

# Green Industrial Policy: Opportunities and Pitfalls

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## 1. Introduction

The past two decades have witnessed a resurgence of industrial policy—government interventions in the economy to produce outcomes in the national interest that markets would not yield on their own.<sup>1</sup> This has particularly been the case in sectors related to decarbonization, where I refer to such policy interventions as “green industrial policy” for the purposes of this memo. Governments across developing and advanced industrialized economies have used such government interventions to combine climate and economic goals by trying to attract clean technology supply chains, including the manufacturing wind turbines, solar panels, electric vehicles, and energy storage technologies.

Green industrial policies have long been deployed in the European Union and China, economies with statist policymaking traditions that were more amenable to government interventions in the economy to advance policy goals. But green industrial policies have also and increasingly been used in liberal market economies that long advocated laissez-faire approaches to governing the domestic economy. The Inflation Reduction Act (IRA) of 2022, which introduced a range of green industrial policy measures to accelerate the domestic development of clean energy industries in the United States, including by using local content requirements, is one recent example. And the IRA is by no means the first U.S. foray into green industrial policymaking, as it was preceded by decades of tax breaks and regulatory incentives to help domestic clean energy sectors compete with fossil fuels.<sup>2</sup>

In this memo, I review existing literatures on (green) industrial policymaking and state intervention in the economy to make three central points. First, I argue that the political logic of the energy transition makes industries related to decarbonization particularly prone to industrial policy interventions. Governments attempt to build political coalitions behind climate policy by promising new sources of growth and employment because the transition to the net zero economy requires vast public investments and subsidies. Second, I argue that although many industrial policy strategies originate in the policy interventions of late economic developers in East Asia, the challenges governments seek to tackle through green industrial policy go beyond those of late economic development. Third, I make the case that current attempts to use green industrial policies to rapidly shift the sources of growth in domestic economies are likely going to be unsuccessful unless they also build new and different institutions to support new industrial activities, for instance through investments in vocational training and the financial sector. I conclude by outlining avenues for future research on this topic.

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<sup>1</sup> For a definition, see Nahm, “Reimagine: Clean Energy Technology and U.S. Industrial Policy.”

<sup>2</sup> Nahm.

## 2. The political logic of green industrial policy has led governments to overpromise

Over the past three decades, markets for low carbon energy technologies have increased dramatically. According to the International Energy Agency (IEA), global investment in clean energy exceeded USD 1.4 trillion in 2022. Large and growing global spending on renewable energy technologies made up a large fraction of such spending, but investments in grids, storage, and energy efficiency, and, more recently, rapidly accelerating sales of electric vehicles also contributed to growing global markets for low carbon technologies.<sup>3</sup>

At least initially, before rapidly falling cost for some clean energy technologies made them competitive with fossil fuels, growing markets for such technologies were reliant on government support, primarily through subsidies and regulatory incentives. Such measures included premiums paid to generators of wind and solar energy, tax credits for the purchase electric vehicles and investments in energy efficiency, and a range of regulatory mechanisms to encourage utilities and car manufacturers to use and sell a growing share of low carbon technologies. Because of the growth trajectory of clean energy markets and the size of fiscal investments and regulatory measures required to sustain them, few governments were content to merely be consumers of clean energy technologies. Instead, governments hoped that green industrial policies would allow them to build domestic industries that could invent, produce, and ideally export clean energy technologies, in addition to deploying them domestically.<sup>4</sup> In many economies, green industrial policies—including direct subsidies, tax breaks for manufacturers, local content requirements, and R&D funding—were deployed to attract domestic clean energy supply chains.

The link between the use of clean energy technologies and the promise of material benefits in the form of industrial development and domestic manufacturing activities followed a broader political logic. Among government initiatives to promote the reduction of greenhouse gas emissions, green industrial policies that offered the possibility of supporting growth and employment were attractive to policymakers because they allowed for the creation of political coalitions behind renewable energy that extended beyond the core group of environmental advocates.<sup>5</sup> Such political support was particularly important for policies that entailed large public expenditures and threatened the business models of existing fossil fuel-based industries. But the promise of growth and employment also helped justify the additional financial burdens for private citizens from the energy transition, including for consumers of electricity asked to pay surcharges to offset the cost differential between traditional energy sources and higher-priced wind and solar technologies. Hence, policies that pursued the dual objective of achieving emissions reductions while creating new sources of economic activity were easier to implement politically.<sup>6</sup>

The political reasoning behind the use of green industrial policy led to a growing number of state interventions in the economy that sought to support the development of domestic clean energy supply chains, including most recently through the Inflation Reduction Act in the United States. But the use of such policies also created considerable tensions in a global trading system ostensibly built around principles of equal treatment and non-discrimination. The perhaps most contentious measure were local content requirements (LCRs), which, dating back to the early

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<sup>3</sup> International Energy Agency, “World Energy Investment 2022.”

<sup>4</sup> Nahm, *Collaborative Advantage: Forging Green Industries in the New Global Economy*.

<sup>5</sup> Aklin and Mildenerger, “Prisoners of the Wrong Dilemma: Why Distributive Conflict, Not Collective Action, Characterizes the Politics of Climate Change.”

<sup>6</sup> Breetz, Mildenerger, and Stokes, “The Political Logics of Clean Energy Transitions”; Meckling et al., “Winning Coalitions for Climate Policy.”

2000s, were used in economies ranging from Canada to China to make eligibility for domestic subsidies conditional on local production. LCRs led to a number of trade disputes involving a range of different economies. The United States filed complaints against China, Japan and the European Union filed complaints against Canada, and reciprocal complaints were filed between the United States and India.<sup>7</sup> Other interventions, such as the use of domestic subsidies for manufacturing businesses and other types of financial support for domestic firms deemed illegal under WTO rules also caused widespread disputes and led to a series of anti-dumping and countervailing duty measures to level the playing field for domestic producers.<sup>8</sup>

Yet despite government attempts to strategically position domestic economies in clean energy sectors, few countries were able to build fully domestic supply chains for such technologies. Governments were able to help domestic firms enter some segments of global clean energy industries, but most countries remained locked in a division of labor in which major products and components had to be imported from abroad. China in particular came to dominate clean supply chains.<sup>9</sup> China is now a leader in the mass production of the technologies most needed to address the climate crisis by decarbonizing the electricity and transportation sectors. Since joining the World Trade Organization in 2001, China has rapidly grown its global share of solar photovoltaic production, leaping from producing less than 1 percent to more than 60 percent of the world's solar panels. China is one of the world's largest producers of electric cars; it makes over one-third of global wind turbines, and a much larger share of components for wind turbine installations around the world. China is home to over two-thirds of the world's production capacity for lithium-ion batteries needed for electric vehicles and storage.<sup>10</sup> Ultimately, it has been difficult for many governments to deliver on the promise of domestic clean energy supply chains in highly globalized industries in which skills, resources, and industrial capabilities are dispersed across global supply chains.

### **3. Green industrial policy is more than catch-up development**

The Inflation Reduction Act (IRA) is now part of a new wave of state interventions in the economy that seek to improve countries' position in global clean energy supply chains and aim to reduce reliance on China. This corrective comes after a growing discrepancy between government claims that clean energy markets would lead to the growth of domestic clean energy industries and the development of global supply chains in which much manufacturing was located abroad.

Implicit in the IRA is the understanding that building political support behind climate policy requires taking advantage of the economic opportunities presented by the global energy transition.<sup>11</sup> This, in turn, will require new forms of government intervention in the economy that break with Washington's past approach to industrial policy. Historically, the U.S. government has sought to build domestic clean energy sectors primarily by providing public funds for R&D while

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<sup>7</sup> Lewis, "The Rise of Renewable Energy Protectionism: Emerging Trade Conflicts and Implications for Low Carbon Development"; Stokes, "The Politics of Renewable Energy Policies"; Lewis, *Green Innovation in China: China's Wind Power Industry and the Global Transition to a Low Carbon Economy*.

<sup>8</sup> Meckling and Hughes, "Globalizing Solar"; Meckling and Hughes, "Protecting Solar."

<sup>9</sup> Nahm, *Collaborative Advantage: Forging Green Industries in the New Global Economy*.

<sup>10</sup> Helveston and Nahm, "China's Key Role in Scaling Low-Carbon Energy Technologies."

<sup>11</sup> Aklin and Mildenberger, "Prisoners of the Wrong Dilemma: Why Distributive Conflict, Not Collective Action, Characterizes the Politics of Climate Change."

supporting the growth of domestic markets through financial incentives and regulatory policy.<sup>12</sup> The hope was that fixing market failures in innovation and creating incentives for the deployment of new energy technologies would yield domestic clean energy industries.<sup>13</sup> After such industries failed to materialize, the IRA has changed this approach. For the first time, the U.S. government now employs a series of tax incentives, which explicitly require electric vehicle batteries, wind turbines, and solar panels to be (at least partially) manufactured in the United States (or a free trade partner) to qualify.

China's dominance in clean energy industries puts advanced industrialized economies in the novel position of using green industrial policies to catch up to the level of industrial development of other economies. The United States—as well as Canada and the European economies, which have passed or are passing green industrial policy bills of their own in the wake of the IRA—are entering a crowded market of clean energy manufacturers, many of which have been investing billions to build these industries for decades. China alone has spent more than USD 50 billion to establish control of virtually every segment of solar supply chains.<sup>14</sup>

The responses of Western economies to China's rise in clean energy sectors bear some resemblance to the late-economic development challenges of postwar East Asia. Japan, and subsequently South Korea, employed state intervention to catch up to world's most advanced economies of the time. For all the challenges of breaking into world markets, the advantage of late development was that governments could benchmark against the economies they were attempting to catch-up to. This allowed them to set clear goals and to reward or punish firms for meeting (or failing to meet) industrial development goals set by the state.<sup>15</sup> Local content requirements contained in the IRA and European Union policies to build a domestic battery supply chain also benefit from the advantages of late development: governments can look to existing battery supply chains in Asia when setting industrial development targets. The European Battery Alliance, which seeks to build a domestic battery supply chain, borrows from East Asian developmental state the idea of the state as a coordinator that strategically places domestic firms to fill perceived gaps in domestic supply chains.<sup>16</sup> These green industrial policies, too, reward or punish firms for their performance, for instance by awarding tax credits only to clean energy technologies that use a particular share of local content or domestically processed raw materials.

Unlike the East Asian late developers, however, states trying to build domestic clean energy sectors are often finding themselves in a position of trying to catch up to market leaders in some sectors or segments of supply chains, while operating at the technological frontier in others. For instance, building a domestic electric vehicle industry in the United States and Europe means contending with formidable East Asian competitors that have existing strengths in manufacturing and the benefit of economies of scale. It entails the coordination of domestic firms along the electric vehicle supply chain to ensure that existing gaps are filled. But it also requires experimentation with new battery chemistries, which cannot be benchmarked against existing competitors, and may necessitate new supply chain structures and entirely different raw materials. Large parts of the decarbonization challenge have not yet been solved – hard to abate sectors,

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<sup>12</sup> Nahm, “Reimagine: Clean Energy Technology and U.S. Industrial Policy.”

<sup>13</sup> Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation*.

<sup>14</sup> IEA, “Special Report on Solar PV Global Supply Chains.”

<sup>15</sup> Amsden, *Asia's Next Giant: South Korea and Late Industrialization*; Evans, *Embedded Autonomy - States and Industrial Transformation*; Wade, *Governing the Market - Economic Theory and the Role of Government in East Asian Industrialization*.

<sup>16</sup> Goldthau, Hughes, and Nahm, “The Political Logic of Reshoring in Low Carbon Technologies: Economic Interdependence and Green Industrial Policy.”

particularly in heavy industry, are still awaiting technological solutions and the market opportunities such solutions will provide.<sup>17</sup>

While green industrial policy can therefore borrow some strategies from late economic development, the problems it seeks to address are more varied, complex, and often sectoral in nature. Existing social science research on industrial policy is of limited utility as a template for designing successful state interventions that respond to such complex challenges. For instance, such research has primarily focused on national styles of policy intervention.<sup>18</sup> Yet states no longer play to type—liberal market economies like the United States have introduced interventionist policies, while statist governments, including China, have excelled at using market mechanisms in green industrial policy. National approaches are unlikely to succeed in meeting the varied and specific challenges involved in building national competitiveness across green industries in various stages of maturity and developmental needs. Ultimately, governments will need to deploy a range of industrial policies that include benchmarking and coordination akin to the policies of late development and others that encourage experimentation at the technological frontier without such state guidance and direction.<sup>19</sup>

#### **4. The institutional limits of green industrial policy**

The IRA—and its international counterparts—are at least in part a response to the growing gulf between the political necessity of showing domestic industrial development in return for public investments in the energy transition, and the empirical reality of global supply chains that remain heavily dominated by China. Yet the existing division of labor in global clean tech industries is not just, or perhaps not even primarily, rooted in cross-national industrial policy differences: governments have historically pursued similar industrial policies and comparable industrial policy objectives in sectors related to carbonization.<sup>20</sup> A key driver of different national specializations in clean energy sector have been vastly different sets of institutions governing the domestic economy. Such differences in domestic institutions have, over time, been accompanied by different economic growth models and structural compositions of the domestic economy.<sup>21</sup> For instance, China’s export-oriented role in clean energy supply chains has built on a network of state-owned development banks that were willing to provide financing for the expansion of manufacturing, at a time when few lenders elsewhere in the world were taking a risk on emerging clean energy sectors.<sup>22</sup>

As governments renew their efforts to attract clean energy supply chains, they will also have to contend with the institutional factors that have in the past stymied attempts to attract the manufacturing of technologies required for decarbonization. Domestic institutions central to building clean energy economies include supportive financial systems willing to lend to manufacturers, vocational training institutions capable of meeting the workforce needs of the

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<sup>17</sup> Allan and Nahm, “The Resurgence of (Green) Industrial Policy: How States Position Firms in Global Supply Chains.”

<sup>18</sup> Hall and Soskice, “An Introduction to Varieties of Capitalism.”

<sup>19</sup> Allan and Nahm, “The Resurgence of (Green) Industrial Policy: How States Position Firms in Global Supply Chains.”

<sup>20</sup> Nahm, *Collaborative Advantage: Forging Green Industries in the New Global Economy*.

<sup>21</sup> Blyth, Pontusson, and Baccaro, *Diminishing Returns: The New Politics of Growth and Stagnation*.

<sup>22</sup> Nahm, “Exploiting the Implementation Gap: Policy Divergence and Industrial Upgrading in China’s Wind and Solar Sectors.”

industries governments are trying to build, and research and development organizations supporting (existing) firms in entering clean energy sectors, among others. These institutions can complement industrial policies in meeting their objectives. But such institutions can also sharply limit what industrial policies are able to achieve and the pace at which they can do so.

The current resurgence of green industrial policy is not yet matched with equally ambitious reforms of the institutions governing the domestic economy. The Inflation Reduction Act, for example, has focused on reviving domestic manufacturing, picking up from the advanced manufacturing initiatives first put forward during the Obama administration. Yet the legislation does not comprehensively target the underlying structural problems that have prevented public investments in R&D and domestic markets from translating into a competitive clean energy manufacturing sector in the United States.<sup>23</sup>

Domestic clean tech firms in particular have faced great difficulty in trying to raise capital for investments in manufacturing, in part because the U.S. financial sector has shunned manufacturing in favor of sectors, including software, that yield higher returns.<sup>24</sup> As a consequence, American financial markets have often failed to meet the capital needs of manufacturing businesses due to low returns and long investment periods, especially in sectors, such as clean energy, that remain dependent on favorable regulatory environments to thrive. Attempts to establish an Industrial Finance Corporation (IFCUS) to meet the financing needs of underserved manufacturing sectors of the U.S. economy have thus far not been successful.<sup>25</sup>

Similarly, a long decline of the U.S. manufacturing sector has been accompanied by the closure of established vocational training institutions, which have made it difficult for new manufacturing firms to find trained workers. Firms in emerging clean energy sectors have struggled to find trained manufacturing staff capable of handling the increasingly complex and automated equipment used state-of-the-art manufacturing facilities. Smaller firms with demand for workers with complex manufacturing skills have reported difficulty filling vacancies. Existing vocational training institutions and community colleges have thus far not been able to meet the needs of clean energy firms, a situation likely to exacerbate as new local content requirements encourage a resurgence of domestic production.<sup>26</sup>

In addition to passing ambitious industrial policy, governments will therefore need to take an active role in improving and expanding vocational training programs for the clean energy workforce. Such institution-building could entail grants for vocational schools and community colleges that seek to establish clean energy manufacturing curricula together with partners from industry. But governments at the national and subnational level could perhaps also help resolve problems that have prevented the establishment of manufacturing apprenticeship systems similar to those in place in European economies. U.S. companies are often reluctant to invest in training out of concerns that trainees will eventually be poached by their competitors. Public support for vocational training is especially important in areas that depend heavily on fossil fuel industries for employment and that are likely to suffer economic losses from a clean energy transition without such programs for a just transition.<sup>27</sup>

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<sup>23</sup> Bonvillian, “Advanced Manufacturing: A New Policy Challenge.”

<sup>24</sup> Nahm, “Could an Industrial Finance Corporation Help the United States Succeed with Clean Tech Manufacturing?”

<sup>25</sup> Berger, *Making in America: From Innovation to Market*; Nahm, “Could an Industrial Finance Corporation Help the United States Succeed with Clean Tech Manufacturing?”

<sup>26</sup> Osterman and Weaver, “Skills and Skill Gaps in Manufacturing.”

<sup>27</sup> Nahm and Urpelainen, “The US Should Treat Climate Policy as Economic Policy.”

## 5. Conclusion

The recent resurgence of green industrial policies has the potential to fundamentally change the politics of climate change, by creating economic and industrial interests that are invested in and benefitting from decarbonization. Instead of trying to buy-off industries invested in fossil fuels, green industrial policies can grow the political coalition in favor of continued decarbonization, shifting the balance of economic interests away from the status quo.<sup>28</sup> Reframing climate policy as economic policy is therefore politically savvy: creating jobs in clean energy sectors will help build new coalitions behind climate policy, including in areas where climate change has not yet been a priority of voters. In the United States, the Inflation Reduction Act is a new chapter not just for U.S. climate policy, but also for rethinking the role of the state in taking advantage of economic opportunities in rapidly growing global clean energy sectors. The bill is just the starting point of a much broader industrial transformation for the United States, and other economies that have started to emulate the U.S. initiative.

Economists have long warned that industrial policies are prone to capture, can lead to inefficiencies and the misallocation of capital, and trigger rent-seeking behavior on part of the private sector.<sup>29</sup> Yet the challenges of green industrial policy may ultimately be less about governments picking the wrong winners than about getting right the domestic and international politics of industrial policymaking. As I have outlined in this memo, governments tend to overpromise on industrial policy outcomes in sectors related to decarbonization. They have a tendency to enact policies that are in fundamental conflict with the existing supply chains that have made clean energy technologies cheap and accessible, and often underinvest in the economic institutions that make industrial policies successful.

These challenges create an opening for social scientists to reinvest in studies that examine the politics and implementation of industrial policy, a topic that at least political economists have largely neglected since the heyday of the East Asian developmental states. To make good on their economic development goals, governments will need to fix structural problems that have long caused a decline of manufacturing in the West without jeopardizing existing clean energy supply chains. The stakes have never been greater. Because climate and economic outcomes are now so closely linked, failing to do so will not just jeopardize the growth of clean energy industries, but also the ability of the United States and other Western economies to meet their Paris Agreement goals.

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<sup>28</sup> Meckling and Nahm, “Strategic State Capacity: How States Counter Opposition to Climate Policy.”

<sup>29</sup> Hallegatte, Fay, and Vogt-Schilb, *Green Industrial Policies: When and How*.

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