MAKING CLIMATE POLICY WORK

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polity

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Preface

We are two scholars who have spent nearly all of our professional lives intersecting with the problem of climate change. For Danny, that has meant a career at the nexus of law, economics, and engineering, looking at how energy systems might evolve in the future. For David, that has meant a career trained in political science and focused on how industrial transformations actually occur. When you spend this much time on one big issue that keeps getting worse, you live a life of constant reminder that the climate problem is really hard to solve.

Realism about the scale of the challenge is often discouraged in climate policy circles because it is easy to confuse with pessimism. Precisely because the climate problem has proven so stubborn, the whole ecosystem of climate activism and scholarship spends a lot of time painting stiff smiles on inconvenient facts. Yet any serious analysis must start by understanding climate solutions for what they are: requirements for profound industrial change that are difficult to initiate, sustain, and run to completion. The river of industrial investment and climate pollution runs deep and fast with powerful incumbents. Elements of change are becoming visible, but most to date are minnows swimming against that strong current.

This level of difficulty, we think, is a call not for pessimism but for realism about solutions. Because it is so hard to make

deep cuts in global emissions – deep decarbonization, as it is called – effective solutions require clear thinking and strategy. Efforts spent tilting at ephemeral, magical policy solutions waste scarce resources that should instead be invested in things that work.

For the last decade, both of us have observed a rapidly growing disconnect between the solutions that are most popular among policy and academic elites and the facts on the ground. Conventional wisdom in elite circles holds that market-based solutions work best; decades of policy advocacy and design within this paradigm have produced a network of fledgling cap-and-trade systems that portend to lay foundations for solutions. In a few places, carbon taxes have emerged as well. These pockets of market-based action have been created, in part, with the belief that they will spread – ultimately to global coverage and with big leverage on emissions. The realities are different, however. Those who are watching closely know those promises are largely failing and, we argue, will continue to fail.

What drew us together as collaborators is that while both of us are rooted in academia – and thus steeped in debates around which policy instruments are best from the perspective of theory – we spend much of our professional lives elsewhere. We work with governments, regulators, NGOs, firms, and investors – institutions whose leaders are all grappling in practical terms with the challenges of deep decarbonization. Everyone is asking about the theory of change. "What moves the needle?" is a common refrain. Outside of the academy we see policymakers and CEOs talking a lot about market-based strategies to address climate change. Yet when they actually do something that moves the needle – such as adopt a policy that makes a big dent in emissions, redirect investment toward low-carbon solutions, or craft a business strategy based on the reality that deep cuts in emissions are essential – they make those choices without much attention to abstract market forces such as carbon pricing. Rather, they respond to policy and political pressures rooted in other concerns – such as fear of losing access to vital markets, rising social opposition to their business models, or regulatory requirements and industrial policies that require big changes in behavior. From Davos to

Washington DC, Sacramento, and Brussels, most elites who talk about the climate crisis from an altitude of 30,000 feet are talking about markets. Meanwhile, at sea level, pretty much all the serious work of deep decarbonization is being done by industrial policy and strategy.

This book is about that disconnect.

Our goal is to explain why market-oriented climate policies have fallen far short. This is not an accident, we argue, but a reflection of the political structure of the climate problem and the administrative tools that modern governments can apply in response. Reducing emissions in the world as it is requires understanding that world. It requires understanding why, after thirty years of diplomatic meetings – most of them tilting at market-oriented policy – we haven't made more progress. That failure is rooted in the difficulty of the challenges of industrial transformation. It is also rooted partly in the fact that policy elites, business leaders, and even some environmental groups that want serious action have imagined they live in a world where the massive changes required for deep decarbonization will emerge with a technocratic nudge from the market's invisible hand.

It is vital that policy designers and advocates start making a sharper distinction between the world as it is and a fantasy in which market policies could do most of the work in creating deep decarbonization. Failure to grapple with that difference means that growing pressure to act on climate change can't be channeled in the most productive ways. Many parts of the world are, plausibly, on the cusp of a huge surge of interest in and action on climate change. Nearly all the evidence from climate science is dark – warming is happening faster than expected, impacts such as rising seas are looking more dire than initially forecast – and a catalog of unknowns mostly points darker. Growing public awareness and concern among corporate leaders and politicians is not leading to swift action everywhere, but it is leading already to a lot more action in some places. The global effort is deepening and widening. Yet most of the key actors pushing for a coherent strategy are pushing a playbook we believe is outdated and ineffective. Market-based strategies haven't just fallen short in the past, but they will keep failing to deliver the elements of deep decarbonization that will be demanded

as awareness of the climate crisis grows. We explain why and offer alternatives.

We come to this project from very different political backgrounds.

For Danny, insights into the climate problem are intertwined with understanding how the left wing of American politics is pushing the country to get serious – whether on economic policy, financial regulation, or energy system transitions. Time and time again the left has expressed a prescient understanding of climate policy dysfunction. The environmental justice community, for example, has sounded the alarm about offsets and other failures of carbon markets much more loudly and accurately than practically any other segment of the political debate. Yet many of the same voices have struggled to articulate alternative policy strategies that are practical to implement at scale. In recent years Danny has been active in Sacramento, participating in regulatory processes, testifying at legislative oversight hearings, and serving on an expert advisory panel focused on California's carbon market. If most of the action on climate change is happening in a few places like California that are willing and able to invest heavily in solutions, how do these leaders channel their resources into actions that really matter for deep decarbonization?

For David, the climate problem began as a topic to be understood through the lens of effective international cooperation and viable corporate strategy. Most of the global climate efforts to date have failed because they were disconnected from facts on the ground – from what governments and firms were willing and able to do. From that perspective, David's career has involved bouncing between the worlds of industrial incumbents (such as electric power companies) and the worlds of Silicon Valley (which is all about disruption, innovation, and dethroning incumbents). If the climate problem is largely about industrial transformation, what really guides the process?

Starting from these two different perspectives, we puzzled through the questions surrounding how to seed and nurture the technological and political transformations needed to address climate change. Many of these conversations were, frankly, a litany of vents. In our different worlds we

separately observed a lot of talk about solutions that didn't seem to solve much. We also saw a lot of actual problem-solving – real companies and governments investing in risky new technologies and building new lines of business – that didn't seem to follow any of the standard academic prescriptions for "first-best" climate policy that relied on simple market signals.

The journey from catharsis to synthesis began when we realized a lot of the conventional wisdom had the story backwards. In a globalizing world where markets seemed to be triumphing over states, we saw serious solutions to the climate crisis rooted in the opposite approach – where the state was playing a much bigger role. And if the state could play an even larger role, so too would firms. That realization is bad news for governments and political parties that have spent a lot of time de-skilling or trashing the state. Firms, left to their own devices, aren't going to decarbonize the world. Governments without the capability to lead transformations won't steward much change. Incumbents are perfectly happy to stay the course.

The standard wisdom about the role of markets will, we think, be shaken badly by the facts. We will show that market forces can help optimize the allocation of resources, but they aren't that good at leading massive industrial transformation. Yet it is exactly that kind of transformation that's needed. This is one of many areas where the left – especially the deeper, more ecological left of the "Green New Deal" and other visions of massive state intervention – has been more accurate than most of the rest of the political spectrum. At the same time, however, accuracy in the diagnosis has also come with deep misunderstandings about how transformation will be organized and can unfold, once compelled to begin. On that front, the practical corporate industrial community has been more accurate than most other groups that are active in the climate policy debate. Demonizing firms just because they are firms or incumbents ignores the reality that these enterprises will steward much of the innovation, transformation, and infrastructure investments needed for climate solutions.

Pragmatists who see existing firms as vital to practical solutions on climate change have failed to appreciate that most of the political energy for reform comes from the left, where

suspicions about incumbency and compromise run deep. What politics must do is create the incentives for industrial transformation so that firms will invest both technologically and politically in a decarbonized future. With successful investment and expanding social movements, those incentives will grow and the forces that want deep decarbonization will become more powerful. That process will happen only if pragmatists and activists recognize the vital roles that each plays in this process of creating broader and deeper political pressure for decarbonization. Successful decarbonization will help lower costs and increase confidence in climate policy, ultimately creating a political dynamic that will accelerate decarbonization and make it more self-sustaining.

Most of this book was written over a six-month period starting in the fall of 2019. As often happens, once a new way of thinking about things emerges, old facts don't disappear so much as fall into new places. The approach we take in this book aims to organize the data on markets' increasingly visible shortcomings into a coherent narrative – one that offers a new interpretation of what is feasible with markets and thus what must be achieved with other policy strategies. We lay out the standard prescriptions for market-oriented policy and then show how the facts actually fit a different pattern. Explaining that pattern requires a theory of politics and some willingness to think differently about what really works, all of which we cover in chapter 1. If you want to read just one chapter, that's the one.

As we completed this manuscript in February 2020, the world was descending into a global economic lockdown. In those rare moments when a huge shock hits, it is tempting to think that everything has changed, but we decided to change nothing in this book as a result of the pandemic. Our aim has been to write a book about the fundamental politics that determine climate policy effectiveness, particularly with respect to market-based policy instruments. Our ideas should be judged by whether we get those fundamentals right. Rather than chase the twists and turns of the pandemic and government policy responses – by May 2020, when the final editing wrapped up, the top ten economies had committed $7 trillion in stimulus spending and counting – we decided the crisis is another opportunity to ask: can market-based

instruments, in the real world, cause the needed transformation in industrial decarbonization? Our answer before the pandemic was no; after the pandemic, we expect the evidence will be even stronger.

On two fronts, the pandemic is revealing how politics affects policies and the industrial action needed for deep decarbonization. First, carbon prices in nearly all of the world's cap-and-trade systems have fallen in line with economic upheaval – and with them, the revenues governments collect from these programs. Carbon markets amplify macroeconomic shocks because they are fundamentally pro-cyclical policies, which is why we are so keen to convince governments to move away from instruments whose practical impact is so flaky and toward other policy instruments, like industrial policy, that can more readily be kept in line with the public's demands and the signals firms need to invest.

Second, the pandemic has transformed political priorities. Abstract global amenities are on the wane, with immediate employment, economic recovery, and public health at the front of all policy agendas. This shift will test the political commitment to cutting climate pollution, with effects that vary by economic sector. In places where the decarbonization agenda is aligned with employment, we expect the public's willingness to invest in deep decarbonization will grow. In other sectors, the opposite patterns may appear. We draw from this a lesson already offered in this book: policy instruments that link together all sectors in a common, transparent effort to impose a single price on carbon fundamentally misread political reality.

In telling the story of how market-based climate policy works in the real world, we adopt the premise that idealized markets would be desirable if they were feasible. We hope this choice allows us to reach readers who identify strongly with the power of market forces, since we hope to change their minds. We want them to understand how political forces constrain what market-based policies can do, especially at the early stages of deep decarbonization, because wishing those forces away isn't practical and hasn't worked. We also seek readers among the many who have long ago rejected markets. We hope they will read on as well, as our critique will help offer a systematic logic for many of their concerns – new

arguments in support of familiar positions – while providing a framework for better policy strategies. What matters most to us – and the planet – is whether a policy works, not which ideological camp claims a notch in its belt.

We wrote this book in our spare time with no grants or other financial support. Our strong suspicion is that had we gone out looking for help, funders would not have been interested. Too much of the support for writing and thinking on the politics of the climate crisis is, in fact, support for advocacy around familiar policy strategies. While climate advocacy comes in many flavors, it is largely rooted in the idea that an elite group of climate intelligentsia knows all the right answers – the right policies, the right technologies, and the right political strategies to deliver the goods. Yet the biggest follies in climate policy strategy over the last few decades all emerged from an uncritical reliance on untested theories of change. Major industrial transformations don't lend themselves to easy planning with existing policy tools – that is why they are transformations. All of us know less than we think, ourselves included. Yet overconfidence abounds, including in policy advocacy. Interest in questioning accepted wisdoms is scarce. Groupthink reigns.

Our book is an effort not just to rattle the climate commentariat, but also to explain why any rigid theory of change is likely to become brittle as circumstances evolve. We hope it leads more groups to reflect on what really works and to anchor their reflections in research. Indeed, many of the key questions around the efficacy of different policy instruments should be addressable with hypotheses and data. What has been most disturbing to us in this project is that the data needed for serious analysis of market-based policies are strikingly scarce, rarely collected together, and usually of low quality. Even where there are legal or fiduciary obligations to report data – such as around where money raised by market-based systems gets spent, or whether carbon offset schemes actually reduce emissions – most information is shrouded in opacity and complexity. More research will help, but in some cases the analytical *terra incognita* is by design. Many climate policy systems that have been created at huge financial and political expense are designed not to reveal their failures. We call out some of the most egregious examples in the hope that

those who want to understand what really works will press harder for both transparency and analysis.

Although we worked without grant support, no project that probes widely into whether the status quo is working could happen without many colleagues who have helped with ideas, data, and constructive disagreements.

There's a world of difference between a book in principle and a book in reality. Louise Knight and her colleagues at Polity sit at the center of that difference. For years Louise has asked about a possible book, and as these ideas came together, she, Inès Boxman, and Justin Dyer – along with a group of insightful external reviewers – played an essential role in turning them into an actual manuscript.

We are particularly grateful to several people who read drafts. Among them, Jeremy Freeman, Peter Gourevitch, Jess Green, Michael Grubb, Lars Gulbrandsen, Justin Gundlach, Matto Mildenberger, Arild Underdal, and Jørgen Wettestad. In tandem, we had many conversations with people about our ideas as they emerged: Grayson Badgley, Ross Brown, Dallas Burtraw, Chris Busch, Geoffroy Dolphin, Meredith Fowlie, Matthew Freedman, Oliver Geden, Larry Goulder, Barbara Haya, Dan Jacobson, Bruce Jones, Jonathan Koomey, Vanessa Pinsky, Ric Redman, Chuck Sabel, Dianne Saxe, Katie Valenzuela, Michael Wara, and David Weiskopf. A special thanks to the many people who helped us with data: Jeremy Carl, (again) Geoffroy Dolphin, David Fedor, David Hytha, Quentin Perrier, and Marissa Santikarn.

In tandem with writing this project, both of us have been working on many other projects that have shaped our thinking – with ideas reflected on these pages.

Danny is grateful first and foremost to his partner, Nina, with whom he is raising twins Adela and Oscar. Nina and Danny's sister, Laurie, spent countless nights and weekends caring for the babies so that Danny could write or field calls at odd times from wherever in the world David happened to be that week. With help from Debbie Sivas, Amy Applebaum, Pam Matson, and Anjana Richards, Danny has been teaching energy and climate policy at Stanford, where several of our ideas began in dialog with curious students. Danny's research in California would not have been possible without selfless support from Karen Fries and José Carmona – not to

mention his collaborators Michael Mastrandrea and Mason Inman, who helped cut through so much of the opacity. Finally, Danny thanks the civil servants, policy advisors, and policymakers who work tirelessly to advance climate progress in California and gave generously of their time to help him learn the ins and outs of state policy – especially Kip Lipper. Special thanks to California Senate President *Pro Tem* Emeritus Kevin de León and Senator Bob Wieckowski for their leadership and for appointing Danny to California's cap-and-trade advisory board.

David thanks four long-time collaborations that have facilitated conversations and ideas that had a big impact on this project. First is joint work with Bob Keohane around the factors that explain the politics of international cooperation – work that has, increasingly, emphasized the national and transnational factors that condition what is possible in the international system. A second is a big book project with Chuck Sabel (slated for publication in 2021) on Experimentalist Governance: that is, on how societies solve problems when there is strong pressure for action but nobody, frankly, knows exactly what to do. Working with Chuck has sharply refined our thinking about the incentives that affect when and how firms invest in new technologies and how societies learn which policy strategies actually work. Third is a collaboration with Frank Geels and Simon Sharpe to look at how the insights from the history of technological change and the history of international cooperation could guide new sector-by-sector strategies for deep decarbonization. That study, released in December 2019 in Madrid, helped us sharpen our thinking about the degree of technological innovation still needed in nearly every sector. It also builds on work that Bruce Jones and David have been leading for several years at the Brookings Institution, one of the publishers of the Madrid study. Finally, every effort to study technological change, for David, involves voices from early mentors on that topic: Jesse Ausubel, Arnulf Grübler, and Nebojša Nakićenović. They – and the International Institute for Applied Systems Analysis (IIASA), where we all worked at various times – have shaped a world view for the better. Although they sometimes arrive at very different conclusions, David has learned a lot from his colleagues in economics

who study market design: Larry Goulder, Rob Stavins, Gernot Wagner, and the late Marty Weitzman. And a special thanks from David to his family – Emilie Hafner-Burton in particular – who were steady supporters even as he was in remote corners of the world on the phone with Danny.

1
A turn toward markets?

In the late 1980s, global attention started to focus on the problem of climate change caused by pollution from carbon dioxide (CO_2) and other greenhouse gases. In tandem, analysts and policymakers argued that the best strategy for dealing with pollutants that harmed the whole planet would be to create environmental markets that also spanned the globe. These market schemes would, in theory, create strong price incentives to cut emissions anywhere and everywhere. The scale of the policy response, it was thought, must be matched to the scale of the problem. And beyond scale, powerful market forces would help ensure that cuts in pollution were achieved at the lowest economic cost. The use of markets became the watchword for smart, efficient climate change policy.

Although the use of markets to control carbon pollution has never been without controversy, its dominance in the climate policy debate is hard to overstate. Market-based strategies were built into every major international agreement on climate change and formed the rhetorical core of the most ambitious countries' climate strategies. Most of these schemes envisioned setting caps on emissions and allowing firms and governments to trade credits – policies known as carbon markets or "cap-and-trade" programs. Governments would negotiate the desired pace and extent of emission reductions

by setting pollution caps. Through trading, the collective genius of the market would discover the best allocation of effort. Many of the world's biggest emitters – starting first in the West, and now spreading to South Korea, China, and other emerging economies – have considered or adopted cap-and-trade programs. A few countries have taken a different market-based climate strategy and set prices directly via carbon taxes. Whereas cap-and-trade fixes the quantity and lets the market find the cost of emitting pollution, carbon taxation does the opposite: it specifies the price and lets the market discover the volume of pollution that aligns.

Market-based policies on a planetary scale, the theory goes, would empower firms and governments with the flexibility to focus investment on the least expensive options for controlling emissions. Flexibility would reduce costs, allowing more environmental protection with fewer resources; in turn, frugality would make it easier to mobilize business and voter support for ever-deeper climate pollution reductions. Ever since the early 1990s, when active efforts to develop climate policy began, the politics of crafting and sustaining policies needed for achieving deep cuts in emissions have been stymied by concerns that deep decarbonization – as the transformation to a climate-friendly future is known – would be expensive, difficult, and could even harm economic competitiveness. That's why policy strategies to keep costs as low as possible were seen not just as good for the economy, but also as essential to mustering political support to protect the planet.

Today, the original vision of a globally coordinated, market-based policy solution lies in tatters.

Many pollution markets exist, but nearly all are smokescreens that create the impression that market forces are cutting emissions when, in fact, other policies are doing most of the real work of decarbonization. Almost everywhere that market systems are in place they operate at prices that are so low as to have little impact on key decisions such as whether to invest in or deploy new technologies. After thirty years of policy attention to climate change and twenty years of active efforts to design market systems, jurisdictions with reasonably ambitious carbon prices – say, $40 per ton of CO_2-equivalent[1] – account for less than 1% of

global emissions (Figure 1.1). Those with carbon prices approaching $100 per ton of CO_2-equivalent – a strong signal more consistent with the level of effort the best new science suggests is needed for deep decarbonization – are an even tinier sliver of the global picture.

In a few places, carbon prices from market-based policies have been powerful enough to induce some changes in emission patterns – such as when firms decide whether to produce electricity from high-emission coal plants or lower-emission rivals. Those impacts, however, have nearly always involved commercially mature technologies competing in stable environments and under other highly restrictive conditions. In the United Kingdom, for example, a climate policy strategy that included carbon pricing accelerated the extinction of coal from electric power because other technologies, notably cleaner natural gas and renewables, were readily available and much more competitive when coal-fired power plants were required to pay the extra cost of their emissions.[2] Those are important roles for markets,

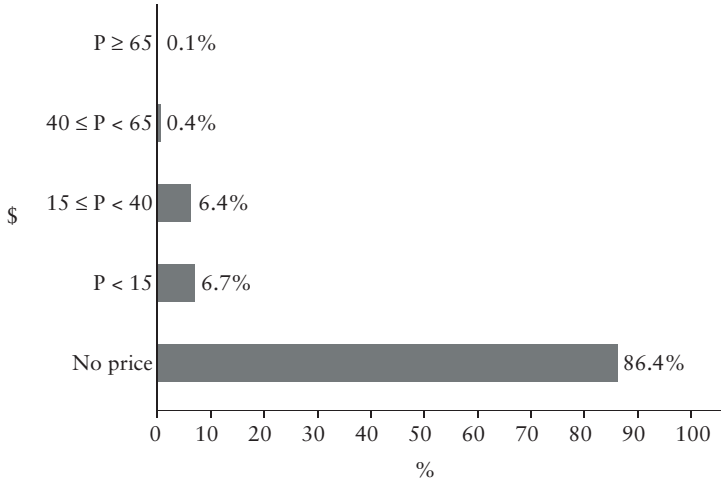

Figure 1.1 Carbon prices around the world in 2019

Source: Figure redrawn with permission from Jesse Jenkins, "Why Carbon Pricing Falls Short and What to Do About It," Kleinman Center for Energy Policy, University of Pennsylvania (Apr. 24, 2019); underlying data from World Bank, "State and Trends of Carbon Pricing" (2019).

but those roles are not central to the challenge of creating a global transition to near-zero emissions.

Nearly all the real challenges of deep decarbonization require incentives for governments and firms to back novel, risky, and untested technological systems – not simply to deploy known, proven options that are sitting on a shelf ready for use. In 2019 a team of scholars supported by the Energy Transitions Commission took a fresh look at exactly where the world stands with respect to deep decarbonization. The results, summarized in Figure 1.2, use the standard S-shaped curve for explaining the emergence, diffusion, and then reconfiguration of infrastructure that is typical of technological change. Strikingly, in nearly all of the ten sectors that account for the bulk of climate pollution, technological progress on deep decarbonization is in the very early stages – when, typically, the best choices are unknown, risks for investors are high, and active policy support is essential. The power sector is furthest along (at least in some countries), which is precisely why marginal market incentives have been able to achieve significant impacts in some contexts by affecting choices of known, proven technologies in that sector. But even the power sector requires comprehensive transformation with new technologies and investments – such as in advanced control systems, building electrification strategies, and bigger electric grids – that carbon pricing, alone, is unlikely to deliver.

What's needed nearly everywhere in the world is to test and deploy novel technologies energy, industrial, and agricultural systems. Even in electricity – where there has been a lot of progress in developing clean production systems – the next frontier will involve electrification of many end uses, including space heating and cooling, which requires continued progress in early-stage technologies such as reliable heat pumps. Carbon prices, even at high levels, won't be enough to induce the necessary investment in and adoption of novel technologies.

In addition to having little impact at home, the world's efforts to create market forces that encourage decarbonization have generated almost none of their promised international benefits. Despite nearly three decades of diplomatic and other policy efforts, no global carbon market exists today.

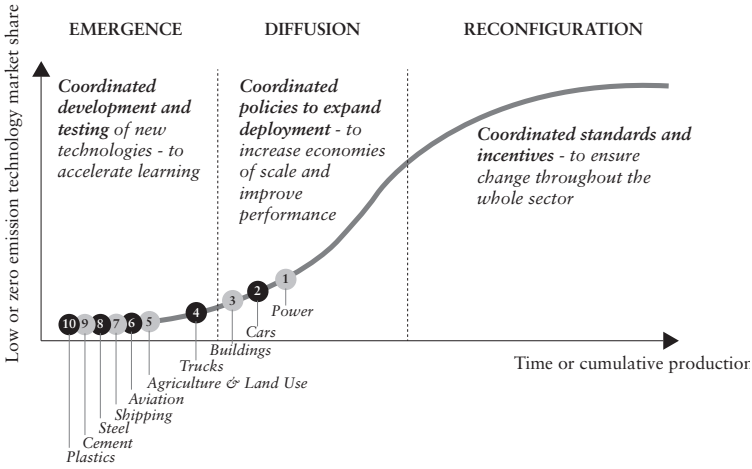

Figure 1.2 The state of decarbonization technology by sector

Source: Redrawn with permission from David G. Victor, Frank W. Geels, and Simon Sharpe, "Accelerating the Low Carbon Transition: The Case for Stronger, More Targeted and Coordinated International Action," Energy Transitions Commission and Brookings Institution (2019), based on assessments of technological development that rely heavily on the work of the Energy Transitions Commission (*http://www.energy-transitions.org/*).

Interregional emissions trading is a footnote in climate policy, not the main attraction. Various efforts to create regional carbon markets – such as in the European Union, across subnational governments in North America, and within private firms – remain inspired by the vision that these decentralized markets will become stitched together in time as the coverage of markets broadens and climate ambitions deepen. Yet in the real world there has been little stitching together and almost zero deepening.[3]

The most visible example of market links – the joint trading program involving California, Québec, and Ontario – recently shrank, with a conservative Ontarian government pulling out of cap-and-trade after winning power in 2018. Years earlier, nascent links between the Australian and EU markets dissolved as soon as Australia abandoned emissions trading. China, meanwhile, is in the middle of an opaque and years-long effort to develop a national emissions trading program in the

power sector, where a small number of powerful state-owned firms dominate, environmental regulators have struggled for influence, and the state planning system has historically been much more potent than marginal market incentives in determining investment and environmental outcomes. Only one integrated international market has proved sustainable – the market for pollution across the European nations – because that market is built on top of a powerful superstructure of common European economic institutions, common rule of law and administrative procedure, and common confidence that the superstructure is robust. Those are highly demanding conditions to meet and unlikely to be seen anywhere else in the world anytime soon. This success within the EU bodes well for Europe, but the continent's share of global emissions is only about 9% and shrinking. As a leader, what it does is relevant to the global problem of climate change primarily if its leadership inspires and directs followership in the places where emissions are rising.[4]

As the sheen of markets dulls, it has also become clear that the world is making little progress on decarbonization. Since around 1990, when diplomacy to address global climate change first began on a sustained basis, world emissions have risen by two-thirds.[5] In only one sector (electric power) and one group of countries (the Western industrial democracies) have emissions declined a bit. Most of that is due to fortuitous changes in fuel markets, the decline in the cost of wind and solar power, and policies that have mandated a shift away from coal toward cleaner sources. In the United States, the shale gas revolution has crushed coal and cut CO_2 emissions along the way (even as evidence grows that needless methane leakage from the gas system undermines the climate benefits from replacing coal with gas). In places where gas is costlier – notably, continental Europe – renewables have been more important in cutting emissions. In most other sectors, such as transportation, emissions keep rising.

The unfortunate truth is that many governments around the world are ignoring the problem of greenhouse gas emissions, focusing, instead, on other priorities. That's why, in Figure 1.1, nearly all world emissions are priced at zero. Even the leaders – the EU, Nordic countries, Japan, and parts of the United States – have until recently been

mostly tinkering at the margins, with market-based policies targeted mainly in sectors where technology has already advanced and costs are low. The best studies suggest that a few percent of global gross domestic product (GDP) should be allocated to controlling emissions – an investment on the scale of recent war and defense-related expenditures, yet requiring sustenance over decades.[6] So far, almost no major economy – except perhaps Germany, and with German leadership the rest of Europe as it contemplates a "European Green Deal" to accelerate deep decarbonization – has stepped up to the challenge. Collectively, the global level of effort is perhaps two to three orders of magnitude lower than needed.

The inconvenient problems of politics

These two profound problems – the failure of efforts to create effective market-based climate policies, and the failure to make significant progress in reducing global emissions – are inexorably linked. Massive political resources have been mobilized to push market forces as the central mechanism for cutting emissions. That mobilization, we will argue in this book, has largely failed and will keep failing. Its failure is not rooted in the economic logic of markets. Nor is it rooted in the idea that resources must be devoted efficiently, so that more protection from the ravages of global climate change can be obtained at lower economic cost.

Rather, the problem with markets is political.

The attractive academic logic of markets has become misaligned with the political realities of the climate problem on two fronts.

One front, most crucial, is that successful climate policy requires building and sustaining political coalitions to support policies that will transform all the major emitting sectors of the economy: electric power, transportation, industry, buildings, agriculture, and so on. Studies that look closely at these political processes show that every sector is different, with varied organization and authority of interest groups.[7] For academics, markets offer the prospect of economy-wide prices

and transparency so that, ideally, all sectors are treated equally. Unfortunately, that feature of markets is toxic to policymakers and climate policy advocates, who must tackle political barriers and opportunities one step at a time, one sector at a time.[8] In some sectors, key political constituencies (such as voters) are highly sensitive to visible policy impacts on prominent carbon-emitting products (such as gasoline). In other sectors, industrial production is oriented around highly competitive, tradeable commodities – like steel – and firms are well organized politically to block policies that would harm their price-sensitive and trade-exposed industries. And so on – a string of problems, all rooted in the political organization and influence of powerful interests, each of which requires a tailored political solution. A market perspective on the climate problem emphasizes that resources and effort are fungible across every economy and around the world. A political perspective sees each sector as a separate challenge that requires bespoke solutions. Because textbook market-based policies treat all sectors with the same price, applying that textbook without an eye to political reality creates markets for which the overall effort is restrained to the lowest common denominator.

On another front, what markets do best – creating transparent, marginal price signals that encourage firms and households to optimize their choices – is misaligned with the industrial challenges facing deep decarbonization today. In most sectors the world is not far along with deep decarbonization: key technologies, demonstration projects, and the emergence of new firms to back low-carbon technologies are fledgling at best (see Figure 1.2).[9] Industrial firms and consumers aren't waiting for a faint, marginal signal from markets to nudge their behavior. Instead, they need active programs to mobilize and apply resources to new technologies that, with time and effort, will launch the global process of deep decarbonization and displace incumbent industries. The incumbents are powerful.[10] The new entrants are not.[11] Well-designed market signals, at best, are good at encouraging optimization when technologies are commercially mature and strategic choices are clear – such as when the UK electricity market had a signal to select mature renewable energy technologies and gas instead of coal. The hardest challenges of deep decarbonization involve redirecting