

In the late 1980s the United Nations began the first round of formal talks on global warming. Over the subsequent two decades the scientific understanding of climate change has improved and public awareness of the problem has spread widely. These are encouraging trends. But the diplomacy seems to be headed in the opposite direction. Early diplomatic efforts easily produced new treaties, such as the 1992 UN Framework Convention on Climate Change (UNFCCC) and the 1997 Kyoto Protocol. Those treaties were easy to agree upon yet had almost no impact on the emissions that cause global warming. As governments have tried to tighten the screws and get more serious, disagreements have proliferated and diplomacy has stuck in gridlock.

This book aims to explain the gridlock and offer a new strategy. My argument is that the lack of progress on global warming stems not just from the complexity and difficulty of the problem, which are fundamental attributes that are hard to change, but also from the failure to adopt a workable policy strategy, which is something that governments can change. Making that change will require governments, firms, and NGOs that are most keen to make a dent in global warming to rethink almost every chestnut of conventional wisdom. In this opening chapter, I will summarize my argument in six steps.

Step 1: why the science of global warming matters

Any serious effort to slow global warming must start with one geophysical fact. The main human cause of warming is carbon dioxide (CO_2). Other gases also change the climate, but compared with CO_2 they are small players.¹ Making a big dent in global warming requires making a big dent in CO_2 . Most of the economic and political challenges in slowing global warming stem from the fact that CO_2 lingers in the atmosphere for a century or longer, which is why

climate policy experts call it a “stock pollutant.” The stock of CO₂ builds up from emissions that accumulate in the atmosphere over many years. As the stock rises global warming follows in tandem. Because the processes that remove CO₂ from the atmosphere work very slowly, big changes in the stock require massive changes in emissions. Just stopping the build-up of CO₂, for example, requires cutting worldwide emissions by about half. Lowering the stock, which is what’s ultimately needed to reverse global warming, demands even deeper cuts. Exactly how much of a cut will be needed is hard to pin down because the natural processes that remove CO₂ are not fully understood. There’s a chance they will become a lot less effective as the stock of CO₂ rises, which would imply the need for even deeper cuts.

Because CO₂ is a stock pollutant the problem of warming is global. Emissions waft throughout the atmosphere worldwide in about a year, which is much faster than the hundreds of years needed for natural processes to remove most of that pollution. Politically, this means that every nation will evaluate the decision to cut emissions with an eye on what other big emitters will do since no nation, acting alone, can have much impact on the planetary problem. Even the biggest polluters, such as China and the US, are mostly harmed by pollution from other countries that has wafted worldwide.

Because our chief pollutant is CO₂, we know that serious regulation will mainly focus on energy policies. CO₂ is an intrinsic by-product of how society burns fossil fuels today, and the vast majority of useful energy that powers modern economies comes from fossil fuels. Tinkering at the margins of the energy system won’t make much of a difference. Deep cuts in CO₂ will probably require a massive re-engineering of modern energy systems. Such an effort will alter how utilities generate electricity and the fuels used for transportation, among many other implications. Such a transformation is not impossible; in fact, over history it has happened several times.² But no country – let alone the world community – has ever planned such a transformation in energy infrastructure. At this stage nobody knows what it will cost, but most likely it will be expensive. Because energy systems are based on complicated infrastructures it is likely to unfold slowly. And because this transformation will require new technologies and business models that do not yet exist the political interest groups that can keep the process

on track do not yet exist. The pace of this transformation will be impossible to plan and predict to exacting timetables.

That's the first step in this book. CO₂ is a stock pollutant, and from that simple geophysical fact comes two important political insights. One is that regulation will require international coordination. The other is that governments will have a hard time making credible promises about exactly how quickly they can make deep cuts in CO₂. Because CO₂ is interwoven with energy systems that are costly and sluggish to change, when governments tighten the screws on emissions – something that has not yet happened except in a very small number of countries – they will find it increasingly difficult to plan and adopt the policies needed to make a difference. As the cost of this transformation rises, what every country does will depend on confidence that other countries are making comparable efforts. Yet even governments working in good faith will be in the dark about what they can really deliver.

Step 2: myths about the policy process

Second, I will argue that international coordination on global warming has become stuck in gridlock in part because policy debates are steeped in a series of myths. These myths allow policy makers to pretend that the CO₂ problem is easier to solve than it really is. They perpetuate the belief that if only societies had “political will” or “ambition” they could tighten their belt straps and get on with the task. The problem isn't just political will. It's the imaginary visions that people have about how policy works. Chapter 2 devotes some space to puncturing these myths.

One is the “scientist's myth,” which is the view that scientific research can determine the safe level of global warming. Once scientists have drawn red lines of safety then everyone else in society optimizes to meet that global goal. The reality is that nobody knows how much warming is safe, and what society expects from science is far beyond what reasonable scientists can actually deliver. Policy makers often ask for a “scientific consensus,” but nothing that is really interesting to scientists lends itself to consensus. The climate system is intrinsically complex with few useful simple red lines; “safety” is a product of circumstances and interests not just geophysics. The result is an obsession by policy advocates with setting false and unachievable goals.

Over the last decade many scientists and governments have set the goal of limiting warming to 2 degrees, which has now become the benchmark for progress on global warming talks. Two degrees is attractive because it is a simple number, but it bears no relationship to emission controls that most governments will actually adopt. And it isn't based on much science either.

Serious policies to control emissions will emerge "bottom-up" with each nation learning what it can and will implement at home. Just as countries learn how to control emissions they will also look at the science, along with their own national vulnerabilities to climate change, and determine the level of warming they can stomach. It is highly unlikely that countries will arrive at the same answers.

I puncture the "scientist's myth" because it creates a false vision for the policy process – one that starts with global goals and works backwards to national efforts. When pollutants such as CO₂ are the concern, real policy works in the opposite direction. It starts with what nations are willing and able to implement.

A similar myth explains much of diplomacy. Environmental diplomats imagine that progress toward solving problems of international cooperation hinges on the negotiation of universal, legally binding agreements that national governments then implement back at home. The scientist's myth starts with scientific goals and works backwards to national policy. Diplomats make the same kind of error and start with binding international law and draw the same backward conclusion. Events like the Copenhagen conference are the pinnacle of this mythical legal kingdom. They are heroic events organized to produce global treaties. When these events fail to produce consensus the diplomatic community doesn't shift course but merely redoubles its efforts to find universal, binding law.

The reality is that universal treaties are a very bad way to get started on serious emission controls. Global agreements make it easier for governments to hide behind the lowest common denominator. Binding treaties work well only when governments know what they are willing and able to implement. Most of this book is devoted to creating an alternative vision for international law. But getting starting on that alternative requires setting aside the conventional wisdom – widely held in the diplomatic and environmental communities – that has made it hard to focus on better approaches. I will offer my skepticism about this view first in Chapter 2, and when I

look at the history of the climate change diplomacy in Chapter 7 I will fully skewer that point of view. Universal binding law has played a useful role in some areas of international environmental cooperation, but the attributes of the climate change problem require a different approach.

Finally, I will take aim at fictions about technology. The “engineer’s myth” holds that once inventors have created cheaper new technologies, these new devices can quickly enter into service. This belief is appealing because it offers hope for quick and cheap solutions. It is also appealing because many engineers believe that the needed technologies already exist. Energy efficiency, for example, is widely believed to be a readily available option for making deep cuts in emissions at no cost. The reality is that much of the exciting potential for using energy more efficiently is not presently practical because the needed technologies are not yet married to how real firms and households make energy decisions. Technological transformation is a slow process because it depends on a lot more than engineering. New business models and industrial practices are needed. The more radical (and useful in cutting the use of fossil energy and CO₂) the innovation, usually the greater the technological and financial risks. Putting those innovations into practice hinges on creating the policies and business practices to manage the risks – especially financial risks – that accompany new technologies. Even when those policies are written in treaty registers and in national laws and regulations, firms that invest in new technology and practices must believe they are credible.

Pretending that engineering innovation is the key step leads to policy goals that are overly ambitious and divorced from the realities of what determines whether these new technologies will actually enter into service quickly. The engineer’s myth also allows governments to avoid grappling with the kinds of technology policies that will be needed to make a difference. Innovation is relatively easy; creating the policy environment to encourage the testing and adoption of innovations is almost always the weak link.

That’s the second step in my book. It clears away false models of the policy process and lets us focus on what really works. The first step laid bare the essence of the warming problem; the second step helps clear the landscape of confusing ideas. The rest of the book builds a new vision.

Step 3: regulating emissions

The third step in the logic is the most important. Slowing global warming requires a big reduction in emissions of CO₂. Achieving that goal will require international coordination. Before I focus on how to make effective international coordination, I must look closely at what individual national governments are willing and able to implement. That is the task of Chapters 3 and 4.

Oddly, most studies of international coordination on global warming ignore national policy and treat governments as “black boxes.” Few analysts of international policy peer inside the box to discover how it works; most just imagine that the national policy process will behave as needed once people have political will and international commitments have been adopted. Black boxing national policy is convenient because it makes it easier to focus just on the simpler and sexier topic of international diplomacy. Such studies start by imagining various ideal mechanisms for international coordination and then expect that the black boxes will follow along with implementation.

The reality is that the black boxes are prone to produce certain kinds of policies. Ignoring those tendencies raises the danger that international coordination will become divorced from what real governments can implement at home. These dangers were not much apparent in the early years of global warming diplomacy because international agreements weren’t very demanding. The black boxes could comply without doing much beyond what they would have done anyway. But as governments have tried to tighten the screws on emissions of warming gases, a huge gap has opened between the agreements that diplomats are trying to craft at the international level and what their own governments can credibly implement at home. That gap produces gridlock. It lowers confidence that international law is relevant, and as confidence declines governments become less willing to make risky, costly moves to regulate emissions. In the extreme, the result are agreements such as the Copenhagen Accord – legal zombies that have no relationship to what governments will actually implement yet are hard to kill or ignore. Crafting a more effective system of international coordination requires a vision for how to avoid such international outcomes.

The third step builds a simple theory of national policy. Politically viable policies to control emissions must avoid imposing high costs on

politically well-organized large groups and also avoid making high costs evident to poorly organized but potentially dominant groups, such as voters. Policies that are politically viable will therefore not be identical with policies that are economically optimal, and in some cases the dispersion between the viable and the optimal will be huge. Armed with that theory, later in this book I will outline a new vision for international cooperation that is more likely to mesh with policies that real governments can adopt at home.

My starting point is power, interests, and capabilities. Power tells us which countries really matter and must be engaged in coordination. Interests reveal what those countries will be willing to do. And capabilities are what they are actually able to do.

In global warming, state power is first and foremost a function of current and future emissions. China and the United States are the most powerful countries on global warming because they have the largest emissions and thus the greatest ability to inflict global harm and avoid harm through their actions. Although the United Nations (UN) officially registers 192 countries on the planet, when it comes to emissions only a dozen or so really matter. I show those big emitters in Figure 1.1. Eventually, all governments will need to play a role in controlling emissions because even the big emitters will be wary about adopting costly policies if small countries become pollution havens. China, for example, will not be keen to control its emissions if the outcome is much higher costs of doing business in China and investments (along with jobs and incomes) “leak” to Vietnam, Thailand, Malaysia or other countries that would become more formidable economic competitors without the burden of costly emission controls. But getting started on controlling emissions requires a vision that is connected to the reality of how the most powerful countries – the biggest emitters – might actually control emissions at home.

Whether big emitters actually control emissions is a function of their interests and capabilities. The full list of factors that determine interests is long, and scholars should spend more time trying to explain and predict the variation in national interests. Some countries are highly vulnerable to global warming, such as the low-lying island states; others, such as frigid Russia, are less worried or might even welcome a thaw. Rich countries are usually more worried than poor ones because wealth brings the luxury of focusing on more than just immediate survival. Democracies seem to be more concerned

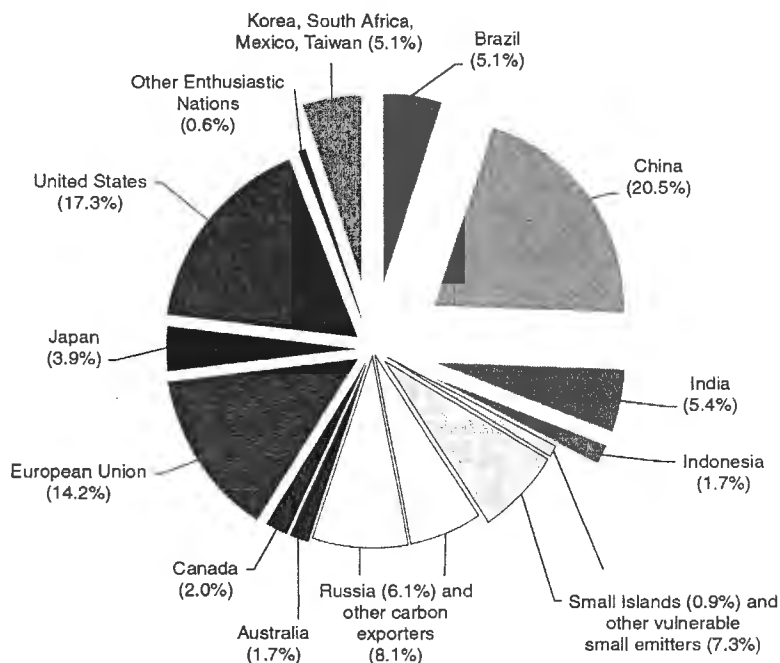


Figure 1.1 National interests and emissions

The figure shows the most recent complete inventory for emissions of CO₂ from burning fossil fuels and changes in land use. “Enthusiastic” countries are shown in black. “Reluctant” nations are shown in dark grey. Together, those twelve countries (treating the EU as one) account for 77 percent of emissions. Excluded from that group is the very large number of small countries (mainly low-income, developing countries) and countries that are large carbon exporters and under little public pressure to regulate emissions, such as Russia and the largest OPEC members. This data set includes full data for CO₂ emissions from fossil fuels drawn from the Carbon Dioxide Information and Analysis Center at Oak Ridge National Laboratory (Boden, Marland, and Andres 2010) augmented with nationally reported data on emissions (and sinks) from land use (including forestry and agriculture) as reported in official emission inventories (see www.unfccc.int and also UNFCCC 2010b). The land use data are 2006 for UNFCCC Annex I countries (i.e., industrialized nations); for non-Annex I countries land use data are 1994 except Mexico (2002) Korea (2001), and Kazakhstan (2005); failures to report data by Angola, Iraq, Kuwait, Libya, and Qatar led me to exclude those countries from the analysis.

than nondemocracies because the ability to organize interest groups and a free press are empowering to NGOs that carry the messages about warming dangers to people and governments around the world. Parliamentary systems are often more energized about warming than presidential governments when green parties become members of ruling coalitions. A nation's interests also depend on what it thinks other countries will do. If one country thinks that emission controls at home will inspire other nations to follow suit it will be more keen to make the move. My home state of California is on the cusp of adopting costly state controls on CO₂ with that theory in mind. A full-blown theory of national interests would need to look at all such factors.

In this book I get started by dividing the world into two categories: *enthusiastic* and *reluctant* countries. Enthusiastic countries are willing to spend their own resources to control emissions. These countries are the engine of international cooperation. The bigger that group and the more resources they are willing to spend on controlling emissions, the deeper the cuts in global emissions. Some of the troubles with global warming diplomacy during the last two decades simply reflected that the group of enthusiastic countries was pretty small and consisted of little more than a few EU members and Japan. But that group is getting bigger and now includes the US and essentially all members of the OECD. Not all these countries have the same interests, of course. What the US is willing to do is a lot more modest these days than the French, German or British effort. And what countries actually do is often not formally labelled climate policy. The US has struggled with national political gridlock on a federal global warming policy, but through direct regulation and many state policies it is making an effort – albeit one that falls short of what it should pursue.

The reluctant nations, such as China and India, also matter. They are already big emitters, and most studies suggest that such countries will account for essentially all growth in future emissions.³ Because these countries don't put global warming high on the list of national concerns, they won't do much to control emissions except where those efforts coincide with other national goals. Outsiders can change how these countries calculate their national interests by threatening penalties such as trade sanctions or offering carrots such as funding for investments that lower emissions. Outsiders can also provide information on global warming dangers, which will (in time) help reluctant

countries see their interests differently. A country whose government and NGOs are better informed about the perils of unchecked climate change will be more likely to mobilize for change – especially if there is an international framework that would allow their national efforts to be magnified through efforts by other big emitters.

The capabilities of governments to regulate emissions is highly correlated with interests. In general, the enthusiastic countries have well-functioning systems of administrative law and regulation and can control all manner of economic activities within their borders. In reluctant nations those systems are generally much less well developed. Typically in the reluctant countries some sectors are under tight administrative control and others beat to their own drummer.

Chapter 3 develops a theory to predict how enthusiastic countries will regulate emissions. They could use market-based strategies, such as emission taxes or “cap and trade” schemes. Or they could use traditional regulation that, for example, forces companies, farmers, and consumers to utilize particular technologies and practices that reduce emissions. I will show in Chapter 3 that the most likely outcome is a hybrid of emission trading and regulation. Emission trading systems are attractive because they create extremely valuable assets (emission permits) that can be awarded to politically well-connected interest groups. Once the initial awards are made, those same groups become a powerful lobby to keep the system in place. Where these lobbies are well organized to manage a market that channels resources to themselves and prevent new entrants, emission trading is the policy instrument of choice. Where regulated firms have close ties to their regulators, then direct regulation better suits their political interests. Many environmental NGOs also like regulation because that approach makes it easier to hide and shift the cost of policy. The political viability of policies rises when the cost can be imposed on groups that are highly diffused and often unaware of what they are paying.

Within this broad range of hybrid outcomes, every nation will make a different choice because each government faces differently arrayed interest groups and different relationships between organized group and government. I will call these hybrid outcomes “Potemkin markets” because on the surface they often look like emission trading markets solutions yet are designed, exactly contrary to the principle of markets, to hide the costs of action and to channel resources only to well-organized groups. This is a prediction of what governments will actually do and one that I will test with evidence. It is not an argument

that Potemkin markets are good economic policy. In fact, as a policy analyst, I find that outcome deeply unsettling.⁴ A simple economy-wide cap and trade program would be more cost-effective than a big dose of regulation. Even better would be a simple economy-wide emission tax. But ideal visions for policy often clash with political realities. Chapter 3 predicts that clash. It also suggests that international accords must be designed with flexibility for governments to adopt different kinds of Potemkin markets since that untidy outcome is unavoidable.

Chapter 4 develops a theory to predict how the reluctant nations will approach emissions controls. My argument is that reluctant nations, so far, haven't done much to control emissions for two reasons. One is that the enthusiastic nations have dithered in creating carrots and sticks that will convince these countries to see the world differently. The biggest existing carrot is the Kyoto Protocol's Clean Development Mechanism (CDM), which is badly administered and creates perverse incentives for reluctant nations to avoid serious emission controls. Sticks, such as border adjustments and trade sanctions, are barely used at all. Better sticks and smarter carrots are needed. The second argument is that much more can be done to encourage these countries to implement policies that satisfy local goals, such as energy security and lower local pollution, while also fortuitously reducing emissions of warming gases. In Chapter 4 I look at a sample of such opportunities, such as the deployment of more efficient technologies in coal-fired power plants, fuller use of natural gas (which has much lower emissions than coal), and better management of endangered forests.

The idea that there are huge "win-win" opportunities is hardly new. Like other studies, I put numbers on the emission reductions to show just how much warming can be avoided by getting serious about this opportunity. (The numbers are huge.) Oddly, the existing literature is largely silent on the question that matters most for policy: which "win-win" opportunities that exist in theory will actually be feasible in the real world?⁵ There are lots of things that governments can do in an imaginary world of perfect information, foresight, and ability. But the real world is different. In this book I offer a framework for determining which "win-win" policies the reluctant nations will be willing and able to implement and a vision for how outsiders can help them do more.

Often, "win-win" policies aren't pure winners on their own merits; they require outsiders to help with financing, technology, diplomatic support or other assets. The problem is that the existing sticks and carrots are nearly always irrelevant to encouraging countries to

implement these kinds of policies. Notably, the CDM encourages governments and investors to find marginal projects whose exact impact on emissions is easy to measure. Yet the biggest opportunities for “win-win” policies are those where the emissions impact is hardest to predict and where no rational CDM investor will tread. (Nor does it help that many CDM projects have no impact on emissions, which floods the market with cheap CDM credits and discourages more costly investments that could actually make a difference.) A different system is needed. Rather than thousands of small CDM projects, efforts to engage the reluctant countries should focus on a small number of huge opportunities where there is large leverage on emissions and where the opportunity aligns with the administrative abilities of the host government. A reformed CDM can play a subsidiary role, but the real diplomatic effort should focus where leverage is greatest. Reluctant countries should compile their opportunities, declare the external resources they will need for each, and let enthusiastic countries compete for the privilege of playing a role.

Eventually the reluctant nations will have to do more and spend their own resources on emission controls, but a big effort to seize “win-win” opportunities is the right way to start. Not only will it make a dent in emissions, but it will also establish a track record of credible engagement that will be needed for the future when global warming politics will get a lot tougher to manage and stiffer incentives will be needed – including bigger sticks to punish recalcitrant nations. In global warming, like most areas of international diplomacy, it is better to lead with positive engagement before bringing out the big sticks.

Chapters 3 and 4 lead to one simple conclusion about emission controls. The tighter the screws on emissions the harder it will be to plan regulation according to exact targets and timetables. And the tighter the screws the more that efforts by one government will depend on what others do as well. This helps explain some of the gridlock from Kyoto to Copenhagen. International negotiations have been organized mainly to encourage governments to coordinate around emission targets and timetables. But no government that is serious about making credible promises actually knows the emission levels that will emanate from its economy.⁶ The insights from Chapters 3 and 4 suggest that international cooperation should be designed differently. It should revolve around what governments can credibly promise to

implement. Moreover, cooperation should elicit contingent promises – that is, governments should outline what they will do on their own merits as well as the schedule of additional efforts they will adopt if other governments make comparable efforts. The theories about national policy in Chapters 3 and 4 can guide serious efforts to design international cooperation that meshes with what governments will be willing and able to implement at home. That’s step 3.

Step 4: investing in innovation

Steps 4 and 5 are detours. I include them in this book because ignoring them leads to a global warming plan that doesn’t work over the long term and leaves the planet highly vulnerable.

Step 4 deals with technology. As the cost of emitting CO₂ rises and as regulations tighten, companies and governments will know that they should find technologies that can lower the cost of compliance. Those built-in incentives for innovation go a long way, but not far enough. Really deep cuts in emissions will require radically new technologies but few companies can justify spending the resources on that kind of innovation because the benefits are so uncertain and difficult to internalize. So an active “technology policy” is needed.

Getting started on technology policy requires focusing on the countries that matter most. Luckily, that list is short: about 95 percent of the world’s innovative activity occurs in only ten countries. A big push is needed not only within these countries but also through collaboration between those governments. Increasingly, the market for technology is global. Good ideas in one country diffuse quickly, which means that individual countries will under-invest in new technology unless they are confident they can create new markets for innovation around the world. In the past there has been almost no serious international collaboration on technology policy. Chapter 5 offers some models for doing that and also looks inside the national systems of innovation in a few of the most important countries. As with emission controls, I show that how every country tackles the innovation challenge is likely to vary with its own national circumstances. Even more than with emission controls, the innovative process does not lend itself to strict targets and timetables; outputs are unpredictable.

Technology policy has become a poor cousin of serious efforts to slow global warming. Nearly everyone agrees that massive innovation

is needed.⁷ Oddly, very few studies actually examine the question that matters most for policy: how to design a big push on innovation. A growing number of advocates call for a “Manhattan project” on global warming but that model is exactly wrong for global warming. In the Manhattan project, the US crash program to develop nuclear weapons, there was just one customer (the US military); commercial competition was irrelevant and costs were no object. “Putting a man on the Moon,” another common refrain, followed the same model and is equally poorly suited for global warming. These are inspiring goals that signal the scale of the needed effort, but they are terrible metaphors for policy. Almost as dangerous are wild ideas for quickly and radically increasing R&D spending without any serious plan for how new money can be spent well. Ramping up spending too quickly will just raise the price of R&D without much affecting what really matters, which is innovative output.

Getting serious about technology policy starts with realizing just how dreadful governments have been over the last generation. From the early 1980s through 2008 world spending on energy technology innovation appears to have plummeted. There’s been an uptick since 2008, notably in the US, but most of that mainly reflects a huge pulse of “stimulus” money that will soon disappear as governments grapple with their fiscal poverty and struggle to provide funding to other national projects that are politically more popular. As this blip in funding fades, what should be done? I argue that good answers to that question have been hidden by a series of fallacies about technology policy. One fallacy is that government is unable to do the job because it will squander resources on white elephants rather than the viable technologies. A second fallacy is that carbon markets will encourage and pay for technology innovation. In Potemkin markets, well-organized interest groups make sure there isn’t much money left over for other purposes; they channel most of the resources to themselves and vest it mainly with incumbent technologies. And carbon prices are so volatile the special grants of emission credits don’t have a value that is reliable enough over the long term to finance the slow commercial gestation of new technology.⁸ The only serious way to fund technology innovation is with reliable funding, mainly from government, and credible guarantees that new technologies will find viable markets if they perform well. In the US, especially, there has been a historical wariness about technology strategies because it is often assumed the nation’s record with government-led energy innovation is a string of

unmitigated disasters. The real record is actually a lot better than commonly assumed, and looking outside energy there are many other useful models where the track record is even better. Government is essential and its track record with technology policy is encouraging. Dangers loom, of course, because an active technology policy can also become industrial policy. The right models – with clear sunrises and sunsets – can help avoid those well-known pitfalls.

Economists argue that technology policy is needed to overcome a market failure. That is true, but an equally important role for technology policy is to help manage a political failure. Governments underinvest in innovation because innovators are usually political orphans. Nearly always, the invention of a radically new way of doing things arrives on the scene with no natural political constituency. And the innovation creates many incumbents who are politically well organized and unfriendly to change. Technology policy helps fix these problems; it also helps build confidence that emission controls won't be impossibly costly to implement. All that reinforces the central task for policy, which is the adoption of credible emission controls that will pull new technologies into the market.

I suggest in Chapter 5 that the problem of political orphans is getting slightly easier to solve for two reasons. One is the growing interest in green jobs – an area where politicians are making reckless claims about the prospects for job creation, but those claims help build a political coalition that so far has been supportive of spending on low-carbon innovation. The other is the possible merging of information technology (IT) with energy. The innovation model in IT and a few other areas such as biotechnology is based on “blockbuster” inventions – that is, new ideas that spread rapidly and generate massive returns to innovators. The belief that energy is shifting to that mode of innovation makes it somewhat easier for private firms and governments to mobilize the resources needed for energy innovation. These are political arguments; whether a new dawn of green jobs or the integration of IT with energy are actually real remains to be seen. (I think most green jobs claims are largely baseless, and I doubt it will be easy to measure “green” versus “brown” job creation.) Politically, though, such arguments are changing the landscape and making it easier to muster the political support for innovation policy.

That's step 4. A technology policy is essential to overcoming market and political failures. But it won't happen without good models for how government can be most effective.

Step 5: bracing for change

Step 5 is my other detour. Even a serious effort to control emissions is unlikely to stop global warming. The climate system and the energy system that emits CO₂ are big, complicated systems that are laden with inertia. They are pointed in the wrong direction, and they won't change course easily. Worse, so far the most important emitters haven't created a viable international scheme to coordinate policies to cut warming gases. Once such a system is in place the benefits of slower warming will be felt only after perhaps twenty years of sustained effort and another few decades will be needed actually to stop warming. Even more time will pass before the stock of CO₂ declines decisively from its peak and warming abates.⁹ (However, technology wildcards, such as devices that can remove CO₂ and other warming gases directly from the air, might indeed accelerate the ability to stop and reverse warming.) These timetables will be seen by experts, who have invested heavily in efforts to set "safe" goals for warming such as limiting warming to 2 degrees, as too pessimistic. My sense is they are about as fast as serious regulatory and technology deployment efforts will run. And this optimistic scenario assumes that governments actually launch serious, prompt efforts to control emissions and invest in new technologies.

Even under the best scenarios the world is in for probably large changes in climate. Chapter 6 looks at how societies can brace for the changes. For many years, this subject was taboo in most circles because many of the most ardent advocates for global warming policy feared that talking about the need to prepare for a warmer world would signal defeat. Worse, it might signal that warming was tolerable, and that might lead governments to lose focus on the central task of regulating emissions. It is much sexier to imagine bold schemes that stop global warming rather than the millions of initiatives that will be needed to cope with new climates. Yet the unsexy need to brace for change is unavoidable.¹⁰

Humans are intelligent and forward-looking, and those qualities make them adaptive to a point, so long as they can anticipate the needed changes and have the resources required to adjust. Farmers, for example, can plant different seeds and switch to new crops. Real estate markets can adjust to the likely effects of rising sea levels and stronger storms that could inundate ocean-front properties. Water planners can anticipate rainfalls of different levels and variability.

The central role for policy is to lubricate these natural human skills in adaptation. More timely information about climate impacts can help; more efficient markets for scarce resources such as water can be created; funding for infrastructures that are less sensitive to changing climates can be mobilized. For rich, capable societies, success in adaptation is hardly guaranteed but at least it is a familiar task.

Much tougher issues arise in less wealthy countries where climate-sensitive agriculture dominates the economy and people are already living on the edge. Small changes in climate can have a big human toll.

When I began this book project I expected to conclude that rich countries, which are most responsible for climate change, should create huge funds to help poor countries adapt. Instead, I have arrived at a much darker place. Such efforts are well meaning, but they are unlikely to make much difference. Adaptation does not arise as a discrete policy. It comes from within a society and its governing institutions, and there is very little that outsiders can do to help. Most so-called “adaptation projects” – for example, building sea walls or creating a national weather service to provide farmers with more useful climatic information to help them adapt – make no sense unless implemented within institutions that can actually deploy and utilize these resources efficiently. I’ll call these adaptation-friendly contexts. One of the hard truths about global warming is that these contexts are self-reinforcing. When they exist, the list of discrete adaptation projects where outsiders can be helpful is short because societies invest in adaptation on their own. When these contexts don’t exist adaptation spending isn’t very useful. Readers will recognize this problem as analogous to the problem of economic development. Foreign assistance for development can be extraordinarily important when applied under the right circumstances, but only a subset – perhaps a small subset – of countries actually enjoy those circumstances. The same is true for adaptation.

The Copenhagen Accord includes promises of massive new funding for adaptation, and it appears that most of those promises will be broken. More money can assuage guilty feelings that rich polluters feel, having imposed climate harms on poor societies that already have enough troubles. But more money, alone, probably won’t do much to make those countries less vulnerable and to boost their welfare. I devote a large space in Chapter 6 to checking whether this insight is correct, and I think it is robust. It raises troubling questions of international justice. So far, most of the theories of international justice

that have been applied to the climate problem have focused on how to divide the burden of controlling emissions; they have not much grappled with the more practical and immediate challenge of how the rich industrialized societies that are most responsible for the build-up of warming gases can help the most vulnerable societies cope with these inevitable changes in climate. My answer is that the rich countries need to be more diligent in controlling their emissions while, in tandem, working harder to facilitate adaptation-friendly contexts across the developing world. In practice, creating those contexts means investing more in economic development rather than focusing solely on adaption. All of that is hard to do and in many developing countries, if not most, won't work perfectly.

If the news about adaption for humans is dark, the news for nature is even more troubling. Unlike humans, nature responds to changing circumstances mainly through natural selection. That means that a changing climate is likely to bring a lot of extinction to species that are already living on the edge while promoting hardier plants and critters such as weeds and cockroaches.¹¹ The impacts will be felt not just in individual species but whole ecosystems. Avoiding these unwanted outcomes will require a more active human hand. Because humans can look ahead and behave strategically they can implement projects such as installing corridors between ecosystems so that plants and animals can more readily march to more favorable climates. Through such efforts, humans might help steer nature away from unwanted nasty outcomes. If climate changes in extreme ways this will turn humans into zookeepers. Huge areas of wild landscapes will be put under environmental receivership, and managing them will require human handling on a scale never imagined. Doing all this across nature will probably cost a lot more than people are willing to pay, and in many ecosystems human management may be worse than letting nature sort itself through the Darwinian method. The need for triage will appear. So far, barely any such discussion is under way.¹² The last century has seen a sharp rise in international funding for nature, much of it managed by NGOs and focused on preserving gems of nature. In a world of changing climates, these NGOs will be on the front lines of nature's triage. They will probably have a difficult time accepting this mission because zookeeping and triage run counter to their core historical missions, which center on protecting nature in its original state. The most successful international nature

NGOs are steeped in a culture of protection – they buy lands, create parks, erect fences where possible, and do their best to keep humans away and to lighten the human footprint. Triage will require more or less the opposite strategy.

If all that isn't dark enough, I also look at some worst case scenarios. Barely a month goes by without a publication of new research suggesting that climate could change more rapidly than previously expected. Once such changes are under way the effects on things that matter could be more horrendous than earlier thought. The unknown unknowns of global climate change might hold pleasant surprises or horrors. The evidence at the horror end of the spectrum is mounting.

Thus I also argue that bracing for change also requires readying some emergency plans. Those will include intervening directly in the climate to offset some of the effects of climate change, which is also known as "geoengineering." Volcanoes offer a model, for their periodic eruptions spew particles into the upper atmosphere that cool the planet for a time. Man-made efforts along the same lines might include flying airplanes in the upper atmosphere and sprinkling reflective particles that might crudely cool the climate.¹³ So far, most of the public discussion about geoengineering treats the option as a freak show of reckless Dr Strangeloves tinkering with the planet. Yet it is hard to digest the most alarming scenarios from climate science without concluding that serious preparations are needed on the geoengineering front. I argue for a research program in this area so that some of the most viable options can be tested. I also argue that such a program needs to follow special rules such as transparency, publication of results, pre-announcement of tests, and careful risk assessments that focus on the possible side effects. That approach is needed so that if governments ever get to the stage where they might actually deploy geoengineering systems, a set of norms and practices are in place about how to treat these technologies. There are two big dangers with geoengineering. One is that the technology will be so controversial that the countries with the best scientists don't invest in testing the options responsible and readying them in case of need. The other is that a desperate country will launch geoengineering without preparing for the side effects. A dozen or so nations probably already have the ability to deploy geoengineering and the list is growing. A race is on between building a responsible research program that can lay the foundation for good governance of geoengineering technologies and

the desperate “hail Mary” pass of a country that can’t stomach the extreme effects of warming and is disillusioned with the lack of serious efforts to stop global warming through regulation of emissions.

Step 6: a new international strategy

The sixth and final step in the logic of this book is a redesign of the international diplomatic strategy. It will seem odd in a book that is about overcoming the gridlock in international diplomacy to wait so long before a new diplomatic vision arrives fully on the scene. But I have started this book with a detailed look at national policy because international agreements that don’t align with national interests and capabilities are unlikely to be effective.

I take on this task in two stages. First, I explain why diplomatic efforts so far have led to gridlock. My argument is that the diplomatic toolbox used over the last two decades is the wrong one for the job. That toolbox comes from experience in managing earlier international environmental problems, which have little in common with the costly, complicated regulatory challenges that arise with warming gases. I show in Chapter 7 that all of the canonical elements in that toolbox are wrong for global warming. Those elements include global agreements, which diplomats cherish because they believe they are more legitimate than smaller more exclusive accords. They include binding treaties, which most analysts wrongly think are more effective because governments always take binding law more seriously. And they include emission targets and timetables, which are a mainstay of environmental diplomacy because most diplomats and NGOs think targets and timetables are the best way to guarantee that governments actually deliver the environmental protection they promise. These conventional wisdoms are so ingrained in environmental diplomacy that Chapter 7 offers a new history of international environmental protection and shows why nearly all the canon of conventional wisdom in this area is wrong for the problem of global warming.

Chapter 8 offers an alternative. It starts with one central insight: effective international agreements on climate change will need to offer governments the flexibility to adopt highly diverse policy strategies. Instead of universal treaties, I suggest that cooperation should begin with much smaller groups – what international relations experts often call “clubs.”¹⁴ It should begin with nonbinding agreements that are

more flexible. And it should focus on policies that governments control rather than trying to set emission targets and timetables since emission levels are fickle and beyond government control. Cooperation challenges of this type are rare in international environmental diplomacy, but they are much more common in economic diplomacy where governments often try to coordinate their policies in a context where no government really knows exactly what it will be willing and able to implement. The closest analogies are with international trade and the model I offer draws heavily from the experience with the GATT and WTO. Chapter 8 explains how a system for global warming based on that model would work.

The backbone of this new approach would be a series of contingent offers. Governments would outline what they are willing and able to implement as well as extra efforts that are contingent on what other nations offer and implement. Negotiations within the club would concentrate on the package of offers that are acceptable to participating nations. By working in a small group – initially about a dozen nations or fewer, as suggested in Figure 1.1 – it would be easier to concentrate on which offers were genuine and to piece together a larger deal that takes advantage of the contingencies. As individual countries gain confidence that others will honor their commitments then they, too, will be willing to adopt more costly and demanding policies at home. As part of this process, enthusiastic nations would also scrutinize the many opportunities for “win-win” emission policies in reluctant nations and offer resources to those that were most promising. A system of bids by those countries would make the range of opportunities more transparent and would encourage enthusiastic countries to compete for the best opportunities.

Deals created in this small group would concentrate benefits on other club members – for example, a climate change deal might include preferential market access for low-carbon technologies and lucrative special linkages between emission trading systems in exchange for tighter caps on emissions. Concentrating benefits on other club members will create stronger incentives for participating governments to deepen their cooperation. Focusing cooperation on contingent offers will help each club member see its efforts multiplied, which will help ensure that the offers are not too modest. In time, this approach of offering benefits that are exclusive and contingent will make club membership more attractive to potential new members. Such club

approaches often fare better than larger negotiations when dealing with problems, such as global warming, that are plagued by the tendency of governments to offer only the lowest common denominator. Clubs make it easier to craft contingent deals and channel more benefits to other members of the club, which creates stronger incentives for the deals to hold.

This system of bidding, negotiation and crafting of contingent deals has an analogy in the process of accession that governs how countries join the WTO, that makes is useful for global warming diplomacy. I call the agreements that could result from this system "Climate Accession Deals," or CADs.

The logic of diplomacy in small clubs underpins many efforts and proposals in recent years to focus on warming policy in forums that are smaller and more nimble than the UN. Those include the G20, the "Environmental 8," the Major Economies Forum on Energy and climate (MEF), and similar ideas.¹⁵ These are all good ideas; what is missing is a strategy that will make such smaller forums relevant. Governments that care most about slowing global warming need to invest in these small forums and focus their efforts on creating benefits that will entice other governments to do more. I am cautiously optimistic that such club approaches will regain favor in the wake of the troubles at Copenhagen, but I am not blind to the power of conventional wisdom. The conventional wisdoms that have created gridlock on global warming remain firmly in place and are hard to shake. Creating a club that works will require leaders who will make the first contingent offers that create incentives for other countries to act. The EU has not been a leader on this front because it is overly invested in the UN approach. Japan has not because it is too timid to swim against the current of conventional wisdom. And the US has not played the leader role because what America says these days on most matters is so volatile that it is not seen as credible. A smarter EU, a more credible US or a big move by China or India could be very helpful. And this book suggests what those leaders could do to make their efforts relevant.

Clubs are a way to get started, but they aren't the final word. Eventually the clubs must expand. Indeed, the global UNFCCC will remain as an umbrella under which many global efforts unfold. The advantage of starting with a club is that the smaller setting makes it easier to set the right norms and general rules to govern that

expansion. In practice, this will be a lot easier than it seems because international emission trading can be a powerful force working in the same direction. With the right policies, the international trade in emission credits creates a mechanism for assigning prices to efforts. It rewards countries with strict policies by giving higher prices to their emission credits. Over the history of the GATT/WTO, the most powerful mechanism for compliance was the knowledge that if one country reneged on its promises, others could easily retaliate by targeting trade sanctions and removing privileges to punish the deviant. With the right pricing policies, emission trading could provide similar kinds of incentives. Making CADs contingent on similar behavior will create additional incentives for compliance.

There is no shortage of institutions already working on climate change. What's missing is a strategy focused on getting countries to make reliable promises about what they can and will implement. The central diplomatic task in the coming years will be to couple those national promises to the efforts that other nations will undertake so that, over time, each major country sees growing incentives to implement more effective policies to control emissions. In this book I draw on models from international economic cooperation where such diplomatic challenges are much more familiar. Indeed, the challenges that climate diplomats face today are analogous to those that have defined much of the history of international efforts to create a rule-based system for advancing international trade. Those same models are the best guides for getting serious about global warming.

The future

This chapter has summarized the main logic and central arguments of this book, and thus I do not include a conventional conclusion that rehashes the argument once again at the end of this book. The global warming problem is a complex one and the solutions offered here are complex as well. It is more useful to have the conclusion at the beginning so that it is easier to see how the pieces fit together as the book proceeds.

Instead of a conclusion, the final chapter of the book speculates on the future. As governments get serious about controlling emissions their efforts will have far-reaching implications for diplomacy, commerce, and the organization of government. The emergence of a serious regulation

to regulate warming gases may also affect how international relations theorists think about the international order. Chapter 9 explores several of the implications that are likely to be more important.

First, I speculate on the implications of my argument for the UN. The UN has had some hard knocks in recent decades – many of them at the hands of American politicians. This book won't be helpful on that front, for it suggests that the UN is ill-suited to take the starring role on the flagship issue of our era.

Ever since UN talks began on the global warming issue analysts have debated whether UN-sponsored deals – the UNFCCC, the Kyoto Protocol, and the process that limped through the Copenhagen Summit – have been good or bad. My view is that those deals have been largely irrelevant. The UN style of diplomacy is not structured in a way that will deliver much leverage on emissions of greenhouse gases in either the enthusiastic or the reluctant nations.¹⁶ It is steeped in conventional wisdoms about how to manage problems that are not aligned with the fundamental attributes of the pollutants that cause global warming. These are not criticisms of the UN, however. The institution is struggling to address a problem that an open, global forum is unable to tackle. The fault lies not with the UN but with the governments that are keen to address the warming problem and have failed to work seriously on alternative approaches that would be more effective.

For too long, governments that care the most about global warming policy have also worked the hardest to protect a UN monopoly on climate diplomacy. Monopolies are especially dangerous when the best strategy is unknown. In every area of the international process on global warming – from crafting commitments by the enthusiastic nations to engaging the reluctant nations to investment in technology to adaptation – there is no consensus on what will work best. In commerce, the solution to such problems is diversity and competition, and the same lesson holds for diplomacy. This suggests that the best role for the UN is as an umbrella under which many different experimental efforts flourish and compete. The ones that succeed will attract diplomatic and industrial resources; the others will wither. And it suggests that the UN itself will become much more effective as an institution if it faces competition. One of the areas where more market competition is especially needed is in international trading of emission permits, for more competition and experimentation in that setting could shift

power away from the UN-based system (the Kyoto Protocol's CDM) and back to nations that have much more reliable control over their markets and a stronger incentive to ensure that markets are actually performing as expected. The result will be markets that are more fragmented yet much better at sending signals about which regulatory strategies are actually working. Chapter 9 explores not just what that means for the UN but also how this market-oriented way of enforcing international obligations will determine which countries have the greatest power and influence over climate negotiations.

Second is the organization of industry and its relationship to government. Deep cuts in emissions – on the scale outlined earlier in this chapter as a best case scenario for emission controls – imply the need for a massive reorientation of energy systems. The pattern of investments needed to obtain that outcome is likely to involve massive financial risks, for most of the technologies needed are not proven at scale, are not yet competitive with incumbent technologies, and will not automatically achieve widespread deployment at carbon prices that are likely to be tolerable. Investors will seek special incentives to make these risks tolerable, and the role of government in the industrial economy could rise sharply. So far, every country that has made serious efforts to control emissions has done so with extensive intervention by government in the industrial economy. Most other tasks that will be needed for climate protection also imply bigger roles for government. For example, the creation of emission trading schemes will require systems for monitoring and enforcing trading, which will require strong national legal and administrative systems.

Serious efforts to address warming gases will require much more capable governments. And those nations with a tradition of capable, intrusive governments may thrive especially well in this world. China, for example, may do well in these circumstances. India, by contrast, is less well poised to intervene in its economy in nimble ways, although a broad array of reforms under way will improve in time the Indian government's administrative abilities. Most of Africa is poised to do poorly.

A much larger role for government in the economy will reopen a long-standing debate over the merits of different systems of economic organization. State-led systems such as in Japan may find the world of government and industry working together closely a familiar one. For the United States this role for government is much less familiar and

politically more toxic. In the early 1970s, at the onset of the last big rise in social regulation, economists warned that regulation does not only serve social purposes but it can also be used by firms to frustrate competition.¹⁷ Those same worries deserve airing today.

In an ideal world government would set clear and credible emission policies and leave industry to invest in many different rival approaches. But governments often find it very difficult to set credible, long-term rules. One of the chief functions for international institutions in this area will be to help national governments become more credible, such as by making policies more transparent and enforceable and by helping governments craft interdependent deals that will be harder for any particular nation to abandon even when those deals prove inconvenient. (Success in the GATT and WTO is rooted, in part, on the ability of these institutions to help governments tie their hands so their promises are more credible.) However, the credibility-enhancing roles for international institutions will take a long time to create. In the short term, my worry is that governments will use direct intervention in industry – with huge subsidy programs and direct control – as a substitute for credible long-term policies. The political logic for that approach is easy to understand, but as a student of regulation who has spent a career worrying about regulatory costs this political expedient outcome carries large dangers for the economy. Looking to the future this tension – between transforming the carbon economy through private market forces or through state-led programs – looms large.

As the long-term viability of state-led programs comes under question then much of the conventional wisdom about the best ways to control emissions will be open for fresh debate. In Chapter 9 I suggest that one area of hopeful questioning will be on the role of carbon taxes. The theory I will offer in this book suggests that carbon taxes would be the best way to control emissions but the worst way to mobilize political support. Emission trading and direct regulation are politically more popular because they allow well-organized groups to create and channel benefits to themselves. But that political logic only helps explain the initial choices of governments. Emission trading – especially international emission trading – is extremely difficult to administer. It creates large incentives for fraud, and if poorly managed it will encourage countries to monetize emission credits and then exit the system after pocketing the proceeds. Tackling those problems will require a new kind of international financial regulation, and it

will also create incentives for governments to shift away from emission credits and toward taxes where it will be easier to manage economic and fiscal outcomes. In Chapter 9 I will outline how that shift may occur and why it is a good idea. (In practice, that shift will probably occur through the inclusion of price floors and ceilings in emission trading schemes, which in theory will combine the political and economic advantages of trading-based and tax-based systems into a single instrument.)

Third, and finally, I note that in many respects, the climate system is already evolving in the direction I advocate – not by design but through default. The UN efforts are stuck in gridlock, and that has left smaller clubs as one of the few places where progress is emerging. While that shift is encouraging, climate strategy by default won't solve the problem of global warming. Making the club strategy work will require active efforts to build institutions and focus on practical policies. So far, there isn't yet much evidence of that kind of heavy lifting. Hopefully this book will offer a roadmap for the countries that care most about slowing global warming to lead the world in doing a better job of actually protecting the planet.