rise of green industrial policy has injected purpose and competition into global environmental politics. Efforts to build green industry have raised the economic and geopolitical stakes of environmental issues as states seek to position their firms in global value chains and reshore strategic industries. This could help to generate the technologies and political momentum needed to accelerate global decarbonization. At the same time, these green interventions confront status quo interests and a variety of industrial policies that support fossil fuel-based industries. To help make sense of this new landscape, this introduction to the special issue defines green industrial policy and situates it within domestic political economy, social policy, and global geopolitics. We present six new studies that demonstrate and explore the global politics of green industrial policy. To illustrate the kinds of effects and implications of green industrial policy we are interested in exploring, we show how green industrial policy has transformed climate politics. Changes in state practice, ideas about the environment and economy, and technological cost declines came together to produce a new opportunistic and competitive climate politics. We then identify areas for further investigation as we call for a new climate politics research agenda, integrating green industrial policy more intentionally into studies of global environmental politics.

In November 2020, Boris Johnson announced £ 12 billion in spending to initiate a “green industrial revolution in Britain” (Parker et al. 2020). It was a striking image: a Conservative prime minister in a famously economically liberal country announcing a significant state intervention. The sheen on this image was perhaps dimmed by the clear need for stimulus in the midst of the COVID-19 crisis. All the same, the move demonstrated the realignment of political forces in the United Kingdom and elsewhere. By 2020, green industrial policy had already made the United Kingdom a leader in cutting power emissions. From 2010 to 2020, no country reduced its carbon intensity more than the United Kingdom, in large part due to a 2013 offshore wind industrial strategy spearheaded by Conservative

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ministers and MPs in the Cameron government (HM Government 2013; Thomas 2020). Moreover, Johnson's Brexit campaign was premised upon the nationalist populist imperative to demonize immigrants and the promise to defend the domestic economy from Europe. This was, as Hopkin (2017) suggests, a political masterstroke: Conservatives promised to defend the country from Europeanization wrought by Thatcherite neoliberalism. The quality of that move notwithstanding, the implication was clear: this wasn't Thatcher's party, or country, anymore.

Even in 2013, the United Kingdom was already late to the party. Embedded within Obama's post-2008 stimulus package was a US\$ 90 billion "green new deal" that included US\$ 25 billion for green energy. And during the prior two decades, Chinese green industrial policy had restructured the global markets for solar and wind, driving down costs and pushing out competitors (Hopkins and Li 2016; Lewis 2013). This has led to policy responses to build and protect green industry so that Europe and the United States can create value chains that do not depend on China.

The new president of the European Commission Ursula von der Leyen has launched the Green Deal for Europe, which increases spending and seeks to implement a carbon border tax (Bloomberg 2020). During his 2020 US presidential campaign, then-candidate Biden outlined a year 1 legislative agenda on climate change that includes record investments in energy and climate research and innovation as well as clean and resilient infrastructure and communities (Biden for President 2020). In summer 2020, South Korea announced a "green new deal" with US\$ 60 billion in support for the domestic hydrogen market, green infrastructure, and advanced technological research (Thurbon et al. 2020). And in Australia, the Department of Industry has released a Technology Investment Roadmap that seeks to position the country as a global leader in low-emission technology (Australian Government 2020).

This special issue explores how these green industrial policies—intentional efforts to build specific industries in the green economy—interact with the political economy of technological change, social policy, broader geopolitical trends, and climate politics. First, green industrial policy has important effects on domestic and international political economy by driving technological change. Technological change alters the costs and benefits of various pathways and shapes the balance of political power among industries (Kelsey, this issue). This illustrates the importance of countries developing the right mix of policy measures to support renewable energy (Lewis, this issue).

However, as we see in two contributions to this special issue (Gao et al. Nahm and Urpelainen), the costs of technology alone do not determine the pace of change. State power, political interests, and patterns of elite investment play a key role in setting the form and pace of the energy transition. Countries may continue to invest in fossil fuels when they are no longer cost-competitive with alternatives because elites can continue to harvest political and financial benefits from fossil fuels.

These political-economic dimensions of the energy transition have distributive implications that link industrial policy to social policy. As promoters of “green new deal” thinking have argued, green industrial policy could be a means to reduce economic inequality (Aronoff et al. 2019; Murphy 2019). In this vein, green industrial policies have been associated with the creation of good jobs and the realignment of power between labor and global capital.

Geopolitically, green industrial policies promise to reposition states in global value chains and reconfigure the landscape of power. By building domestic industries, countries seek autonomy and growth in the context of competitive interdependence (Farrell and Newman 2019; Sbragia 2010). Efforts to reconfigure global networks of trade, investment, and production will also have important effects on the international institutional order.

Furthermore, green industrial policy poses unique challenges for a globalized world due to the tensions between the political economy of domestic renewable energy support and the principles of the liberal trade regime, with direct implications for nations’ abilities to transition to low-carbon economies (Lewis 2014). For governments to garner political support for renewable energy technologies, they must promise job creation and domestic technological progress, both of which compel direct interventions with international trade flows and may conflict with multiple World Trade Organization (WTO) provisions and domestic trade laws. This also presents complications for global supply chains, which are important to optimize cost declines and widely scale the use of green technologies (Helveston and Nahm 2019).

The collection expands the field of global environmental politics (GEP) by showing the effects and implications of green industrial policy at the national and international levels. This introduction illustrates the kinds of effects and implications we are interested in highlighting by tracing the transformation of global climate politics since 2000. As we suggest in this overview article, the iterative interaction among green industrial policy, policy ideas, and technology costs transformed climate policy practice and political discourse in the run-up to the 2015 Paris Agreement. As a result, climate action is no longer exclusively thought of as a cost to the economy to be captured by pricing carbon. Rather, green industrial policies are motivated by the idea that environmental action can be a means to create strategic industries, jobs, export revenue, and economic growth. This new opportunistic frame for climate action has further effects on international institutions and geopolitics, heightening competition and presenting new challenges for cooperation.

Defining Green Industrial Policy

Green industrial policies include investments, incentives, regulations, and policy supports designed to stimulate and facilitate the development of environmental technologies (Harrison et al. 2017; Rodrik 2014). The distinctive feature of green industrial policies vis-à-vis other environmental actions is the

intent or the goal of the policies rather than the instrument used. It is the intent to restructure and transform the economy into a green economy that distinguishes green industrial policy. This drive for restructuring and transformation is often motivated by domestic economic priorities, the global pressure for competitiveness, and the desire to secure better positions in global production and trade networks.

In the economic literature, green industrial policy is represented as a response to a set of market failures and opportunities. The central problem is that returns to innovation are diffuse and the risks of failure are high (Rodrik 2014). Even when entrepreneurial bets pay off, they produce more benefits to society through spillovers and industry-wide learning than they return to the original investors. In the case of climate change, the problem is even larger, because emissions reductions are an archetypal public good. All this entails that private returns to green technological development are well below their return to society as a whole.

But to really understand green industrial policy, we need to see it not as a functional response to market failures but as a strategic response within a complex global environment. In this frame, states are trying to creatively address problems in their strategic situation. Green industrial policies are economic interventions that serve the goals and purposes of states. In the context of global environmental politics, the promise of green industrial policy is that it can help motivate political action for addressing climate change by reducing abatement costs and generating societal co-benefits (Malhotra and Schmidt 2020).

Any number of instruments might be used to pursue green economic transformation. Direct capital subsidies, research and development (R&D) grants, export credit assistance, local content requirements for manufacturing, tariffs or customs duties, and procurement policies have all been used to create specific industries. Even feed-in tariffs or market-based mechanisms could be interpreted as industrial policies if they were designed in a targeted fashion to push a specific industry (such as the electricity sector) toward environmental goals. Given this, it is difficult to establish tight analytical boundaries around green industrial policy.

Nonetheless, some instruments are more likely to be associated with green industrial policy than more general attempts to reduce emissions or control pollutants. For example, grants and subsidies; support for research, development, and deployment (RD&D); and local content requirements are all more likely to be used to bolster specific targeted industries rather than produce general effects on the economy or environment. Figure 1 shows the number of new fiscal programs providing grants and subsidies and RD&D support specifically for climate goals. The figure reveals a flurry of new measures from the late 1990s through to the 2008 economic crisis, which introduced fiscal pressures that dampened a strong upward trend. Figure 2 plots local content requirements for renewable energy to clearly show their emergence in the 1990s and accumulation over time.

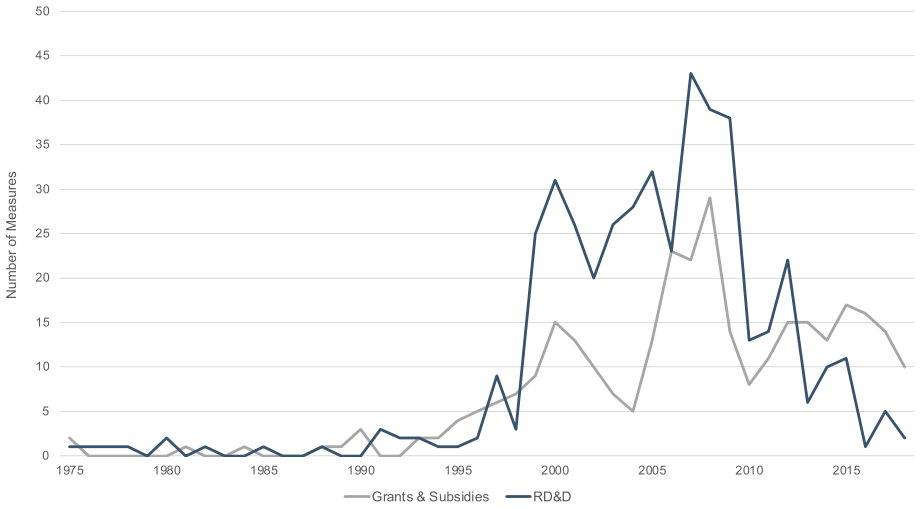


Figure 1
Climate Policy Instruments: Grants and Subsidies and RD&D Support (1975–2018)

Source: NewClimate Institute (2021)

Given the rapid rise of green industrial policies in global environmental politics, we need further work to situate these policies within broader analyses of the political economy of technological change, social policy, and geopolitics. In political economy, we highlight the role of green industrial policy in processes of

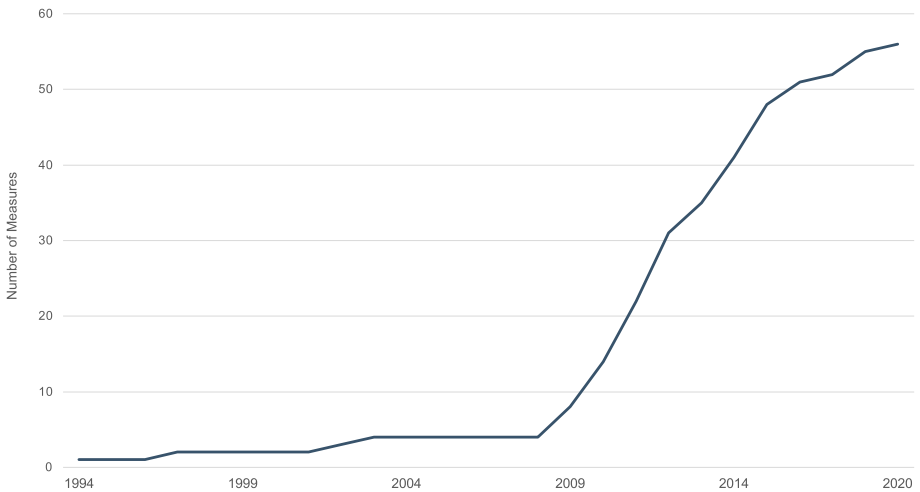


Figure 2
Local Content Requirements for Renewable Energy

Source: Lewis (2021)

technological and political change. In social policy, we outline the potential distributive consequences of green industrial policy. In geopolitics, we show how green industrial policy links environmental issues to the core concerns of power politics to show that power politics has always been about energy and environment.

The Political Economy of Technological Change

This special issue builds on recent research on the political economy of green technological change (Aklin and Urpelainen 2018; Breetz et al. 2018; Geels et al. 2017; Lewis 2013; Meckling and Nahm 2019; Meckling et al. 2015; Nahm 2021; Schmidt and Sewerin 2017). This literature shows the power of green industrial policy to generate new technologies in a complex global economy, illustrated most clearly in the case of China.

China's green industrial policy has resulted in manufacturing expansion and R&D that drove down the costs and increased the deployment of clean energy technologies (Helveston and Nahm 2019; Lewis 2013). By empowering new firms and redistributing regional power in China, the creation of new industries has altered the dynamics of China's energy politics (Lewis 2013; Nahm 2021). This is a key insight of the literature in the political economy of technological change: green industrial policy can break carbon lock-in by broadening the coalition for change (Breetz et al. 2018; Meckling et al. 2015). The implication is that if policy makers sequence policies appropriately, they can increase the ambition of climate policies along the decarbonization path. As Meckling et al. (2015) argue, it makes more sense to start climate action with green industrial policies that build supportive coalitions than it does to start with market-based policies that could create backlash. The flip side of this potential green spiral (Kelsey, this issue) is that decades of industrial policies in support of fossil fuels have created powerful entrenched interests and political coalitions. The result is a competition between fossil and green industrial policies.

Second, China's green industrial policy has had important global effects. It has produced global benefits in the form of cost declines that enable other countries to decarbonize cheaper and faster than they might otherwise have done (Helveston and Nahm 2019). More broadly, China's green industrial policy has helped to build and reconfigure global value chains (Nahm 2021). Green industrial policy unfolds at the complex intersections between domestic and international political economy. Countries pursue industrial policies and trade policies strategically to influence the location of global value chains with the aim of encouraging local manufacturing. While not all countries are well positioned to become competitive exporters of the same green technologies, if industrial policies can help create competitive domestic manufacturers, countries may be able to capture direct domestic economic benefits (Lewis and Wiser 2007). But the realities of the global economy mean that it is difficult for a country to create an industry on its own. Industries depend on

global supply chains as well as international markets for both investment and final demand.

Moreover, these types of policies are often illegal under international trade regimes (Cottier et al. 2009; Kuntze and Moerenhout 2013). Local content requirements in particular create an inefficient application of resources and price inflation and, despite some new job creation in the targeted country, can result in net overall job losses globally. The reduction of world trade due to local content requirements is estimated in one study to be US\$ 93 billion annually (Hufbauer et al. 2013). Indeed, green industrial policy tends to raise concerns over a return to the zero-sum world the liberal trading regime was designed to dismantle.

Ultimately, the political economy of clean energy innovation is about winners and losers, with broad geopolitical implications. Thus a key insight of the literature is that green industrial policies generate complex trade-offs between local and global benefits.

Green Industrial Policy and Social Policy

Because it has important distributive implications, green industrial policy can be linked to social policy. In particular, the rise of green industrial policy has created opportunities for linking major investments in the energy transition to efforts to reduce inequality by strengthening the working and middle classes.

In the United States, for example, the “Green New Deal” has emerged as a means of integrating the broader issues of economic and social injustice with a climate policy. This movement contains many themes similar to those we see in other mobilizations of green industrial policy, including local job creation, direct investments in low-carbon industries and R&D, and the enactment of trade rules “to stop the transfer of jobs and pollution overseas” and “to grow domestic manufacturing in the United States” (Ocasio-Cortez 2019). It explicitly connects these efforts to the task of building domestic industries that will produce benefits for the working and middle classes. The political and policy innovation here was to fold industrial policy into the language and frame of environmental and social justice.

The call for a Green New Deal inspired new thinking and political responses throughout the world. In the United Kingdom, new think tanks like Common Wealth developed the ideas, building out a road map for thinking about the Green New Deal domestically and internationally (Brett et al. 2020; Murphy 2019). The Labour Party picked up this call and made it a component of its 2019 election platform. The call promised to create 1 million green jobs in the United Kingdom in new sectors of the new “industrial revolution,” such as hydrogen and tidal energy (Proctor 2019). The language of the Green New Deal also entered elections in Canada, Europe, Latin America, and Asia. These movements did not always directly link climate action to the creation of new industries. Nonetheless, the spread of the new frame demonstrated that many climate leaders were ready for a new approach that folded climate policy into a broader

political economy framework to motivate strategic state action to build the green economy.

This global movement has legitimated and bolstered green industrial policy by highlighting the need for state interventions to reduce rising global inequality. Furthermore, this alliance between environmental activists and economic actors has broadened the coalition for action in many countries. The key question for the future of green industrial policy is whether its deployment exacerbates or reduces inequality. On one hand, green industrial policy could strengthen the incumbent financial and business interests that are driving increasing inequality. On the other hand, it could be used to disrupt incumbents, redistribute opportunity, reform labor markets, and invest in marginalized communities.

The New Geopolitics of Climate Politics

Since its emergence in the 1960s and 1970s, environmental politics been separated from political economy proper. Treated as a special case, it was considered a “low-politics” issue, like global health or human security, which had emerged on the global governance agenda but was ultimately immaterial to global power politics. Today, however, there is broad recognition among policy makers and scholars alike that climate politics has geopolitical implications. We know that the emerging geopolitics of energy “will be fundamentally different from the conventional map of energy geopolitics that has been dominant for more than one hundred years” (IRENA 2013, 14). Less clear, however, is exactly what this “new geopolitics” will look like.

A growing literature attempts to outline the likely consequences of an energy transition (Vokalchuk et al. 2020). Most studies agree that the transition away from fossil fuels will create winners and losers (see, e.g., IRENA Global Commission 2019; Overland 2019). Recent work conceptualizes winners and losers in terms of the conflicting interests of asset owners with very different exposures to the short-run impact of climate change and decarbonization (Colgan et al. 2021; Oatley and Blyth 2021). Green industrial policy assumes tremendous geopolitical as well as social and environmental significance within this framework.

Green industrial policy is an important instrument in the competition for global primacy in green technology and intellectual property (Scholten 2018). For example, China’s green investments in alternative energies and in electric vehicle and lithium-ion battery technology since 2008 have placed it in the leading position to capture the rents associated with these green technologies. One might suggest that the greatest prize in international politics—global power primacy—goes to the state best positioned to exploit an emerging energy system.

We might also expect the great powers to use their financial capabilities to support alternative energy projects to compete for clients and allies (Lewis 2020; Liu and Urpelainen 2021). China, for instance, currently finances coal, oil, and

natural gas projects in low-income societies with pressing energy needs. As Gao et al. argue in their contribution to this special issue, emerging economies must be intentional about the transition to clean energy because foreign sources of finance threaten to trap them into large new investments in dirty energy.

It is also an open question what effects green geopolitics will have on the current institutional order. We highlighted previously the tension in the liberal trading regime, but green industrial policy also poses challenges to investment treaties and standards regimes (Birkbeck et al. 2020). In a world of competitive and weaponized interdependence, states maintain complex institutions and global regulations but also seek to exploit and shift them (Farrell and Newman 2019; Sbragia 2010). There is a tension here, and it is not yet clear whether naked competition and complex interdependence are compatible in the long run. The pressures for decoupling between the West and China are a case in point (Stein and Whalen 2021).

As in the domestic sphere, green industrial policy will create geopolitical winners and losers. The competitive dynamics unleashed by green geopolitics may be salutary in some ways. If states compete in hard-to-build green industries, they may produce global public goods in the form of cost declines and big domestic green coalitions that will drive further rounds of ambitious policy making. At the same time, this competition could derail the kinds of cooperation most likely to make Paris and other agreements a success.

The Transformation of Global Climate Politics

In this special issue, we present six new articles that explore the politics of industrial policy. The articles cluster around three key themes that emerge from this research in the context of the broader literature and policy debate. The first is the increased role of the state in environmental action, marking a break with the liberal compromise of earlier eras. The second is the centering of technological innovation and technology choices in political strategies for environmental action. The third is the new importance of geopolitical competition in climate politics. It is this folding together of state power, technological change, and geopolitical competition that gives green industrial policy its special purchase in the analysis of global politics.

We frame these themes within a narrative about the transformation of global climate politics that demonstrates the importance of green industrial policy to recent changes in the regime. The shirking and deadlock of the Kyoto era have been replaced by a flurry of spending announcements and net-zero commitments by the major powers. It is too early to tell whether these actions will produce substantial emissions reductions, but climate politics is now marked by concerted action and competition to capture economic value in the transition.

What caused this transformation of climate politics? In a rationalist framework, one could argue that the rapid declines in the cost of wind and solar

between 2010 and 2015 drove a process of political change—as states saw the costs of mitigation decline, they became more willing to take action on climate. But as the literature on technological learning and green industrial policy has shown, these cost declines were in fact driven by national and subnational policies (Hayashi et al. 2018; Schmidt and Sewerin 2017). We therefore suggest that an iterative positive feedback loop developed between green industrial policy, discursive shifts, and technological change that has produced a new opportunistic and competitive climate politics. In short, green industrial policies motivated by state interests spurred processes of policy learning and technology cost declines that in turn made green industrial policies more likely and made clear the geopolitical stakes of the energy transition. This interaction between state action (or inaction), the domestic politics of technology, and geopolitical considerations is essential to understanding the politics of green industrial policy.

The Role of the State

State action or inaction plays a central role in determining the pace of the energy transition. This point is often missed in modeling that centers on the relative costs of renewable and fossil energy. For decades, state action in global environmental policy making was dominated by what Bernstein (2001) called the compromise of liberal environmentalism. Proposed solutions were dominated by market-based policies such as efforts to put a price on pollutants. In global climate politics, this culminated in the Kyoto Protocol and subsequent efforts to build national and regional carbon markets.

Meanwhile, state inaction was structured by the political power of fossil fuels and the popularity of fossil fuel subsidies that made fuel cheap and society dependent on the internal combustion engine (Oatley, this issue). This structure of interests motivated a panoply of industrial policies that entrenched and expanded the role of fossil fuels in the economy.

However, in the 1990s, China initiated a series of green industrial policies that transformed the market for renewable energy technologies. In subsequent decades, the global policy community learned from these and other experiments. In so doing, they argued that state action was needed to invest in infrastructure, drive innovation, and create new industries (Meckling and Allan 2020). In particular, the originators of the “green growth” arguments at the United Nations Economic and Social Commission for Asia and the Pacific drew inspiration from the environmental economic development policies of South Korea and China. When the United Nations Environmental Programme developed the “green economy” framework for its work, it represented South Korea’s and China’s green investments as models for others. In short, discussion of industrial policies helped to change the global policy discourse. The 2008 global economic crisis increased interest in this argument, reinforcing the rise that had begun around 2000. Thus the rise of green growth thinking was in part a reac-

tion to green industrial policy. All of this has inspired further experiments in green industrial policy.

Kelsey's contribution to this issue suggests that even small initial actions by the state might create a positive feedback loop that further alters global policy dynamics. In contrast to earlier work on the ozone negotiations, Kelsey's article focuses on the technological dynamics of the case. Kelsey examines the ozone negotiations to argue that what she calls the "green spiral" was critical to making these negotiations a success. In a green spiral, early negotiations result in initial policy moves that shift the sticky material interests of industries, forcing them to adapt to regulation. Initial adaptations in turn increase the feasibility of more stringent regulation in subsequent negotiating rounds. The article shows that the green spiral explains the overall success of the negotiations as well as the timing and nature of the shifts in negotiating position and regulatory behavior of participating countries. She then uses this analysis to discuss how conceptualizing environmental negotiations as path-dependent processes with feedback between environmental policy and economic interest groups provides a useful lens for understanding the outcomes from climate negotiations and how they might be improved. Thus small regulatory actions can spur broader change.

Despite a potentially positive role, the role of the state in the energy transition is questionable because many states are invested in fossil industry. In this special issue, Nahm and Urpelainen examine the concept of state capacity by looking in depth at interest group opposition to green industrial policies in China's coal power sector. They employ a novel data set of investments in 2,675 Chinese coal power plants to show that public actors at different levels of government have remarkably similar financial holdings in, and thus exposures to, coal plants. Not only do state actors have controlling shares in the majority of nominally private coal plants in China but the majority of such plants have investments from agencies at multiple levels of government. These findings suggest that opposition to green industrial policies might come from within the state itself as state-owned coal plants and government agencies with substantial investments in such enterprises object to and strive to block policies that reduce the value of these assets. The study highlights a predicament for the Chinese state in climate policy: it has set ambitious goals to decarbonize but also has a vested interest in ensuring the profitability of the world's largest coal-fired power generation fleet. Nahm and Urpelainen argue that this implies that we must reconceptualize state capacity to include the ability to overcome internal opposition.

Similarly, Gao et al.'s contribution to this special issue (discussed further later) suggests that the balance of fossil fuel interests in a country determines the rate of coal phaseout. Taken together, the implication of these two contributions is that the contest between green industrial policy and fossil industrial policy, and not the politics of carbon pricing, will set the pace of change in much of Asia and the rest of the middle-income world.

The Politics of Technology Choices

Despite the failures of Kyoto and other climate policy initiatives, by 2010, there had been significant changes in the landscape of climate policy practice and ideas. State action through green industrial policies had initiated the process of technology change, and green growth ideas had reframed the problem. Then, the prices of solar and wind declined precipitously between 2010 and 2015 (IRENA 2021). These cost declines played a contributing role at Paris. They helped to secure the support of the private sector and served as an inspiration for initiatives like Mission Innovation. Announced at Paris, Mission Innovation was a commitment by twenty-one countries, including the United States, China, Brazil, and Germany, to double their investment in clean energy and support the role of the private sector in the transition. It was premised on the need to build on recent clean energy cost declines and deployments (Mission Innovation 2015).

As Schmidt and Sewerin (2017, 1) suggest, “the Paris Agreement might ultimately represent a paradigm shift from cost-minimizing to opportunity-seizing, and thus from a focus on emissions to a focus on technologies.” But the key here is that Paris was not the *cause* of this shift; rather, it reflected changes set in motion by green industrial policy. As such, it reflects the power of green industrial policy to alter the politics of energy and climate at both the domestic and the international levels.

In this special issue, two articles examine the complex politics of technology choice in which green industrial policies intervene. Gao et al. look at the domestic politics of transitioning away from entrenched fossil fuel industries by examining the politics of coal plant construction in Indonesia and Vietnam. Globally, coal is the largest global contributor to heat-trapping carbon dioxide and must be phased out to meet Paris Agreement targets. Most new coal plants are being built in the Asia Pacific region, and an increasing fraction are reliant on finance and construction services provided by government-supported and private-sector banks in China, Japan, and South Korea, with Indonesia and Vietnam the two leading recipients. Recent developments, however, suggest a change in coal politics as Indonesia and Vietnam have canceled projects. Gao et al. find that in Vietnam, which has canceled more capacity than Indonesia, fuel switching and national planning were common reasons for canceling, whereas cancellations in Indonesia reflect a more diverse set of factors. In addition, public opposition appears as more of a cause for cancellation in Vietnam than in Indonesia. These findings suggest that though coal interests remain strong in both countries, Vietnam has moved further toward coal phaseout than Indonesia. They conclude that more rapid coal phaseout in Asia will require coordinated global action and that emerging economies must be intentional about the transition to clean energy because of entrenched fossil fuel interests in the domestic arena, and foreign sources of finance threaten to trap them into large new investments in dirty energy. The complexities of Asian coal politics suggest that though green

industrial strategies have transformative potential, they must compete with fossil interests and the international politics of energy financing.

Lewis examines the evolution of green industrial policy in supporting renewable energy (RE) technologies, particularly as countries have pledged RE targets in the context of the Paris Agreement. The examination of the use of green industrial policies is notably absent from most studies of RE policy design, even as they are being more frequently implemented. Given the trade and economic concerns resulting from the use of industrial policy to support renewable energy, Lewis argues that policy makers and researchers alike should pay closer attention to how RE industries are being supported around the world and continue to engage in global conversations about how best to foster clean energy innovation, rapid technology deployment, and economic development, with a shared vision that does not leave emerging and developing countries behind. Furthermore, given the adverse impacts of industrial policy, she presents alternative strategies to reap local economic benefits from RE deployment.

Geopolitical Competition

The rise of green industrial policy accelerated after 2016 as a number of factors converged. The rise of populism, and especially the election of President Trump, shook the liberal international order. The fallout from decades of cartel politics that neglected rising inequality has empowered populist movements denouncing global elites and markets (Hopkin and Blyth 2019). President Trump challenged the idea of free trade without substantially altering its practice, which opened up political space for other attacks. This general weakening of free-trade norms and the interconnected decline of international institutions' authority have made it possible for states to openly espouse nationalist economic ends. As the French finance minister put it, building a European battery industry was a "matter of sovereignty" (Hall and Milne 2019). Furthermore, rising economic and political tensions with China have led both Europe and the United States to use green industrial policy as a means to reshore value chains and compete with China.

In this special issue, Meckling and Oatley highlight different aspects of the broader geopolitical shifts occurring in climate policy writ large. Meckling argues that as green industrial policy has moved into the center of climate change response, climate policy has become less a classic instance of environmental policy and more a central component of economic and industrial policy. This reconceptualization matters because industrial policy and environmental policy differ in their goals, instruments, and distributional effects. Moreover, this change in approach raises questions about how interactions between industrial and environmental logics in climate policy might affect decarbonization. Meckling takes some initial steps to identify complementary and conflictual dynamics between the two policy logics at the domestic and international levels. Continuing to deepen our understanding of these policy interactions, he concludes, will be central to leveraging the potential of industrial policy to advance environmental goals.

Oatley's article provides a historical frame within which we can understand the long history of global energy geopolitics and the role of the state within it. His contribution focuses on how industrial policies have shaped the coevolution of energy systems and the complexity of international order. He argues how, over time, the complexity of international order ratchets up—the world becomes more populous; it becomes more differentiated socially, economically, and politically and therefore more interdependent. As societies organize many of their activities over a larger geographic area, the amount of energy needed to sustain international order thus also increases. Each turn of the coevolutionary cycle then begins from a baseline of greater complexity. This coevolution has brought us today to the point at which we must find new sources of energy to sustain the most complex international order in human history. The latest tranche of green industrial policies is initiating a new movement in this coevolution with implications for the structure and dynamics of international order. Oatley notes that a key implication of this history is that green industrial policies confront a more complex international order, and therefore face a harder task, than previous industrial policies did in building the fossil fuel-based order.

Toward a New Climate Politics Research Agenda Integrating Green Industrial Policy

The rise of green industrial policy has transformed climate politics. However, the result is a fragmented and uncertain landscape. In the era of Kyoto, the task of global climate policy was politically difficult, but at least everyone could envision the end point: a global system of linked carbon markets that would raise the price of fossil fuels. The folding of political economy, populism, and geopolitics into climate politics makes the end game much harder to envision.

A green competitive race driven by green industrial policy could pull in finance, insurance, and other industries to produce a global decarbonization "lock-in." In this scenario, net-zero commitments from states and corporations generate the cost declines necessary to establish a self-reinforcing green spiral. An alliance of capital and thermodynamics forms, creating a race for green competitiveness that drives down global emissions. Or, in another optimistic scenario, the global rise of green industrial policy generates the domestic coalitions necessary to support the Kyoto-style global carbon market that was impossible decades before.

However, green industrial policies could also fail to generate widespread transformation in the face of incumbent interests and fossil industrial policies. Even if fossil energy were uneconomical, political economy could sustain it for decades. This would set up a protracted contest between low-carbon and high-carbon interests that would unfold as the world warmed (Colgan et al. 2021).

Even in the optimistic scenarios, there is a danger in relying on green industrial policy to drive decarbonization. As Meckling explains in this issue industrial policy and climate policy operate according to distinct logics. Industrial policy

seeks to change the economy, whereas climate policy remains focused on greenhouse gas reductions. It is possible that a green industrial race will produce lots of competition but little decarbonization. How can we ensure that the technological gains translated into complete sectoral coverage with low rates of leakage? In addition, as Lewis argues in this issue the majority of countries pursuing industrial policies are developing countries, placing them at risk of becoming implicated in costly trade disputes. Moreover, competition means that countries will be duplicating efforts. Reshoring supply chains may produce a net cost to the global economy as countries have to replicate the cost declines achieved by competitors. We may not have the time or extra resources for such duplication.

To understand this future—as well as the future of the circular economy, biodiversity politics, and so on—we need further work that seeks to define, operationalize, explain, and understand green industrial policy. There is no authoritative database of green industrial policies—building that, despite the inherent definitional difficulty in deciding on cases, should be the first task. Once we have better data, and more nuanced taxonomies and typologies, scholars should seek to explain why states adopt different green industrial policies in different contexts.

Given the spread of green industrial policy and its importance to the coming energy transition, we need to complement this work with an action-oriented research agenda that analyzes the conditions under which green industrial policies will generate transformations in low-carbon industries. For example, scholars should seek to identify which technologies are amenable to green industrial policy (Malhotra and Schmidt 2020). Another difficult issue is how to situate subnational, national, and supranational jurisdictions in global macroeconomic and technological contexts in such a way as to enable strategic action.

We also need a research program on the interactions between green industrial policy and its interactions with international political economy. As Gao et al. and Nahm and Urpelainen show in this issue, networks of finance and investment are essential to the coming contest between green and fossil industrial policies. Oatley's contribution gives us a sense of the interconnections between the energy regime, the trade and investment regime, production networks, and security, but the mechanisms at each juncture must be better understood.

Moreover, green industrial policy runs the risk of harming welfare through industry or state capture. This suggests the necessity of a research program on the institutional and political-economic foundations of successful green industrial policy. Are the conditions of success for green industrial policy similar to other forms of industrial policy? What institutional designs can structure productive interactions between the public and private sectors? Under what conditions can industrial policies be translated into green spirals instead of competitive duplication? What green industrial policies actually add value to economies and their peoples? How can green industrial policies be harnessed to reduce rather than exacerbate inequality? It is clear from this special issue that a rich research program in the study of green industrial policy is needed.

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