PART 1

Setting the stage

This is a book about the strategies that society can take to solve climate change. Some strategies, or policies, are better than others. The insight I hope you will agree with and remember is that those strategies that have dominated discussions of climate change both in the media and in academic circles – carbon taxes and fees, global emissions targets, and steps to reduce our energy use – actually belong to the list of less effective ones. I describe the reasons that they haven't worked and why climate change continues to grow worse. At the same time, there is a new set of strategies that has started to work and can continue to work. All of these focus the power of the people on innovating and implementing a new set of technologies that will give us the energy we want without the carbon dioxide emissions and with no major effects on the economy. The difference is one of sticks and carrots. In Part 2, I explain why the sticks don't work, and, in Part 3, I explain why the carrots do.

Before jumping into theories of strategy and policy, however, I need to briefly set the stage, clarifying the problem for which we need a good discussion of strategy – of carrots and sticks – in the first place. That is what these first three chapters are about. Chapter 1 describes the state of hopelessness that many people feel toward solving climate, leading a good number of them to deny that it is a problem at all, and how this contradicts what others might see as an easy problem to fix. Chapter 2 digs into the science of climate change. What is important here is to distinguish what we know pretty well from what we can only make educated guesses at. The fact that the latter category is so large, and unlikely to become much smaller anytime soon, does in fact define some of the goals we ought to set. Chapter 3 blazes through two approaches toward coping with the symptoms of climate change once they are upon us without really solving the underlying problem. These need to be gotten out of the way so that they don't distract us later on.

1

From optimism to pessimism and back again

It was the middle of an oil crisis and the belief that the world was rapidly running out of everything. My parents, college professors in Boston, started growing an organic vegetable garden and bought a diesel Volkswagen that accelerated to highway speed in about five minutes. They put in a wood stove that entailed their teenage son getting to work splitting and stacking logs, and they installed a solar water heater on the roof of the house. As that teenage son, I was more concerned with swim practice than with world peace and the environment, but I nevertheless learned and remembered from my parents the name of the person guiding these choices. Amory Lovins. He was their guiding light.

Not long ago, I met and talked with him for the first time. Amazingly, he looked exactly the age that I had imagined him thirty-five years ago. Lovins had made his big first splash in 1973, with his book *World Energy Strategies*, when he was only twenty-six years old.[1] By the time he was thirty-five, he and his wife Hunter had founded the Rocky Mountain Institute, in Snowmass, Colorado, as a base from which to do research and demonstrate practice on sensible energy technologies, pathways, and policies. Lovins's two themes at the time were *energy efficiency*, the idea that we could get more value out of using less energy by simply using it more intelligently, and *renewable energy*, which could supply us with what we needed from sunlight, wind, wood, and water. The two themes came together under the name of *soft energy paths*.[2] Lovins's books of the 1970s and 1980s showed how these made more sense than the hard energy paths we were on. And it was in the 1980s that just about everyone in my school, even those of us on the swim team, were terrified of one particular hard energy source because it had the word "nuclear" there, right before the word "energy."

In the early years of the Reagan presidency, before Mikhail Gorbachev ended up as the Soviet leader, the teenagers of America whom I knew were convinced we were going to die during a nuclear attack. The Australian activist and physician Helen Caldicott came and spoke at our school; she suggested that even if war were not to kill us, we still had better not eat the chocolate from the town of Hershey, Pennsylvania, because it contained milk infused with radioactive fallout from the Three Mile Island nuclear power station.

But all that is history – or at least it used to be. It became history because what Amory Lovins said actually worked, and the United States and other countries reduced their consumption of oil to the point where prices fell. Energy became cheap again, people realized that it had never been all that scarce in the first place, and everyone stopped caring. Renewable energy faded from the picture, and when my family's solar hot water heater broke, my parents didn't fix it. The threat of nuclear war went away as well, a product of the same forces. As the geopolitical expert Daniel Yergin describes, the Soviet Union in its last years had grown completely dependent on revenues from oil exports to support its inefficient and bloated economy.[3] The collapse of oil prices in the mid-1980s was the final blow to a fragile empire. Food shortages became common and severe. Discontent rose. And then, on Christmas Day, 1991, Gorbachev went on national television to announce that he would no longer be president of the USSR because the USSR would cease to exist.

But the fact that the energy crisis became history is now itself history. The relevance of soft energy paths, or the same thing by any other name, has returned, although for different reasons. In 2011, the Tohoku earthquake off the coast of Japan killed more than 15,000 people as a tsunami that many of us watched on live Internet television swept across coastal farmland and obliterated the towns and cities in its path. It also flooded the backup diesel generator of the Fukushima Daiichi nuclear power station. With no power to keep pumping water into the containment vessels of the separate reactors, a series of seven meltdowns occurred. There were no immediate deaths, and may never be any deaths, but the accident spooked the world about the safety of nuclear power, which many analysts had suggested was on the verge of a dramatic upswing. Chancellor Angela Merkel of Germany, in the wake of the crisis, announced that she would accelerate the shutdown of Germany's fleet of aging nuclear power plants, replacing their capacity with an *Energiewende*, or energy transition, of exactly the kind that Lovins had advocated way back when.

And then there is climate change, which is my own motivation for wanting to change the energy system. Unlike a generation ago, Chancellor Merkel could not announce a move from nuclear energy to increased reliance on Germany's own domestic coal reserves, even if to some extent that is what has actually occurred. This is because it had become accepted in German political circles, as in scientific circles worldwide, that carbon dioxide (CO_2) from the burning of coal and gas is in fact one of the biggest threats humanity faces, far worse than Hershey's chocolate or even high energy prices. The centerpiece of Merkel's strategy had to be an effort to promote renewable energy.

And so Amory Lovins, who was never really gone, is back in business. *Time* magazine in 2009 listed him as one of the 100 most influential people on the planet,[4] and by now he has received ten honorary doctorate degrees and national and international prizes beyond counting, including the MacArthur "genius" prize, and has briefed nineteen heads of state.

I met Lovins in 2012, when he came to my institute to promote the ideas in his latest book, *Reinventing Fire*.[5] That book, the result of a group effort among his scientists at the Rocky Mountain Institute, people from government, and, perhaps most importantly, business executives from the private sector, showed once again – indeed more clearly than ever – that the United States could eliminate the burning of coal and oil and nearly eliminate the burning of natural gas while saving money, increasing economic growth, and creating new net employment, and, paradoxically once again, enjoy falling energy prices. The trick, as he explained at my institute, is to combine a million possible improvements in energy efficiency – which save money – with a switch to temporarily more expensive renewable sources of energy. Lovins documented how, over the past decades, sometimes behind the scenes and sometimes up front and center, new technologies have been developed that can do the work of fossil fuels, ultimately for less money. Businesses want to invest in these and rely on them to benefit themselves while helping the planet. Indeed, they are doing so, but often cannot do so quickly enough because of a patchwork of barriers, from legal to institutional to simply having more important things to worry about. To make it happen faster would require no major legal changes from Washington, but rather the continued development of new policies and programs at the state and local level, policies and programs designed to stimulate businesses to think a bit more ahead, work together a bit better, and ultimately make a bit more money.

The tone of his book and of the talk he gave was full of optimism and hope. Why, after all, wouldn't people do the obvious? Near the end of his talk, Lovins said that he was confident that in fifty years we would look back at climate change as one of those problems that had been solved relatively painlessly and easily.

Widespread pessimism

Amory Lovins may be too optimistic on some points. But there is also a great deal of evidence to support his core qualitative proposition, that we could make the transition to a carbon-free energy system at no noticeable net economic cost. So, then, why are so many people so pessimistic about humanity's collective ability to solve climate change?

Pessimism is what you see and hear from just about every expert in the business. In 2009, the world was gearing up for major international negotiations in the Danish capital of Copenhagen on a new climate treaty. The British newspaper *The Guardian* conducted a poll of climate experts to find out from them whether they thought the problem would be solved.[6] By then, "solving the problem" had been taken to mean constraining the global rise in temperature in comparison to preindustrial times, to no more than 2°C. As of 2009, the world had already warmed by about 0.8°C, and another 0.5°C warming was seen as inevitable, even if carbon emissions were to cease entirely. That left 0.7°C of wiggle room. Two hundred scientists and sixty-one other experts, from a total of twenty-six countries, responded to the survey. Despite the wiggle room, 39 percent of the respondents said that achieving the 2°C target was simply impossible, that there was no way governments could get people to stop burning fossil fuels fast enough. Another 47 percent believed that it was technically possible, but didn't think that the 2°C target would be achieved. Only 14 percent thought the 2°C target would be reached.

The majority of respondents said that temperatures would rise by more than 3°C, about 15 percent said by a catastrophic 4°C or more, and a handful said by more than 6°C. And those few souls who thought that the 2°C target was realistic? "This optimism is not primarily due to scientific facts, but to hope," said one. "As a mother of young children I choose to believe this, and work hard towards it," said another. Others who thought the target was possible did not see it happening because of reduced emissions, but rather because of efforts to "geoengineer" the planet to keep the temperature under control, things like shooting reflective

particles into the stratosphere or seeding the oceans with iron filings to boost photosynthesis in the water and thus sequester carbon.

That was seven months before negotiations in Copenhagen on a new global climate treaty, which started with a large contingent of the countries walking out and ended even worse. And that was before another five years of climate negotiations that have so far produced roughly nothing.[7] Even the global recession, which chilled energy demand in 2009 and caused emissions to sink, made barely a dent. As *The Guardian* reported in May 2011, by the end of 2010, emissions were up to their highest levels yet, close to being back onto a business as usual track, as if the recession had never happened.[8] The article reported the Chief Economist at the International Energy Agency, Fatih Birol, describing the achievement of the 2°C target as "a nice Utopia." Lord Nicolas Stern, an economist who is one of the most respected climate experts in the United Kingdom, suggested that continuing in the observed path would likely result in temperature rising by more than 4°C by 2100. "Such warming would disrupt the lives and livelihoods of hundred of millions of people across the planet," he said, "leading to widespread mass migration and conflict."[9]

In June 2012, Matthew Wald of the *New York Times* posted to his blog an article entitled "On not reaching carbon goals."[10] There, he reported how emissions were higher than ever and that the International Energy Agency (IEA) suggested that achieving the 2°C target was still technically possible but that the "trends in energy use are running in the wrong direction." Coal consumption was rising, while the United States and other countries were also "feverishly building" new natural gas installations. And while the evidence for climate change was only growing stronger, by 2012, the issue had, if anything, " fallen further down the political agenda."[11] Chris Berg of the Australian Broadcasting Company wrote on his blog that "we can't stop climate change."[12] Accepting climate change and adapting to it, he suggested, are now the tasks for humanity.

Denying the problem

In the face of something that can't be solved, one useful strategy is to deny that a problem exists in the first place. Indeed, that is what has happened: climate change has not only moved out of the political spotlight, but the number of people who say that they believe in it has declined.

The seeds of the latest upswing of disbelief in climate change began to take root even as climate change was at its most visible politically. The Intergovernmental Panel on Climate Change (known as the IPCC), a collection of roughly 2,000 scientists appointed by governments and working voluntarily to synthesize the latest scientific knowledge, won the Nobel Peace Prize for work completed in 2007. The IPCC shared the prize with Al Gore, following the success of the film documenting his speaking tour, *An Inconvenient Truth*. But, at the same time, British documentary filmmaker Martin Durkin had put together a film of his own, *The Great Global Warming Swindle*. The documentary cast doubt on the basic science of climate change. It also suggested that the motivation for climate scientists spreading the nasty rumors was financial and that the policies aimed to stop it would curse millions of people – the whole continent of Africa and more – to poverty.

It premiered on the United Kingdom's Channel 4 on March 8, 2007, and then later, in other countries. I first heard about it while vacationing on a farm in the German Alps. The farmers had seen it on German television, and, knowing that I worked on climate change, they wanted to share with me what they had learned. "It's all got something to do with sunspots," they told me. A few months later, I joined a group of climate scientists to watch it and discuss the arguments. The climatologists in our viewing audience pointed out that the scientific arguments in the film were based on work that had since been convincingly demonstrated to be inaccurate. The social scientists in our group, one by one, could demonstrate how the implications for society, committing us to poverty, were equally flawed. All of us introspected and asked ourselves whether what was motivating us to do our science and reach our conclusions was financial reward. We agreed this wasn't the case. But never mind. The film captured a large market share and won praise by climate skeptics. It touched a nerve that needed tickling.

That was before "Climategate." In November 2009, somebody hacked the email server at the Climate Research Unit at the University of East Anglia, home to a number of leading climatologists, copying thousands of emails to various Internet sites. Of these thousands, several had the appearance of covering up inconvenient holes in climate science. Or at least they seemed to, when taken out of context. Scientists describing "tricks" they had used to obtain a particular temperature record, where "tricks" in reality referred to valid and established statistical methods designed to enhance the accuracy of data. Once the emails were put back into context, they simply revealed

a group of scientists communicating with each other about their legitimate findings. If you had the attention span to follow the emails this far, then you saw that the apparent cracks in the climate change armor were illusory.

Two months later, however, in January 2010, cracks looked like they might be appearing in the established science. Suddenly, the possibility seemed more real that climate change might indeed be a house of cards. The IPCC report, the one that had won the Nobel Peace Prize two years earlier, had reviewed the peer-reviewed scientific literature, summarizing the findings from across a vast body of literature and highlighting the most important. One of those findings was that a large number of glaciers in the Himalayas would vanish within thirty years. This sounded credible, except to many of the scientists who actually knew the glaciers. In fact, the scientific evidence for such a pace of glacier retreat was simply not there. The scientific paper on which the IPCC had relied for the claim was peer reviewed, but it was merely restating the result from another paper, which was not. When people discovered the error, the IPCC immediately issued a statement that the claim about the glacier retreat was an error and documented how it had occurred. But the damage was done in terms of credibility. If such an error had made it through the IPCC review process, then that process must have been flawed and then, certainly, other errors could be there as well. To those who wanted not to believe in climate change, then here was good ammunition to doubt the science.

The number of people who saw climate change as a hoax, or at least did not believe it to be a serious problem, started rising. In the United States, the Pew Research Center had been pooling Americans about their top environmental concerns. In 2007, when climate change was first included on the list, 38 percent listed it as a top concern. By 2010, that number had fallen to 28 percent.[13] A Stanford University poll in July 2012 showed the number to be down to 18 percent.[14] The Stanford group also asked people if they believed climate change were actually occurring. Eighty-four percent said yes in 2007; that declined to 80 percent in 2008, 74 percent in 2010, and then to 60 percent in 2012.[15] Taken together, the polling data showed that concern about climate change gradually rose from the 1990s until 2007, peaked, and then, by 2010, was back down below the 1990s values.[16]

The trend was not limited to the United States. In a series of polls taken in Hamburg, Germany, between 2008 and 2011, the proportion of people who felt that climate change was either not a problem or not a serious problem rose consistently from 37 percent to 54 percent,

whereas the number who felt that it was a serious or very serious problem fell from 63 percent to 44 percent.[17] In the United Kingdom, polls at the time of Climategate showed a drop in the number of people believing climate change to be a reality from 83 percent to 75 percent, between November 2009 and February 2010. In New Zealand, the number of people who felt that climate change was not a problem more than doubled from 8 percent in 2007 to 17 percent in 2010; a similar trend could be seen in Australia.[18]

During the 2008 U.S. presidential campaign, candidate Barack Obama stated that he supported cutting greenhouse gas (GHG) emissions by 80 percent by 2050, while his Republican adversary, John McCain, agreed with him on the reality of the problem and suggested somewhat less ambitious cuts of 60 percent. Fast forward to the 2012 race. All of the Republican primary contenders either denied climate change as a problem or opposed government measures to deal with it.[19] Mitt Romney, the ultimate Republican challenger, changed his personal views in 2011, as the primary battle was heating up. In June 2011, he stated in a speech that he believed that climate change was real, that people were causing it, and that it was important to do something about it. He started backpedaling in August, and then, by October stated, "we don't know what's causing climate change on this planet."[20]

The state of North Carolina made news headlines in the spring of 2012 for a proposal that would "wish away" climate change. The official policy of the state is to recognize and respond to climate change, and, indeed, the website of the Department of Environment and Natural Resources describes the state's climate change initiative, including both measures to reduce GHG emissions and to adapt to sea level rise and other impacts.[21] But in late May 2012, Republicans in the state legislature proposed a new law that would require ignoring projections of climate change for coastal planning. Coastal planning is of high importance in North Carolina because the state includes the Outer Banks, a string of low-lying barrier islands that are popular tourism destinations and that are frequently battered by hurricanes making their way up the coast. Specifically, the law would require basing any projections of sea level and associated coastal flooding only on historical data from the first half of the twentieth century and in no cases on model projections of future sea levels.[22]

There are countless websites that provide the opinions and sounding boards for those who deny the climate change problem. A theme running through those websites and the discourse of denial

more generally is to link the disbelief in climate change with a profound dislike of the policies that would be needed to stop it. The denialist website www.climategate.com states this linking of problem and feared solution especially well: "The goal of Climategate.com is to provide a daily dose of information regarding the world's greatest scam ... and other information and news to help you in your battle against the Religion of Settled Science to dispute their views on Anthropogenic Global Warming, and in addition, to battle the one-world socialist agenda, which is the movement's leaders' real goal."[23]

For some time, I have suspected that what really drives the denialist movement has very little to do with the thermometers on people's kitchen windows, but rather with the belief that solving climate change requires this "one-world socialist agenda." And then, one day I asked myself: is this sort of political agenda something that goes way beyond climate change and really has to do with restructuring society in some pretty radical ways, "the movement's leaders' real goal?" My first thought was that it could not be. And then I thought some more. And then, eventually, I came to the conclusion that actually it was – or at least it could certainly look that way.

How the experts tell us we will solve climate change

Since the early days of climate change existing as a policy problem, experts have been busy telling people how to solve it. All of them have said that the real need is to stop burning fossil fuels. That is obvious. The tricky part is the set of strategies that governments need to adopt to make that happen, and, for that, the experts dictated three changes: we need to change how the economy runs; we need to have a global agreement for CO_2, perhaps the strongest global agreement that has ever existed on anything; and, we need to change how people live their daily lives.

Let's start with the economy, which raises the issue of socialism. Almost every newspaper article or editorial touching on climate change policy has suggested that to stop burning fossil carbon, society needs to make it more expensive, taxing it at a rate equivalent to the harm it does to society – its social cost. Paul Krugman, the Nobel Prize-winning economist who is a columnist for the *New York Times*, put it quite clearly: use "market-based" environmental laws that make it more expensive to burn carbon and emit CO_2. These laws can either take the form of a direct tax on CO_2 emissions or can put a price on the emissions indirectly, by requiring government-issued permits to emit