1

Introduction and Overview

Ever since the passage by Congress of the great wave of late twentieth century federal environmental statutes, two competing normative principles have shaped the debate over how federal regulatory agencies should implement the statutory command to protect the environment. On the precautionary principle, regulation of an environmental risk is justified whenever there is some credible scientific evidence of a potentially "significant" risk of irreversible harm to human health or the natural environment. On the competing principle, that of economically efficient regulation, risks to health or the environment should be regulated only if the benefits of a particular regulatory intervention – reducing such significant risks – outweigh its costs – which often include the creation of new, equally significant and equally irreversible risks.

Most of the federal environmental statutes passed by Congress since 1970 have endorsed what may be called a pragmatic precautionary principle. Under such a principle, the existence of a significant risk is enough to trigger regulation but the scope of the regulation and its stringency depend not just on the magnitude of the risk reduction but also the costs imposed. Pragmatic precautionary statutes do not require that federal environmental regulations be justified on the grounds that their benefits exceed their costs. However, by longstanding executive order, agencies such as the federal Environmental Protection Agency must prepare regulatory impact analyses (RIAs) that analyze the benefits and costs of proposed regulations, with such RIAs reviewed by the Office of Information and Regulatory Affairs within the Office of Management and Budget.

With regulations implementing pragmatic precautionary statutes subjected routinely to review on cost-benefit grounds, as the EPA has continually tightened emission standards and broadened the activities and substances covered by such standards over the last several decades, the same story has been repeated over and over again: the EPA defends new regulations as necessary to lower health or environmental risk, and regulatory targets argue that the costs of the regulation outweigh any potential benefits.

Climate change regulation has become the most dramatic instance of the battle between the precautionary call for risk reduction regulation and arguments for

a more balanced consideration of both the costs and benefits of regulation. The field of climate science has since the late 1970s produced studies demonstrating that the increasing concentration of atmospheric greenhouse gases (GHGs) (primarily carbon dioxide, CO_2) in the lower atmosphere (troposphere) may generate future surface temperature increases large enough to cause serious and indeed potentially catastrophic harm to future generations of humans. As most of the increase in atmospheric CO_2 is due to fossil fuel use to produce electricity and power transportation in industrialized nations, such fossil fuel use is easily identified as a target for precautionary regulation. But fossil fuels – coal, oil, and natural gas – are in a very real sense the foundation for modern civilization. As Smil (2017) recounts, everything from modern medicine to the information technological revolution has been built on fossil fuel energy. Actions to end the use of fossil fuels as a source of energy, to decarbonize western economies, are likely to impose costs that dwarf the cumulative cost of all previous, conventional environmental regulations. The precautionary principle says little if anything about how such costs should be weighed in designing policy. But, given the highly uncertain and unpredictable future impacts of rising atmospheric GHG concentrations and the unprecedented cost of reducing GHG emissions, any rational regulatory response to curbing human GHG emissions must surely closely scrutinize the case for decarbonization. The purpose of this book is to provide precisely such an examination.

One response to such a proposed examination is that any such critical scrutiny is unnecessary, the reason being that moving from fossil fuels to various forms of renewable energy – decarbonizing the US economy – is actually not such a big deal at all. As then-Secretary of State Kerry asked rhetorically back in 2014, even if it turns out the climate change risks are lesser than many people fear, "'what's the worst that can happen"[1] from ending the use of fossil fuels? In Part I of this book, I provide an answer. Precautionary US climate policy has already cost lives, damaged the environment, and increased costs for the basic life necessities, such as electricity, in ways that are felt most acutely by the poorest American households.

US precautionary climate policy has had three primary facets: subsidies and mandates for the use of renewable power, common law litigation against CO_2-emitting firms, and federal regulations promulgated during the Obama administration intended to increase the cost of mining and burning coal to generate electricity so drastically that coal-fired power plants would disappear from the US electricity system.

In Chapter 2, I begin my explication of precautionary US climate policy with a discussion of the key cases and the regulatory finding, the Endangerment Finding, that opened the door to Obama administration climate change regulation under the Clean Air Act. I begin in this way because the story of how the Obama administration went about regulating greenhouse gas emissions under the Clean Air Act (CAA) displays all of the major themes in precautionary climate policy. As I summarize in Chapter 2, even after Congress amended the CAA in 1977 and 1990, that law was all

about reducing local air pollutants that were not only annoying but believed to cause increases in mortality. Congress had added a few provisions of the law dealing with international air pollution, and it added an entire Title of the law that implemented the 1987 Montreal Protocol's ban on ozone-depleting chlorofluorocarbon refrigerants (CFCs). But although several bills that would have amended the CAA to actually cover GHG emissions had been introduced over the years, such a bill never passed.

Frustrated by the George W. Bush administration's failure to regulate GHG emissions, a group of states and environmental groups sued, arguing that the CAA regulated GHG emissions and the EPA was legally required to decide whether such emissions endangered human health or welfare. In *Massachusetts* v. *EPA*,[2] the Supreme Court accepted this argument. In an opinion written by Justice Stevens that resonates with fear over imminent doom to America from changing climate – doom supported, he said, by assertions about climate change that federal government climate change science bureaucrats had made in sworn affidavits – the Court interpreted the CAA using techniques of statutory interpretation that for the most part were quite mainstream. To nonlawyer readers, these techniques may well seem bizarre and also surely wrong on a very basic common-sense level: the Court ended up concluding that a statute that regulates air pollution and which Congress had tried but failed many times to amend to also regulate GHG emissions actually never needed to be amended, because it already did regulate GHG emissions.

The Obama administration quickly proceeded to find that GHG emissions were "reasonably likely to endanger human health or welfare." Along with the Court's decision in *Massachusetts* v. *EPA* that CO_2 is an "air pollutant," this finding, known as the Endangerment Finding, opened the door to a raft of Obama-era EPA regulations that required reductions in CO_2 emissions under the CAA. The Endangerment Finding was upheld in court. The finding and its success in court vividly display several of the core features of precautionary climate policy. The finding relied entirely on climate change science assessment reports done by government climate change science agencies, primarily the Intergovernmental Panel on Climate Change (IPCC) and the US Global Change Research Program (USGCRP). The EPA's Endangerment Finding is quite literally a very long summary of such reports, primarily IPCC assessment reports. When a large group of plaintiffs challenged the Endangerment Finding in court, in *Coalition for Responsible Regulation* v. *EPA*,[3] the DC Circuit Court of Appeals engaged in no serious review of the science underlying the EPA's finding. Impressed by what it said was the participation of thousands of scientists from across the world in the production of IPCC assessment reports, that court simply accepted everything that the IPCC said as truth. Moreover, the court said, the word "endanger" as used in the CAA mandates a highly precautionary regulatory approach. Together with the court's own confessed very limited or nonexistent climate science expertise, this "precautionary" standard itself required that the court simply defer to whatever

the EPA said was true (actually what the EPA said the IPCC said was true) about climate science.

As I trace out in subsequent chapters in Part I, the extreme judicial deference given to the EPA's Endangerment Finding – essentially, to the IPCC assessment report that it summarizes – has been the rule, with no exceptions, when the physical, statistical, or social scientific basis for any EPA climate change-related regulation has been challenged in court. Administrative lawyers and legal scholars know this, but I believe that most of my nonlawyer readers do not and therefore this point cannot be overemphasized: federal courts have failed completely to engage in any actual serious review of whether the supposed scientific basis for a climate change regulation is as strong, and typically one-sided, as the EPA (or other agencies) say it is. They do not look to see whether there is any scientific work contradicting what the EPA proclaims to be the scientific "consensus." Even more shockingly, federal judges, who do believe that they have expertise in crafting procedural rules for trials and appeals that are both fair and effective in getting at truth, have virtually never inquired into the procedures by which IPCC assessment reports are produced and disseminated. Instead, judges have uncritically accepted public relations statements about IPCC procedures. This is a complete abdication of the constitutional responsibilities of Article III, life-tenured judges.

Federal judges have punted in this way in reviewing all sorts of federal environmental regulations, and to the extent that they have a justification other than their lack of expertise, it typically is that the statute is "precautionary." By invoking this term, courts are actually invoking the same precautionary principle justification given for a whole raft of environmental regulations across the world. In Chapter 3, I explain the origins of this principle and its application to justify the European Union's ban on hormone-treated US and Canadian beef and to justify the international ban on CFCs. The precautionary principle itself says only that evidence of a serious and irreversible risk justifies regulation of the risk. Although a ban on the risky activity is the most direct type of precautionary regulation, the principle itself contains no guidance on what such regulation should look like. What the principle does say is that even scant scientific evidence of an actual risk can justify both some sort of risk regulation and a program of sustained government expenditure on research into the risk. As a practical matter, precautionary risk regulation depends upon politics. As a stylized fact, advocates of precautionary regulation stress the benefits of such regulation – the dire risks potentially avoided – while tending to minimize the costs. How this plays out in detail depends upon the outcome of what is primarily a political-economic contest between those who believe they will benefit from precautionary regulations and those who bear the costs.

The remainder of Part I therefore provides a detailed account of how American precautionary climate regulation has worked out in practice. I begin with the raft of Obama-era federal regulations targeting coal and cars. The first such regulation was a direct consequence of the EPA's Endangerment Finding, new standards for

automobile mileage. Other regulations soon followed. Regulations promulgated under federal environmental statutes other than the CAA greatly increased the regulatory compliance costs of the coal mining industry, so much that their cumulative effect might well have been to end the industry. New air pollution regulations under the CAA, most importantly regulations requiring decreased mercury emissions, imposed massive new compliance costs on the coal-fired electric power industry. The final set of regulations, culminating in what was called the Clean Power Plan, had the goal of reducing CO_2 emissions from the electric power industry by terminating the combustion of coal to generate electricity.

This assault, explicated in Chapters 4, 5, and 6, caused serious harm. One form of harm was to the US constitutional structure, in which Congress, not the EPA, passes laws. The EPA promulgated regulations so at odds with statutory language supposedly justifying them that it made itself into the legislature. The Supreme Court ultimately rejected some of these arguments. For example, the CAA says that firms emitting more than 250 tons of covered air pollutants have to comply with permitting and certain other emission reduction requirements. But millions and millions of businesses emit more than 250 tons of CO_2 and so the businesses, never before covered under the CAA, would have faced multimillion dollar compliance and permitting costs. This would have politically killed the EPA's attempt to regulate GHG emissions under the Clean Air Act. So the EPA tried just to rewrite the CAA to say that for GHG emissions, the programs only applied to firms emitting more than 100,000 tons per year. In *UARG* v. *EPA*,[4] the Court said that the EPA could not act as the legislature to rewrite the statute. Relatedly, when the EPA said that it could determine that power plant mercury emission reductions were "appropriate" without even considering the cost of such reductions, the Court in *Michigan* v. *EPA*[5] said that such an interpretation was irrational and reversed the agency.

Judicial resistance, however, was spotty, succeeding in slowing the EPA's regulatory grab only when the agency had gone so far in extending its reach that its regulations could not be justified by any plausible reading of the statutes they supposedly implemented. With its auto mileage standards, the EPA, not Congress, put itself in charge of automobile fuel economy. With its Clean Power Plan, the EPA threatened to take control over state electric power systems. Such moves represented an attempt by unelected federal bureaucrats to put themselves in charge of a national system of GHG regulation that they themselves had created, a system that Congress had not established through legislation. The EPA represented the interests of people who perceived themselves to be winners from GHG emission reduction regulations. Consideration of the interests of those harmed by such regulations, which would have found a voice in Congress, are simply not the EPA's job to consider.

True to the precautionary principle, in its rulemakings, the EPA systematically exaggerated the benefits flowing from its congeries of GHG emission reduction regulations while completely neglecting many important costs. The EPA's new

automobile mileage standards caused an increase in the price of used cars and new large, high-powered, and safe cars. Thus the EPA's war on automobile GHG emissions forced the poorest Americans to choose between more expensive used big cars and new small, fuel-efficient cars that had low prices but which, as has long been known, are much more dangerous in a crash with larger vehicles. The EPA's attack on coal-fired power plants meant the closure of hundreds of power plants and the permanent loss of tens of thousands of high-paying jobs in the coal-fired power industry. Added to this was the indirect loss of many more hundreds of thousands of jobs. A large body of work shows that prolonged unemployment increases mortality and reduces long-run future earnings. Yet in the cost-benefit analysis that the EPA is required to do for each of its major regulations, that agency does not attempt to quantify the social harm from such mass, regulation-induced layoffs. With its rules attacking the coal-fired power industry, the EPA not only systematically and massively underestimated plant closures and job losses, but following its standard procedures, did not even attempt to quantify the social costs of job loss.

These regulations evidence the precautionary principle at work. There was never any mystery as to the Obama administration's intent: it was to end the use of coal as an energy source for electric power, and, if possible, to end gasoline-fueled automobiles. With the EPA's promulgation of the Clean Power Plan (CPP) in 2015, this goal became explicit: the Clean Power Plan aimed to eventually convert the entire US electric power system to one based solely on electricity generated by solar and wind farms and hydropower. The CPP anticipated that the EPA would oversee state regulators as they attempted to effectuate this fundamental transformation in the American energy and transportation systems. But the EPA has no experience regulating the electric power industry. States are responsible for such regulation. Moreover, without some economically realistic substitutes available, a ban on ostensibly risky activities that have been as crucial to the US economy and society as coal and cars would have been not only politically unacceptable, but obviously catastrophic.

For this reason, the Obama-era climate change program coupled the regulatory attack on cars and coal with dramatic increases in subsidies for renewable electricity and electric cars. In many cases, these federal subsidies were built upon an already existing federal structure of subsidies for renewable energy that had been passed during the precautionary panic over American reliance on imported oil that arose during the 1970s in the aftermath of the OPEC oil embargo. That panic, of course, has turned out to be completely irrational. Once freed by deregulation, market incentives have stimulated the technological revolution called fracking that has made the United States one of the world's leading oil and natural gas producers. Regardless, over several decades, Congress has enacted a series of laws subsidizing renewable power, and in the aftermath of the Great Recession of 2007–2009, those laws plus some new ones were used to substantially increase subsidies for wind and solar power.

Combined with laws in many states that mandate that their electric utilities buy a certain fraction of their electricity from wind and solar power producers, Obama-era federal renewable power subsidies succeeded in quickly increasing the amount of electricity provided by wind and solar. Increasing the share of renewable power on an electricity system, however, turns out to be a complex and costly endeavor. The reason is that wind and solar power is intermittent, available only when the wind blows or the sun shines. On an electricity supply system (commonly called a grid), supply must be perfectly and continuously balanced with demand (called load). Failure to achieve such balance can result in damage to equipment and, in the extreme, to power blackouts affecting entire regions and lasting days. Adding substantial amounts of electricity from intermittent wind and solar to a power grid while ensuring the reliability of electricity supply can be very costly, in that additional electricity generating capacity must be paid for but held in reserve to cover periods when wind and solar are not available.

Chapter 7 explains why this is so. Among the things revealed by the chapter is that increasing wind and solar power on a grid actually increases the demand for easily dispatchable electric power generation (dispatchable in that it can be turned on and off, as it were, quickly and at relatively low cost) from natural gas-powered generators. Wind farms in particular are typically located in remote areas and require massive new investments in high voltage transmission lines to connect them to centers of electric power demand. As shown in Chapter 8, which follows, while it is possible to achieve relatively high levels of renewable power penetration and also ensure grid reliability, the costs are substantial. States that have high renewable power shares have high electricity prices. The cost of electricity and other utilities makes up a higher share of household income, the poorer the household. In this way, policies, such as state Renewable Portfolio Standards, that mandate high shares of renewable power impose costs that are disproportionately borne by the poor.

And these are not the only costs. Chapter 8 describes in some detail a list of present-day environmental harms caused by wind and solar farms and by hydropower projects. Grid scale wind and solar farms consume enormous amounts of land and cause a whole series of alleged harms to nearby landowners. Wind turbines and solar panels are made from materials that cannot be recycled and which must be disposed of in landfills at the end of their relatively short 20–30 year lifetimes. Wind and solar farms kill birds and bats in astounding numbers. In an effort to protect and restore natural aquatic ecosystems and fisheries, environmentalists have for decades opposed new hydropower projects and sought to remove old dams. State RPS laws very often call instead for expanding old hydropower facilities and building more dams.

In a nutshell, the raft of Obama-era regulations targeting coal and cars and subsidizing renewables have harmed the present-day environment and imposed costs disproportionately on poor households. But such regulations are not the costliest manifestation of precautionary US climate policy. The costliest, and most

completely irrational, aspect of US climate policy is the decades-old attempt to use common law litigation as a means of assessing climate change damages against fossil fuel companies, electric utilities, and other firms whose activities have generated GHG emissions. I discuss such lawsuits in Chapter 9. These lawsuits typically allege that GHG emissions constitute a public nuisance. I argue that on purely legal grounds, the public nuisance theory cannot be applied to GHG emissions. On broader policy grounds, such lawsuits represent an attempt to completely bypass the democratic process by allowing states and environmental groups who have nothing to lose from the decarbonization of the US economy to force decarbonization on people who will bear all the costs but are not even parties to the lawsuits. Public nuisance suits are the perfect precautionary tool, for if they ever succeed, they would allow the costs of GHG emission reduction requirements to be completely ignored.

Chapter 9 completes Part I. My hope is that the content of Part I will have persuaded the reader that the precautionary climate change policies pursued thus far in the United States have been extremely costly along many dimensions that range from harm to the rule of law to harm to the present-day environment and poor households. A reader might well agree with this assessment and yet respond by arguing that whatever the costs may be, precautionary climate policy is fully justified by the potentially catastrophic costs of not pursing such a policy. This is the essence of precautionary policy: something, anything must be done and done now, to avert potentially catastrophic and irreversible future harm.

The obvious question to ask someone making this argument is how they are so sure that virtually any cost of reducing GHG emissions is justified by the potential harm risked by failing to make such reductions. Another way to put this is to say that given what we have seen are the enormous potential costs of rapid GHG emission reduction, a rational policy response would seem to require some assessment and consideration of the probability that such costs might be incurred incorrectly, in the sense that the actual climate change risk does not justify costs of such magnitude at such point in time.

To assess this risk of error, a rational policy analyst must undertake some evaluation of the evidence supporting the precautionary case for GHG emission reduction. This evidence consists primarily of physical science work involving the extent of climate change to date and its possible causes, and evidence on how climate can be expected to change in the future under alternative GHG emission paths. As it is such evidence that supports precautionary policy responses including even common law litigation, to fail to evaluate the evidence is essentially to undertake a policy without any consideration of whether it might be wrong. This is an irrational approach to any human choice.

Testifying on the basis of my own personal experience, even raising this possibility – that one take a critical look at the climate science case for precautionary climate policy – enrages precautionary policy advocates. They immediately raise a host of objections to such a critical look. Perhaps the most basic is that nobody can evaluate

anything about climate science except climate scientists themselves, and as there are already two government sponsored organizations – internationally, the Intergovernmental Panel on Climate Change (IPCC), and nationally, the United States Global Change Research Program (USGCRP) – that have produced climate science assessments in a group effort engaged in by thousands of scientists from across the world, there is literally nothing more to do. Were one to insist, and not defer to these organizations, then precautionary climate policy advocates bring out rather more insidious arguments. They argue that surveys have shown that all scientists agree that radical and costly decarbonization is scientifically justified, and so there literally is nothing more to learn or say. Even worse, they argue that the only kind of people who question anything about climate science are bad, evil people, either greedy corporations or corrupt scientists who are in their pay.

In Chapter 10, which begins Part II to this book, I address these final two arguments – the existence of scientific consensus and the ad hominem argument. I discuss the ad hominem first. It has very often been made by politicians and the media, but the surprising thing that the reader may not know is that it is a staple rhetorical tool of climate scientists who advocate for precautionary climate policy (I refer to such scientists as climate science advocates). However often it may be made, the ad hominem argument is logically fallacious, and I explain why this is so in Chapter 10. As I also explain there, the argument from consensus as indicating the truth of the consensus opinion relies upon intuition about group agreement formalized in a mathematical theorem (the Condorcet Jury Theorem) that holds only under circumstances that do not pertain when it comes to climate science. Actual empirical findings about climate change science consensus have been generated using methods of determining consensus about climate science – searches by the consensus seeker in scientific article abstracts, and surveys of scientists – that are methodologically invalid for a large number of reasons.

Dispensing with the ad hominem and consensus objections to thinking critically about climate science still leaves unaddressed the objection that as a formal science assessment organization involving peer review by thousands of scientists, the IPCC has already done the assessment. Faith in the IPCC, however, is faith in its process. In Chapters 11 and 12, I provide a history of how the IPCC and, (secondarily) the USGCRP evolved and describe their structure and the process by which they produce assessment reports. These organizations were from their inception political, not scientific institutions. The purpose of each was to produce and compile scientific evidence supporting international, United Nations-coordinated policies on climate change (in the case of the IPCC) and (in the case of the USGCRP) to provide a continuing justification for congressional funding to government science agencies. As for how the IPCC assesses science (about which much more is made public than for the USGCRP), that process does not actively involve "thousands" of scientists. Rather, it engages a few dozen highly committed climate scientist advocates who write the chapters that comprise IPCC assessment reports. They

write those reports free of any obligation to respond in any way to outside review comments, and thus have complete discretion to choose among competing scientific work which typically consists in part, if not large part, of work that they or their co-authors have produced. The scientists who have headed prominent US climate science organizations, such as NASA's Goddard Institute for Space Studies, have for decades been outspoken advocates for precautionary climate policy, so outspoken that they have established a tradition of "hottest temperature ever" reports about even individual months, knowing full well that climate change is defined not by a hot month or year, but rather by changes in thirty-year averages of climate variables like temperature and precipitation.

Chapters 13–15 actually do the unthinkable by discussing the substance of climate science. I say "unthinkable," but of course climate science has been argued back and forth in the blogosphere (with NASA GISS scientists as active participants) for many years. One problem with this debate has been that it tends to center on the latest scientific study said to support, or weaken, the case for dangerous climate change. People go back and forth about one study. There is no attempt to contextualize studies within a larger body of literature. I provide some context to my discussion here by focusing on what seem to be three crucial scientific questions for the design of a more rational climate policy: first, the reliability of recent observations of climate variables like temperature, sea level change, and the frequency of extreme weather events and how recent trends in these variables compare to past trends; second, whether the only explanation for industrial era (post-late nineteenth century) temperature is an increase in atmospheric CO_2 caused by humans, or whether the literature shows that other forces are known to play a role; and, finally, how future climate is projected from computer models and reconstructions of far distant paleoclimate.

It is of course possible that as a mere economist, I have made some errors in my interpretation of climate science. But the only pieces of scientific knowledge that I do describe on my own, as it were, are things that are taught in high school (or should be taught there). These are far from the scientific frontier. For things that are on or close to the scientific frontier, my goal is just to report on what I have found in the literature. And, to be quite clear, what I have looked for are not studies that confirm conclusions in IPCC assessment reports. Those reports talk about such studies in great detail. I have looked for studies by clearly accomplished researchers that have appeared in peer-edited science journals but which are either completely ignored or dismissed in often highly misleading ways by the IPCC. My purpose is not to determine whether these studies are in some sense "correct." That is beyond my expertise. Rather, it is to reveal the existence of a substantial body of peer-edited scientific work that raises serious questions about many popularly held beliefs about climate science that are crucial to policy design. Due in large part to the active propaganda campaign carried out by climate scientist activists with assistance from the media, these questions have *not even been asked*. But for climate policy to be