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Carbonomics

How to Fix the Climate and Charge It to OPEC

by **Steven Stoft**

with assistance from **Dan Kirshner**

A Fix-It Manual for Global Warming and Energy Security

Carbonomics **exposes the hidden side of energy policies and global oil markets. Stoft is a truly subtle and skilled economist, with twenty years' experience in energy policy.** ***Carbonomics*** **takes today's best policy proposals a step further. Stoft's proposals serve environmental and energy-security goals, while they also align national and international interests. This book makes a very important contribution to the solution of the world's most urgent problem.**

—George Akerlof, Koshland Professor of Economics, University of California, Berkeley
2001 Nobel Laureate in Economics

The centerpiece for mitigating greenhouse gas emission, one way or another, must be a significant price on carbon dioxide and its equivalents. ***Carbonomics*** **provides a clear and compelling exposition of the key issues in an essential read for policy makers.**

—William Hogan, Raymond Plank Professor of Global Energy Policy,
John F. Kennedy School of Government, Harvard

From ethanol to the future of Kyoto, Stoft reveals the hidden economic forces of energy markets to show why some policies succeed and others fail. It is refreshing to see a first-rate economist expose the myth that price is all important but efficiency programs are worthless.

—Art Rosenfeld, Commissioner, California Energy Commission,
the "father of energy efficiency" and winner of the 2005 Presidential Enrico Fermi Award

The European Union and the world await the return of an innovative America. Stoft, a scientist by inclination and training, has given us a popular-science book on energy markets and energy policy. ***Carbonomics*** **gives us new recipes for policies that jointly cure two plagues: energy insecurity and climate change. If you want a practical approach to changing things for the better, read this book. As I did, you will gain new insights.**

—Jean-Michel Glachant, Loyola de Palacio Professor of European Energy Policy,
the European University Institute, Florence, Italy
former Chairman of the Department of Economics, Université Paris-Sud

Insightful and engaging, ***Carbonomics*** **dispels the myths and reveals the simple economics of carbon policy. Stoft shows how straightforward policies that respect basic economic principles are the key to solving global warming and providing energy security. A must-read for all policy makers and voters concerned with whether we are headed in the right direction.**

—Peter Cramton, Professor of Economics, University of Maryland
Chairman of Market Design Inc.

Carbonomics:

How to Fix the Climate and Charge It to OPEC

(a synopsis—not in the printed edition)

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Preface

When I started high school, my father gave me a book by a world-class physicist, George Gamow. *Mr. Tompkins in Wonderland* explained quantum mechanics and relativity at a popular level. Travel fast enough for long enough, and you will be only thirty when your twin turns sixty. Some infinities are bigger than other infinities. Contrary to what Euclid said, the three angles of a straight-sided triangle do not always total 180 degrees. The world is full of surprises, and I loved it. I soon discovered that physicists have a tradition of explaining advanced ideas to the public just because they find the concepts fascinating.

Economics, though still a primitive science, contains a few surprising and delightful ideas of its own. Unfortunately, economists seem less interested in explaining their ideas to a broad audience simply because the ideas are fascinating. But I see signs of change, and this book joins what I hope is the start of a flood of popular books about economics.

However, a more practical idea motivated my writing this book. Our nation, and in fact most of the world, is putting in place an enormous and untested set of economic policies and is at risk of a global policy meltdown. Such a failure could waste most of the money we spend and fail as well to achieve its twin goals of climate stability and energy security. With this book, I hope to make such a failure slightly less likely.

My hopes would be higher—but I've been down this path once before. I had the privilege of watching, from up close, the restructuring of the California electricity market—a well-intentioned energy policy with unintended consequences. Later, I acted as the expert witness in the field of economics for the California Public Utilities Commission and Electricity Oversight Board when California sued the Federal Energy Regulatory Commission (FERC) to undo some of the long-term electricity contracts that the state had signed at the height of the 2001 electricity crisis. The state bought $40 billion of electricity, for the distant future, at double the normal cost of power to "protect" Californians from presumed astronomical prices in the future. Three months later, the cost of power was back to normal—but not because of those contracts.

Now, you might think California has little to do with national energy policy, but with prices already double, and a month before the state began to overpay, the Democratic chairman of FERC dragged California and some large power sellers into the Republican White House and instructed California to start buying. The disease of misguided energy policy is national in scope and cuts across party lines.

Watching the development and implementation of new global warming policies feels strangely familiar. People have a lot of enthusiasm and some good ideas, but major programs have already gone far astray. European utilities have made tens of billions of dollars in excess profits from free cap-and-trade permits. The United Nations' Clean Development Mechanism is paying fifty times more than it needs to for emission reductions. In 2006, the United States spent $7 billion on subsidies and higher prices for ethanol with the likely result that worldwide carbon emissions increased.

While it's easy to criticize, my interest lies in fixing energy policy. Technically, that's not so difficult. But it will not happen until more people understand the dangers of trillion-dollar policies based on hunches and appreciate the low cost, power, and simplicity of well-designed policies.

The hardest part of learning new ideas is giving up misconceptions. This is true of physics as well. Even Einstein found the uncertainty of quantum mechanics—the next step after relativity—so disconcerting that he never accepted it. As Mark Twain put it, "It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so."

In that sense, economics is tougher than physics, because everyone already knows so much economics "for sure." We all go shopping. So everyone knows for sure they understand prices. It's simple. A higher price makes me poorer and the store richer.

True enough, but what few realize is that prices have a hidden talent for making us rich that surpasses even the best new technology. Adam Smith discovered this in the 1700s and was so impressed that he called it the "invisible hand," which back then meant the hand of God. Strangely, even those who are the most pro-market usually don't believe much in prices. If I explain one economic idea in this book, it's that market prices save you money, and subsidies waste your money. There are exceptions to every rule, but understand why this one is usually true, and I'll make you an honorary economist.

So what does that have to do with energy policy? Price confusion is at the heart of today's energy politics. The policy wonks are saying, "Carbon and oil are priced too low. Fix those prices, and the invisible hand will fix our energy problems." The political interest groups are saying, "Yes. Great idea. Let's raise the price by taxing carbon or selling permits. That will bring in hundreds of billions of dollars for subsidizing our pet projects." A few people are just out to collect the subsidies, but confusion over how the invisible hand works is the biggest part of the problem.

If we learn this lesson, we'll reap an unexpected reward. Since subsidies waste money and prices work on their own, we can have all the money back. That's right. Tax energy and mail all the tax revenues back to consumers on an equal-per-person basis, and the invisible hand still works just as well. Economists

have understood this for a hundred years. I know it sounds far-fetched, and it actually is a bit tricky to understand—so I wrote this book.

I won't go into the reasons here, but several other surprising ideas are important for putting our energy policy on track, and with global warming and tightening oil supplies, that's more important than ever. Good intentions do not suffice. An enthusiastic start is no guarantee of future success. Dig deeper, and you find things are not as they seem. That is what this book is about. If we want our energy policy to work better than California's electricity market, we had best pay close attention to the way governments and markets really work.

Acknowledgments

When I decided to write this book, I asked my friend Dan Kirshner, a lifelong environmentalist, to be my coauthor. We met years ago in the University of California at Berkeley graduate economics program, and our paths crossed again in California's electricity market design process. He spent years working for the Environmental Defense Fund, so I knew I could count on him to present an environmental perspective that made sense economically. Although he declined to be coauthor, he did read all the chapters, many of which never made it into the book because he turned out to be a staunch defender of the public's right to clarity. He also suggested innumerable improvements to the content and wrote a couple of the more memorable passages. In short, the book you see before you would not exist had it not been for Dan's continual guidance.

Even Dan's help was not enough, so my friend Joanna, writer extraordinaire, pitched in to straighten out the first few chapters. An author, writing instructor, and onetime journalist, she set me on a new course, leaving both me and my readers deeply in her debt. Hugh Biggar, another friend and an environmental journalist, followed that up with a read that produced a host of helpful clarifications. My copy editor, Kathleen Christensen, has been a delight to work with, going beyond the call of duty by carefully considering my arguments from the viewpoint of the broader audience I hope to reach. Finally, my invaluable proofreader, Ann Marie Damian, made quick work of countless errors.

Any remaining errors are those I snuck in after the others had finished. I own the typesetting program, which proved to be too tempting for someone who can't leave well enough alone.

From the start, François Lévêque pushed my thinking forward with tough questions. I also thank him for publishing chapter excerpts on www.energypolicyblog.com. Pete Ordway, an engineer, gave the book its first test read. Meaty but dry, he said, add stories and graphs. I took that to heart. And thanks too to the rest of the gang—Sandy, Sarah, Doug, and Dave—for their suggestions and helpful news notes, and to Raymond O'Mara, whose sense of design gave the cover of this book some pizzazz.

None of this would have been possible without the encouragement, guidance, and assistance of my wife, Pamela. I would especially like to thank her for putting up with a second book. I also owe a debt of gratitude to my mother, who taught me what good writing is and tried valiantly to pass on some of her skill, and to my father, who taught me most of the science I know.

Disclaimers

Experience indicates that when I write that the market is useful, it will be said that I believe markets solve all problems. So let me make a few things clear.

I do ***not*** believe

- Markets are more important than government.
- Government is more important than markets.
- Global warming will surely bring disaster if untreated.
- There's a moment to lose on global warming.
- Energy security is secondary to global warming.
- Global warming is secondary to energy security.

As the old saying goes, "predicting is difficult—especially about the future." So I do believe we should hedge our bets immediately.

Acronyms

DOE	The U.S. Department of Energy
CO_2	Carbon dioxide
IPCC	The U.N.'s Intergovernmental Panel on Climate Change
OPEC	The Organization of Petroleum Exporting Countries
GDP	Gross Domestic Product

Numbers

Energy Price Increases Caused by Carbon Pricing

CO_2 $ / ton	Gasoline ¢ / gallon	Oil $ / barrel	Electricity ¢ / kWh
$10	10¢	$5	1.2¢
$30	30¢	$14	3.6¢
$90	90¢	$43	11.0¢

Values rounded for ease of use. Residential electricity costs about 10 cents per kilowatt-hour in 2008.

Throughout the book, carbon prices are given in dollars per ton of CO_2.

Asterisks (*) in the main text indicate material discussed in endnotes.

Part 1

Fossil-Fuel Myths

chapter 1

Once upon a Time

The Stone Age came to an end not for a lack of stones, and the oil age will end, but not for a lack of oil.

—Yamani

Once, many years ago in a distant land, Yamani the Enigmatic launched a great experiment. Without warning, he sent out a proclamation to every corner of the earth declaring the need to conserve energy. At first, people conserved little. But gradually, the pace quickened—only to slacken once again.

After six years and only modest progress, Yamani issued a second, stronger proclamation. This time, the world reacted dramatically. For the next six years, while the people of the earth multiplied and grew richer, their use of oil diminished—something never seen before. After twelve years, Yamani and his confederates, duly impressed with the power of their methods and the world's response, withdrew their proclamations.

There matters rested for another eighteen years. Surprisingly, much of the world's reaction continued, and by the end of the thirty-year experiment, the world had saved, by a most conservative estimate, eight times as much oil as it now uses in a year.*

The story is true. Yamani has retired, but his confederates have begun a second and more sophisticated experiment. Fortunately, the lessons of that first experiment, if properly applied, provide a path to escape the enormous costs that now await us if we fail to choose a secure and sustainable energy future.

Sheikh Ahmed Zaki Yamani, famous for his enigmatic sayings, was Saudi Arabia's oil minister when OPEC, the Organization of Petroleum Exporting Countries, conducted its "great energy experiment."[1] The first "proclamation" led to the October 1973 oil shock, which tripled the price of oil. The second "proclamation" led to the 1979 oil shock, which doubled the price again.

While the worldwide response was enormous, the U.S. response was even more dramatic. U.S. addiction to oil decreased over a thirteen-year period, as did the country's carbon dioxide (CO_2) emissions. The United States conserved not just oil, but all kinds of energy. In the thirty years from 1973 through 2003, the United States saved energy equivalent to twenty years of U.S. oil consumption at the rate we now consume it.*

Carbonomics, the economics of fossil fuels, not only explains that astounding success, but also teaches us how to repeat it—but this time without paying OPEC another trillion dollars in tribute.

Yamani's experiment did more to reduce CO_2 emissions than the Kyoto Protocol has; there is simply no comparison. The experiment taught the world how to gain independence by saving energy, how to stabilize the climate by saving carbon, and how to increase security by reducing the world price of oil. By 1986, these lessons were fairly well understood, but OPEC had been crippled, and climate change was not yet a concern, so there was little motivation to act on the new understanding. As a result, nothing was done, and now the lessons are forgotten.

Climate Stability and Energy Security

The key to an effective energy policy is to understand that climate stability and energy security are twin challenges—though not identical. Both are global issues, and both suffer from the problem of free riders, which I describe later in this chapter. Unfortunately, those interested in one challenge often show little interest in—and sometimes antagonism toward—the other. I believe the two challenges—climate stability and energy security—are not only compatible, but that solving either requires solving both.

Twin Global Challenges. It's clear that global warming requires a global solution, but Yamani's experiment taught us that energy security also requires a global solution. In 1974, the United States recognized the need for a global response to OPEC, and Secretary of State Henry Kissinger organized what the *New York Times* called "a counter-cartel of the major oil-consuming countries." That organization, the International Energy Agency (IEA), still exists; twenty-seven countries including the United States, Japan, and most of Europe are members. But it has forgotten its purpose.

1. You can meet Yamani at www.azylawfirm.com/founder.asp.

Later, in 1979, after OPEC doubled the oil prices that it had already tripled, the seven industrialized nations held a "world economic summit." They issued a communiqué, which the *New York Times* again said "amounts to a consumers' cartel." This effort also failed; nevertheless, the global response to high oil prices eventually did crush OPEC—but not permanently.

Now, the lessons that Yamani's experiment taught have been forgotten, and people think the United States can achieve energy security on its own. But even if Americans cut oil imports to zero—say, by driving hybrid cars that burn ethanol—we would not achieve independence. The world oil market would still control the price of corn ethanol at American gas pumps, just as it does now. I explain this in Part 2, along with other lessons, including how to crush OPEC again.

So energy security is a global challenge just like climate stability. OPEC's market share has grown again, and OPEC is short on production capacity, as it was before 1973. China and India are rapidly expanding their demand for oil. Greenhouse gas emissions are increasing faster than ever, and China has passed the United States to become the largest emitter of CO_2. No one country, not even the United States, can meet either challenge on its own.

The Problem of Free Riders. By curbing our use of oil, we can force down its price on the world market. While this is worth doing, the job is tough if we go it alone. Any price decrease we cause benefits all consumers worldwide, even if they do nothing to help out. Economists call those who benefit without helping out "free riders." These free riders take advantage of the lower price to use more oil, counteracting our efforts.

Climate change presents a parallel problem. No country, acting alone, can do much to stop climate change. Any country that tries will find that most of the benefit accrues to other countries. So the more we do to reduce global warming on our own, the less others will worry about global warming, and the less they are likely to help.

Solving the problem of free riders requires an international approach, such as the Kyoto Protocol. But energy security also requires a global approach—a point that Kissinger's team recognized in 1974, but which is now forgotten. Fortunately, because the challenges are twins, the same international organization can address both. But we need a better design than the Kyoto Protocol or the IEA offers. Part 4 provides a blueprint of that better design along with the rationale for unifying these two problems and their solution.

Conflicting versus Joint Solutions. Some proposed solutions that help with one challenge conflict with the other. Joint solutions, however, help us meet both challenges. One proposal for increasing energy independence conflicts most intensely with solving the problem of climate change: turning coal into gasoline. Unfortunately, this proposal is a favorite of Big Oil and Big Coal.

Coal companies like the idea of making gasoline from coal for obvious reasons—it takes a lot of coal. But oil companies are just as enthusiastic because they would build and operate the new coal refineries. The problem is, these refineries use far more fossil energy than oil refineries do, which is terrible from a global warming perspective.

Fortunately, conservation—the main activity that crushed OPEC in the early 1980s—is an ideal solution, though not the only solution, for both challenges. In fact, conservation is better for energy security than producing gasoline from coal. Of course, the oil companies hate conservation, which is shorthand for not using their product. Gasoline made from coal keeps us addicted and keeps us paying prices set by the world oil market. Conservation helps us break the habit.

Cooperation

Breaking the world's oil and coal habits is no easy task, and those who think it can be done by either resolute proclamation or a change of consciousness will once again be disillusioned. Only a program with the broadest support and based on self-interest can succeed. This explains why joint solutions are crucially important. Only joint solutions can provide the basis for broad-based national and international cooperation.

National Cooperation. The chance of achieving a sound energy policy is now better than ever, because we have a double motivation. OPEC is again breathing down our necks, and climate change has become the number-one national concern on the environmental front. But Americans divide into two camps over which challenge deserves priority. One camp focuses on energy security and the other on climate stability. If one camp adopts a policy that conflicts with the goal of the other camp, the double motivation is lost; in fact, the two camps could cancel each other out.

On the other hand, adopting a cooperative strategy could produce a complementary alliance between the two groups. The environmental camp can provide the staying power and the link to popular international concern about energy issues. The energy security camp can provide the motivation that comes from the short-term tangible gain that is possible in the oil market. It took only six years to bring about a huge reduction in world oil prices after OPEC doubled oil prices in 1979 and 1980. It will take much longer to have an impact on climate change.

International Cooperation. China and the United States together emit half of all greenhouse gases, yet neither has made a commitment to take specific action. If these two countries fail to cooperate, the world has no real hope of success against global warming. And nothing substantial will be done about OPEC's increasing market power and the tightening oil market.

Although both countries claim to be concerned about global warming, both are also afraid of reducing economic growth. As things now stand, neither is likely to make or keep a strong commitment.

One thing, however, could motivate China and the United States to come together. Both are addicted to oil, and their addiction is growing. China is predicted to increase its oil imports from 20 percent of the country's oil use now to about 80 percent in 2030. China is already building plants to refine coal into gasoline. Any reduction in the world price of oil would provide a huge economic benefit to both countries. Surprisingly, only one thing is likely to lower global oil prices—an effective international climate agreement.

An international climate agreement is also, like it or not, an oil consumers' cartel. A consumers' cartel is simply an international agreement to use less oil, and any effective climate agreement will make sure we do just that. Instead of hiding this fact to avoid upsetting OPEC, we should advertise it to enhance the appeal of an international agreement.

That a climate agreement is automatically an oil consumers' cartel may come as a surprise, but it shouldn't. Among economists it's an open secret. In fact, in 1998, when the U.S. Department of Energy (DOE) analyzed possible U.S. compliance with the Kyoto Protocol, it found that even such a weak agreement would have served as an oil consumers' cartel—though it did not use the word *cartel*. The DOE found that the Kyoto Protocol would have lowered the world price of oil by 16 percent had the United States fully complied. With oil at $100 a barrel, that would have saved the United States $70 billion a year on imported oil. American consumers—who must pay domestic oil companies as well as OPEC—would have saved over $100 billion a year.

Unfortunately, the Kyoto Protocol is fatally flawed. It does not require developing countries to make any firm commitments to reducing emissions. This is one reason the U.S. Senate voted against such a treaty 95-to-0. Our problem with the Kyoto oil consumers' cartel—if I may call it that—is much the same problem that Yamani had with the OPEC cartel. Smaller OPEC producers went for a free ride at Saudi Arabia's expense. They did not restrain their production, leaving that job to Yamani.

Developing countries take a free ride on the Kyoto Protocol by not restraining their consumption. This damages both climate stability and energy security.

Although our organizational problems are similar to Yamani's, a consumers' cartel has two organizational advantages over OPEC. First, the consumers' cartel can piggyback on the goodwill and momentum of international climate initiatives. Second, according to experts in the field, a climate agreement can use international trade law as an enforcement mechanism.

The oil price benefits of an international consumers' cartel do not detract from its climate stability benefits. The two are entirely complementary. In

fact, to garner support, the proponents of any climate agreement need to take advantage of people's short-term self-interest, playing up the five years it takes to reduce oil prices, as opposed to the fifty or so years it could take to solve the problem of global warming.

Part 4 of this book discusses how to put together a durable international organization that challenges OPEC and stabilizes the climate. The first step is to replace the emissions-cap policy that has stymied the Kyoto Protocol. The second step is to use China's interest and the U.S. interest in lower oil prices to lever these two into an international agreement with binding commitments. The third step is to curb the problem of free rides with an enforcement mechanism better than anything Yamani ever dreamed of.

None of these ideas are new. For example, the move away from international carbon caps has support from a wide range of experts, from George W. Bush's chief economist N. Gregory Mankiw, to liberal economist Joseph E. Stiglitz. But the ideas are important because the people currently debating national energy policy are ignoring these important international considerations and may well end up obstructing rather than advancing international cooperation.

A Fossil Philosophy

So far, I've mentioned the twin challenges, joint solutions, learning from OPEC, and free riders. Another theme of this book is prices and markets. Most people consider pricing to be weak medicine compared with government mandates such as a strict cap on carbon emissions. But markets—driven by prices, not mandates—have built the modern world, with its engines that consume 40,000 gallons of oil per second (this is not a typo). If prices are strong enough to drive the world's economies, they are strong enough to meet our present challenges.

Another theme of this book is conservation, which many also consider weak medicine. Conservation, however, moved quickly and vigorously against OPEC. In fact, it moved ten times more forcefully than all the increases in energy supply—including non-OPEC oil supplies, nuclear energy, and synfuels.

Just a few ideas underlie all of the themes of this book. These ideas make up a sort of fossil philosophy. As with all philosophies, we cannot follow this one to the letter. But it does provide guidance in many situations. The underlying ideas are these:

- Treat the problem, not the symptom.
- Support cooperation.
- Focus on real benefits, not imaginary disasters.

These are the simple tenets that guide the energy policies of this book. But simple as they are, they are often forgotten.

Treating the problem instead of the symptom is the most important. We rely too much on coal and oil and not enough on wind and conservation. Those are the symptoms. But why do we do that? What is the underlying problem?

The price of oil does not include the military cost of protecting oil supplies or the cost of oil's effect on the climate. So the price of oil has long been too low. That is the root problem. Not having enough wind turbines is only one of a million other symptoms, large and small. Using the government to try and fix a million symptoms is, according to the first principle of fossil philosophy, a bad idea.

Of course, the first principle wouldn't be worth much if a million underlying problems led to the million symptoms. But, in fact, only four major problems account for almost all the symptoms. Called market failures, the four underlying problems are these:

- The low price of carbon (fossil fuel).
- OPEC's market power.
- The nearsightedness of consumers.
- Insufficient reward for advanced research.

Not that it will be easy, but fixing these four problems is all we need to do to meet the twin energy challenges.

Pricing Carbon. We can raise the price of carbon with either a cap-and-trade policy, a tax on carbon, or an untax on carbon. A central purpose of this book is to explain the old and venerable concept of an untax. The term is mine, and I hesitate to introduce it. But the economic description—"a Pigovian tax with a full, equal-per-person refund"—seems a bit awkward. In any case, the untax is a combination of a carbon tax and a per-person refund that the government mails out, say, once a year. An example is Alaska's Permanent Fund, which issues annual refunds of revenues from the Trans Alaska oil pipeline to Alaska's residents.

While refunding a tax may seem circular, the untax provides more bang for our bucks than any other energy policy. I explain this economic mystery in Part 3, but for now I will simply note that, in July 2008, Al Gore called an almost identical proposal "the single most important policy change we can make." But this is no liberal nostrum. Former Bush economist Mankiw supports a proposal identical to Gore's, and the right-wing American Enterprise Institute is on board. James E. Hansen, the most outspoken climate scientist, also proposes an untax by a different name.

A Consumers' Cartel. The solution to the second problem—OPEC's market power—is, as I've already mentioned, an international consumers' cartel. Although, in 2007 and 2008, Saudi Arabia was withholding about 20 percent of its oil production capacity and has underinvested in new capacity for twenty years, OPEC may not be the main supply problem. The main problem might

be natural limits—that is, we might be near the peak of cheap conventional oil production. Fortunately, a consumers' cartel works even better against a natural shortage than against an antagonistic producers' cartel.

A Race to Fuel Economy. When making purchases that can save energy over many years—for example, the purchase of a house or car—consumers tend to be systematically nearsighted. That is, they undervalue future energy savings. So consumers don't push automakers as much as they could to improve fuel efficiency. We can address this failure of the energy market by engaging car companies in a race to produce fuel-efficient cars. This eliminates the need for government standards and produces a more powerful incentive to improve.

An Energy Moonshot. Lately, people have been talking about the possibility of an energy moonshot—a major effort something like Project Apollo, which put a man on the moon. This could correct the fourth market failure, a shortage of funding for advanced research. However, we need to be careful. This market failure justifies government funding of basic research but not vast subsidies for existing technologies. Clean coal technology is an excellent example of an energy moonshot the government should fund.

~

Most of Part 1 concerns energy myths. In Chapters 2 through 4, I demonstrate the importance of rejecting imaginary or speculative disasters. To balance things out, I debunk the myth of energy miracles in Chapter 5, while in Chapter 6 I question the most pessimistic view of policy. And for those anxious for answers, the last chapter of Part 1 summarizes the national policies that I propose in more detail in Part 3.

However, before I go into detail about my proposals, I lay a foundation in Part 2 for understanding both national and international policies. In Parts 3 and 4, I focus on solutions to the four basic failures of the energy market. Parts 3 and 4 also focus on cooperation, at both the national and international levels—even down to the level of car companies.

I have designed this book to help readers who wish to skip ahead. But for a solid understanding of why the policies I propose are necessary and cost-effective, I suggest you first clear your mind of the myths about fossil fuel right here in Part 1, then read about the realities of energy markets in Part 2.

chapter 2

Wreck the Economy?

The Kyoto treaty would have wrecked our economy, if I can be blunt.

—President George W. Bush, 2005

If I may be blunt myself, of all the fears concerning climate change and addiction to oil, the fear of wrecking our economy is most paralyzing but least substantial. Even if the costs were greater than they actually are, for America to turn away in fear from the challenges of climate and addiction would dishonor our heritage and lay our own responsibilities at the feet of future generations.

The irony of America's recent energy policy is that, by taking little responsibility for our energy use, we have once again handed the power of the oil market to the Organization of Petroleum Exporting Countries (OPEC). The connection is straightforward. The Kyoto Protocol calls on nations to reduce their use of fossil fuel, mainly coal and oil. Reducing the use of oil makes oil less scarce and reduces its price. In fact, as I mention in the previous chapter, a reduction in the world's use of oil was what crushed OPEC's market power for eighteen years.

Our choice is not between a wrecked economy and economic growth. It is between controlling our own energy policy and letting OPEC's high prices force upon us an energy policy of its own design. Theirs is a poor policy indeed, as OPEC profits from our addiction and dislikes policies that stop global warming. But its policy is forcing us to conserve oil. By 2007, our rising oil use leveled off,

and in the first half of 2008 U.S. oil use was down over 2 percent from a year earlier and oil imports were down 2.5 percent. Compare this with an annual growth rate in oil use of 1.5 percent in the decade before 2005. President George W. Bush claims credit for reducing energy intensity—energy use compared with gross domestic product (GDP). But the reality is that OPEC's high prices are making us conserve—just as they did in the 1980s—while the economy continues to grow. While conservation is a benefit, when administered by OPEC, it comes at far too high a price.

Instead of idly waiting to see what OPEC had in store for us, we could have chosen our own destiny. Our own market-based policies could have guided the use of better technology to reduce our dependence on coal and oil. According to the Department of Energy (DOE), this would have reduced the world price of oil—just as it did in the 1980s. The DOE discovered this in 1998 when Congress asked it how signing on to the Kyoto treaty would affect our economy. The DOE also discovered that implementing the Kyoto Protocol, flawed as it was, would not wreck our economy.

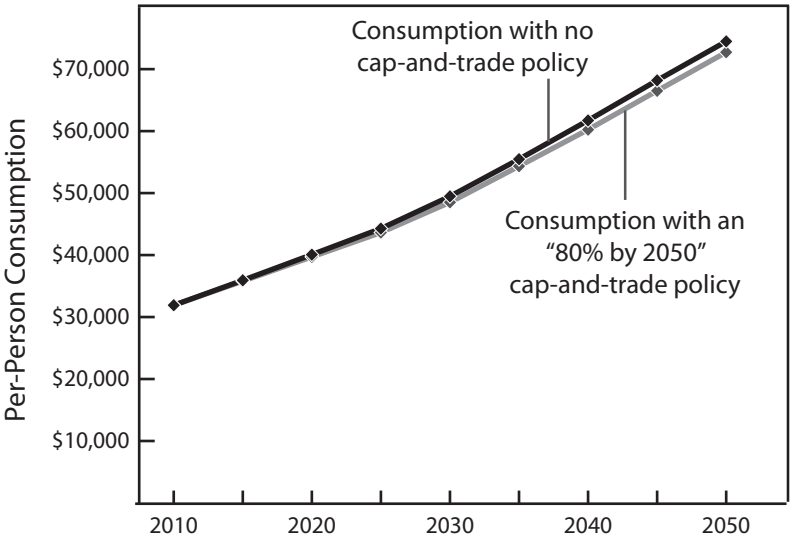
It is too late to avoid paying the present round of tribute to those powers both foreign and domestic that control the world's oil. But we can, in a few years, regain control of our energy destiny by heeding the advice of a president who presided over some of the most perilous times in U.S. history. Even before confronting the perils of World War II, Franklin D. Roosevelt faced the dangers of the Great Depression. He did not flinch, saying, "Only a foolish optimist can deny the dark realities of the moment." But he also warned of the greater danger of being ruled—and paralyzed—by fear, famously declaring "We have nothing to fear but fear itself."

Just as it was seventy-odd years ago, fear itself is again our greatest enemy. That's why I begin this book by dispensing with the exaggerated predictions of economic ruin, catastrophic shortages, and unstoppable climate change. And although the book is motivated by the real dangers of global warming and the dependence on foreign oil, I do not dwell on these. Instead, I present a plan to improve our chances against both threats, without wasting money and at a surprisingly low cost. Although no panacea exists, what we need as a nation is courage, cool heads, and a clever, low-risk plan of action.

Overcoming Fear

Only after we lay to rest the fear of taking action will it make sense to plan a more secure and environmentally sound energy future. But after so much misleading rhetoric, a simple claim that the U.S. economy is strong will not suffice. The belief in economic damage is so ingrained that it afflicts even some of those most willing to take action.

Figure 1. Effect on Personal Consumption of a Strong Cap-and-Trade Policy



As the cap of a cap-and-trade program tightens, it takes an increasing bite out of income. This graph assumes a program that targets an 80 percent reduction in greenhouse gas emissions by 2050 and is similar to programs proposed by Congress. After forty years, average per-person (not per-family) consumption would have reached only $72,700 instead of $74,500. The graph is based on data published in April 2007 by a team of researchers at MIT.*

Another way to think of the "sacrifice" required is as a delayed increase in income. Under the strict policy that the MIT team studied, the country must wait until 2051 to achieve the income it could have attained in 2050.

How Can It Be So Cheap?

You may now be wondering if the economists who come up with these numbers are in touch with reality. How could it be so inexpensive to cut back on fossil fuel, the very lifeblood of a modern economy? Why are we so addicted if it's so cheap to switch?

The basic answer is this: The United States is rich, and fossil fuel is not as costly as you might think. In fact, it has been too cheap to pass up. Much of the cost of electricity and gasoline is not the cost of fossil fuel, but of wires, generators, and refineries.

The DOE's 1998 model predicted that the largest carbon savings would come from replacing coal-fired generators with natural-gas-fired generators. Coal is higher in carbon per unit of energy produced than other fossil fuels and produces 35 percent of U.S. CO_2 emissions. Natural gas is the cleanest

chapter 3

Peak Oil or Liquid Coal?

Civilization as we know it will come to an end sometime in this century, when the fuel runs out.

—David Goodstein, Professor of Physics, Caltech

Peak-oil theory combines serious geology with pop economics to "envision a dying civilization, the landscape littered with rusting hulks of useless SUVs," as Caltech professor David Goodstein describes it in his book *Out of Gas*. The most popular leaders of this movement also envision a massive "die-off" of the world's population, along with the end of industrial civilization.

There is only so much oil worth pumping out of the ground. Peak-oil theory claims that once it's half gone, the rate of pumping will reach an all-time production peak and start to decline. The peak will herald the beginning of an "earth-shattering crisis," as one author puts it. The world economy and, most likely, the world's population will decline right in step with oil production. According to peak-oil theorists, the oil is about half gone. Our time is up.

Goodstein, a physicist, says that "until the 1950s, oil geologists [believed] that the same rate of increase [in oil production] could continue forever." And geologists say that economists think this still. But I can find no evidence that anyone has ever believed in limitless oil. Back in the 1800s, a famous economist named William Stanley Jevons predicted peak coal in England far too early. And patent-medicine salesmen, hocking "rock-oil" remedies, predicted peak

oil just before Edwin L. Drake drilled the first oil well in Pennsylvania. (Before then, people got oil from natural oil seeps.)

Starting in 1979, the *Mad Max* film trilogy painted a bleak and violent picture of a world plagued by oil shortages that cause a nuclear war. Since then, predictions of a similarly grim economic future have become attached to peak-oil theory.

Peak-oil geology has fascinated me since 1998, when I read a *Scientific American* article by two leading peak-oil geologists. Pursuing the topic more recently, I found its basic tenets showing up in mainstream arguments over U.S. energy policy. One such policy—that the U.S. military is to achieve "energy independence" through subsidies for liquid fuels derived from coal—is backed by the Departments of Energy, Defense, and the Interior.

As with the idea that we will "wreck the economy," fear of peak oil is counterproductive. Peak-oil scare tactics aid in the push for liquid coal and synfuels. Using these can nearly double carbon dioxide emissions. Worse still, overblown claims of economic collapse have led, naturally enough, to the erroneous conclusion that peak oil will solve the climate-change problem. This makes it easier to accept the push for liquid coal.

Peak-Oil Theory

In 1956, oil geologist M. King Hubbert predicted that U.S. oil production would peak between 1965 and 1972. It peaked in 1970. He also predicted that world oil production would peak between 1995 and 2000. He did not, however, predict an earth-shattering economic crisis at the peak. Experts base their predictions of peak production on graphs of historical production rates and clever extrapolations. These techniques involve neither geology nor economics and are easy to understand. For example, just read geologist Kenneth S. Deffeyes's fascinating book *Beyond Oil*.

More recently, peak-oil enthusiasts have added the *Mad Max*-flavored economic collapse to Hubbert's sober theory of peak oil. The collapse is most clearly explained by electrical engineer Richard C. Duncan, one of the most popular peak-oil proponents on the Web. (In 2007, Google listed 450,000 Web pages referring to him.) He claims the "world population will decline to about 2 billion circa 2050." Since the world's population is currently over 6 billion, that would mean over 4 billion would die—over sixty times more than died in World War II.

C. J. Campbell, a petroleum geologist and the leading peak-oil expert, also believes world population will fall to "pre–Oil Age levels," which would imply even more deaths. Richard Heinberg, the most prolific peak-oil author, tells us this is not "necessarily such a bad thing" because it "just means a return to the normal pattern of human life—life that is in tribes or villages" (see "The

The Peak-Oil "Die-Off"

The World's population has grown in parallel with oil production to its present level of 6.4 billion. … It is hard to avoid the conclusion that this Century will see the population fall to close to pre–Oil Age levels.

—C. J. Campbell, leading peak-oil geologist

The recent fossil-fuel era has seen so much growth of population and consumption that there is an overwhelming likelihood of a crash of titanic proportions. … Verbal and mathematical logic, joined with empirical evidence, make an airtight case: we're headed toward a cliff.

—Richard Heinberg, most prolific peak-oil author

Perverse as the comment may seem, I don't think collapse, in this instance, would necessarily be such a bad thing. As Tainter points out, collapse really just means a return to the normal pattern of human life—life, that is, in tribes or villages. … Perhaps peak oil at last provides the word "sustainability" with teeth.

—Richard Heinberg

Peak-Oil 'Die-Off" for his full quote). But Heinberg, a new-age journalist, was predicting this die-off even before he latched onto peak-oil theory.

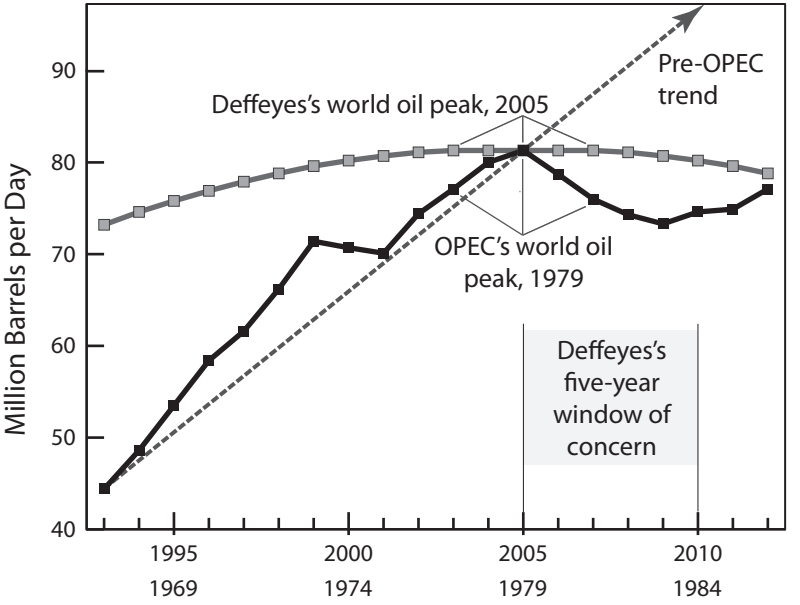
What Happens after the Peak?

Oil production will certainly peak, and perhaps it already has. But what about the worldwide economic collapse? Will that certainly follow? The world did experience a peak in oil production in 1979, when the Organization of Petroleum Exporting Countries (OPEC) cut production and raised prices. Production declined sharply for four years and did not surpass the 1979 peak again until 1989. This provides a real-world test of the peak crisis theory.

So what happened when world oil production suddenly stopped rising and started falling in 1979? The world did not shatter; instead, it kept growing. Moreover, it outdid OPEC, cutting oil use more than OPEC had intended to cut production. Deffeyes, the most respectable peak-oil geologist, says we're now sliding over and down the final oil production peak. But by his calculation, the decline in oil production for the first five years after the peak, the period he's worried about, will be considerably less steep than the decline after the 1979 peak.

Deffeyes is a Princeton geologist and, for my money, by far the most interesting of the peak-oil experts. He has nominated November 24, 2005—Thanksgiving of that year—as World Peak Oil Day. Better yet, in *Beyond Oil,* he gives his exact formula for the peak, which we will soon check. Figure 1

Figure 1. The 1979 OPEC Oil Peak Was Sharper than Deffeyes's Oil Peak



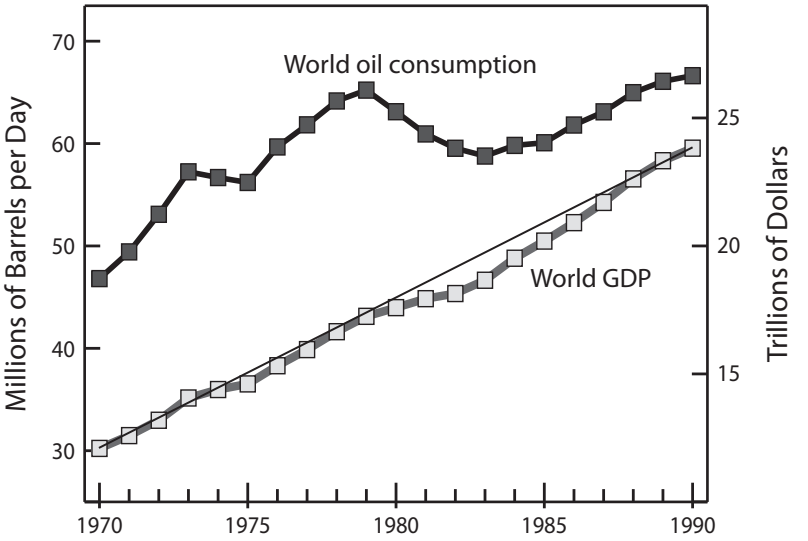
The graph aligns the 1979 peak in world oil production caused by OPEC with the world's final oil production peak, as predicted by Deffeyes, so that the two can be easily compared. Peak-oil theory predicts a smooth peak. Consequently, the shock to the world economy was much greater during the first six years of OPEC's peak than the economic shock expected from the current peak—if this is, in fact, the peak.

shows Deffeyes's predictions about world oil production. The peak in production centers on 2005, and the graph is based on his "logistic" formula and his value of a 10 percent drop-off by 2019. Deffeyes is optimistic that in fifteen years we will find adequate "renewable, non-polluting, sustainable" energy sources, but he says he's worried about the first five years, 2005 to 2010. "What can we expect on the five-year time scale? … Get acquainted with parsnips and rutabaga." In particular, he's worried that "war, famine, … and death … are serious possibilities." But in the first five years, production would drop only 1.4 percent. Why is he so worried?

He's concerned that world demand for oil was growing at almost 2 percent per year before World Peak Oil Day and that growth will have to stop. With Deffeyes's prediction of slightly negative growth in production, we would fall behind a full 10 percent in five years. That's a lot to be short of gasoline.

However, in 1979, the world's use of oil had been rocketing up more than twice as fast as in recent years. Five years after the 1979 peak, oil supply had fallen about 20 percent below its upward trend. So the shortfall after the

Figure 2. Peak Oil Had Little Effect on World GDP



Although the 1979 peak in oil production and consumption was sharp, it did not have a catastrophic effect on world economic production. The final peak in oil production will not cause a global economic crisis killing billions, as predicted by a number of peak-oil proponents.

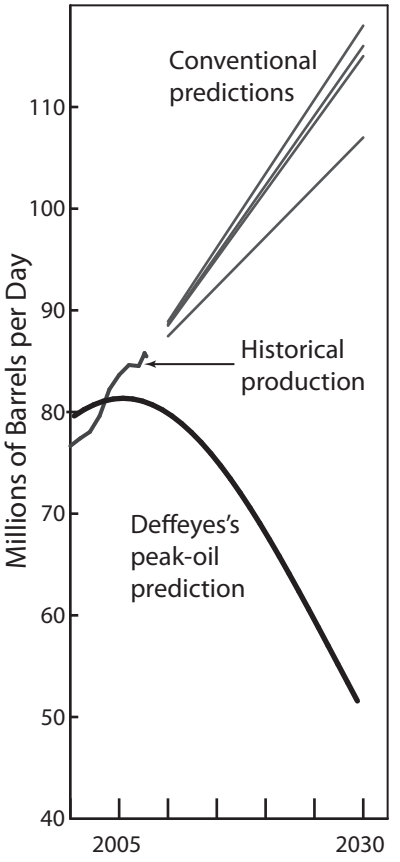
1979 peak was twice as severe as the shortfall Deffeyes foresees as likely to cause war, famine, and death. So what actually happened in the five years after the 1979 peak?

During that time, when total world oil production and consumption fell 8 percent, world gross domestic product (GDP) grew by 13 percent (see Figure 2). I'm not saying OPEC's impact was painless, but 13 percent growth in five years is not a calamity. The first few years were tough times—the poor suffered, and the rich were annoyed—but the world economy did not stop growing.

World oil production did not make it back to its 1979 peak until 1989, and in those ten years, world GDP grew 35 percent. Supply reductions tend to send prices soaring, and at first they did. But by 1986, with world supply down 8 percent from its peak, the price of oil was down 70 percent from its peak. How could a drop in supply cause prices to collapse?

Ahmed Zaki Yamani, the Saudi oil minister and a decent economist, foresaw this and tried to rein in OPEC's price increases in 1979. He succeeded a bit, but he knew it was not enough. Yamani knew high prices were a two-edged sword. They pried trillions of dollars from the purses of consuming nations. But what the peak-oil proponents deny—and what Yamani understood—was that consumers do not sit idly by and watch this happen. When OPEC's prices soared, consumers, including businesses, cut demand so much that they more

Figure 3. World Oil-Supply Predictions



In his book *Beyond Oil*, Deffeyes predicts the oil production peak graphed here. So far, it has not happened. Actual world production is shown from 2000 through the first four months of 2008. These data are from the U.S. DOE (see endnotes for more details).

The National Petroleum Council, in its July 2007 report *Hard Truths,* cites four conventional predictions for oil production in 2030. From highest to lowest, these are from the U.S. Department of Energy (DOE); the International Energy Agency (IEA), a group of industry consultants; and an average of international oil companies' predictions.*

than made up for OPEC's supply cuts. Supply did not fall short of demand.

In Figure 1, notice the huge gap that opens up, in the 1980s, between the oil supply trend and the actual supply of oil. This gap is the result of conservation. Conservation punished OPEC's excesses for decades. Peak-oil geologists may know their oil. But Deffeyes confesses, "I emphatically do not understand economics." Someday the market will teach him the same lesson it taught OPEC.

Some might argue that the 1979 and 2005 peaks are fundamentally different. The 1979 peak was not the real peak, and world oil production surpassed 1979 levels ten years later. When the real peak comes, there will be no going back. But knowing that the peak is final will only cause markets to adjust to falling supply more quickly and decisively than they did in 1979.

Has the World's Oil Supply Peaked?

November 24, 2005, has come and gone. As Figure 3 shows, it wasn't exactly World Peak Oil Day. But if there's a sharp decline in oil production after 2009, Deffeyes will not have been so far off. The trouble is, we just don't know, and prognosticators have a long history of jumping the gun.

In 1919, for example, the director of the U.S. Bureau of Mines predicted that "within the next two to five years the oil fields of this country will reach their maximum production." In 1943, Secretary of the Interior Harold Ickes published an article referring to U.S. oil production with the title "We're Running Out of Oil!"

It can be a bit difficult for those of us who are not geologists to believe predictions of an imminent peak in oil production because such predictions are in sharp disagreement with the forecasts of the oil industry and government agencies.

If most experts believe the peak-oil proponents are wrong, why take them seriously at all? One reason is that the experts themselves have been wrong of late. Between 2005 and 2007, the DOE cut its prediction of the 2010 world oil supply by 4 percent. That's quite a lot for such a short-term prediction. Something is changing unexpectedly. Since 2005, in spite of prices that might have stimulated more production

chapter 4

Is the Globe Warming?

I don't want to wait around until the house burns down till I decide whether it's a serious fire or not.

—Oilman T. Boone Pickens on climate change, 2008

Two myths have clouded our understanding of climate science. Believe the first—that climate science is still too uncertain to serve as a guide for action—and we will do nothing. Believe the second—that the signs of imminent disaster are so obvious that we no longer need science—and we may waste trillions.

Fortunately, an easy solution is at our disposal: Believe the Intergovernmental Panel on Climate Change (IPCC), and believe this chapter's quote from T. Boone Pickens. They both make sense, and together they provide the clarity we need. The IPCC is the world's leading scientific authority on global warming, and T. Boone Pickens is a hard-nosed oil billionaire.

Science is cautious. It does not accept the result of one experiment or test but demands cross-checking by many scientists. Consequently, science is slow to reach a firm conclusion, and scientists are prone to say, "It's probably like so, but we aren't sure yet." And that is exactly why we should believe them. Don't trust those who jump to conclusions or have an ax to grind; they are the mythmakers.

The IPCC tells us that human activity is probably causing most of the global warming but that the IPCC isn't sure about that yet. They're scientists. They are only 90 percent sure. That leaves the door open for the first myth—that

we don't know enough to do anything yet. That's where T. Boone Pickens comes into the picture.[1] He admits the scientific uncertainty but draws the obvious conclusion: If our house is on fire, we should not wait for the scientists to tell us precisely how serious it is before we do something about it. The scientists won't be completely sure till it's too late.

In this chapter, I first investigate the sources of the two myths. Then I take a closer look at just what the IPCC has to say and why it makes sense to get moving as soon as possible—which will be none too soon, given the sluggishness of international organizations.

Doubt and Uncertainty Is Their Strategy

A leaked memo reveals the origins of the first myth—that scientific uncertainty means we should do nothing about global warming. It was an internal memo of the Global Climate Coalition, an organization of major corporations that, from 1989 to 2002, fought attempts to reduce greenhouse gas emissions. In the 1998 memo, the group clarified its definition of victory: "Unless 'climate change' becomes a non-issue, meaning that the Kyoto proposal is defeated and there are no further initiatives to thwart the threat of climate change, there may be no moment when we can declare victory."

To the oil, coal, and auto companies that formed this coalition, victory was the defeat of the Kyoto Protocol and the end of all "further initiatives to thwart the threat of climate change." Those companies did not wait for scientific proof that their profits were threatened before forming their coalition just a few months after the United Nations organized the IPCC.

Wary of the new scientific initiative, the coalition focused on casting doubt on the science. The 1998 memo shows them chagrined to find they have been losing the battle, but it points to an opportunity: "The science underpinning global climate change theory has not been challenged effectively in the media." The memo also emphasizes the need to get "average citizens to 'understand' (recognize) uncertainties in climate science."

But as climate science turned up more and more evidence against the coalition's position, the group began to disperse. DuPont, British Petroleum, Shell, Ford, DaimlerChrysler, General Motors, and Texaco all left by 2000. Exxon stuck with the coalition until it became inactive in 2002. By that time, Exxon had found champions in the new Bush administration.

Among top Republicans, Frank Luntz may be the most renowned public relations specialist. He was the principal author of and pollster for Newt

1. Pickens's insight is supported by a difficult but brilliant paper by Martin L. Weitzman, a Harvard professor, "The Stern Review of the Economics of Climate Change."

chapter 5

Cheaper than Free?

Climate protection would actually reduce costs, not raise them … because saving fossil fuel is a lot cheaper than buying it.

—Amory Lovins, *Scientific American*, 2005

If peak-oil proponents are the pessimists of the energy world, physicists are the optimists. Peak-oil buffs believe that having less oil will "end civilization as we know it," while energy guru Amory Lovins tells us that "oil problems will fade away" and that "displacing most, probably all, of our oil … makes money." Lovins thinks that oil production will peak, not because we'll run out, but because we'll realize it's a waste of money and largely stop using it.

In the early days of the first OPEC crisis, when the Organization of Petroleum Exporting Countries (OPEC) tripled the price of oil, a number of physicists vigorously advocated conservation as the primary defense against OPEC. They claimed it was cheaper than increasing the supply of oil and sometimes cheaper than free. For example, insulation might save more in fuel costs than it costs to insulate. A couple of years into the crisis, in 1976, Lovins published, in *Foreign Affairs* magazine, a manifesto for the conservation movement. In "The Road Not Taken," he advocated a "soft energy path" to reverse the growth in U.S. energy use by conservation measures that would be cheaper than free. In spite of lacking a degree in physics, this made him perhaps the best-known member of what I will call the physics camp.

While many policy analysts and politicians, including Presidents Gerald Ford and Jimmy Carter, believed in stimulating conservation by raising energy prices, few believed this could be the primary solution to our energy problems. But as it turned out, it was mainly what put an end to OPEC's reign in 1986.

Without question, the physicists were right about conservation's importance. And they were right that, as Lovins puts it, conservation does not have to mean "discomfort or privation (doing less, worse or without)." Most of the physics camp, and many economists, agree that some conservation measures are cheaper than free. But Lovins goes further and claims that everything we need in the way of energy policy is cheaper than free. Is he right about this?

How Cheap Is Electricity Conservation?

As with peak oil, we can look to history to evaluate claims that conservation will be cheaper than free. Lovins's 1990 paper "Four Revolutions in Electric Efficiency" provides a historical test of this idea. It concludes that four electricity revolutions were in full swing with no roadblocks in sight (see "Electric Revolutions"). In short, he predicted that by now we could be using almost no electricity—only about 3 percent of what we used in 1990—and that this conservation effort could save us, counting all costs, over $200 billion a year. To be fair, he did not think we would take full advantage of these opportunities.

Lovins's starting point is that already in 1990, "the best technologies now on the market could save about 92 percent of U.S. lighting energy." However, for all electrical uses combined, he claimed that only three-quarters of the electricity used was unnecessary at that time. Moreover, Lovins tells us that his conservation measures would have cost eleven times less than the value of the saved electricity.

Next, he claims that the cheaper-than-free opportunities had doubled in the previous five years and would do so again in the next five and that he saw "no signs of this slowing down." Better yet, the cost of conserving would be decreased by three times every five years. (See "Predicting Conservation" for his calculations.)

As it turned out, between 1990 and 2005, electricity use went up 34 percent, not down 97 percent. It's hard to say exactly what went wrong, because Lovins doesn't leave behind documentation that others can check. But the point to remember is that counting on energy savings to happen on its own, even when the potential seems gargantuan and the monetary savings enormous, is risky business.

Hypercars and Formula One Race Cars

After predicting revolutions in electricity conservation, Lovins refocused on "Hypercars," vehicles designed to get such good mileage that they will, according

chapter 6

No Free Lunch?

Increased fuel efficiency, however, is not free. … Any truly cost-effective increase in fuel efficiency would already have been made.

—Former Council of Economic Advisers Chairman
N. Gregory Mankiw, 2007

N. Gregory Mankiw is the mirror image of Amory Lovins, the protagonist of Chapter 5. Lovins knows that every energy measure we could possibly need will save more than it costs. Mankiw knows that all such measures will cost more than they save. Mankiw served as George W. Bush's chairman of the Council of Economic Advisers from 2003 until 2005 and is well respected within the economics profession.

The Mankiw-Lovins bipolarity highlights an important split in energy policy circles. On one side, we find Mankiw and other "neoclassical" economists. They oppose not only fuel-economy standards but all energy-efficiency standards and energy-efficient building codes. That is, they oppose all measures favored by the "physics camp" that I mentioned in the last chapter.

On the other side of the split, the physics camp is less strident. Although they tend to believe efficiency standards are most important, they rarely take a strong stand against the policies favored by the neoclassicals. Although Lovins shares the camp's belief in abundant, cheap efficiency measures, he is not typical of the physics camp, because he sees less need for standards than do most in that camp.

The neoclassicals, being economists, favor policies that change the price of energy. They call this "sending a price signal" to the market. They favor sending the price signal by taxing fossil fuel. That would, of course, raise its price. But since taxes are unpopular they've come up with a stealth tax, which is not so easily recognized. It's called a "cap-and-trade" policy, and six or seven of these have now been proposed to Congress. Like a tax, a cap-and-trade policy raises the price of fuel and electricity. It "sends a price signal," which pleases the neoclassicals.

The physics camp tends not to like either taxes or stealth taxes, both of which they see as unpopular because they are clearly costly, not cheaper than free. Instead, they prefer to mandate more efficiency with a standard, which they have precalculated will save more than it costs. While working at Lawrence Berkeley National Laboratory, I helped make these precalculations for national appliance standards.

So where do "free lunches" fit into this controversy? "A free lunch" is what the neoclassicals call any policy that provides a benefit that is greater than its cost. The term is descriptive, but it also conjures up the slogan "there's no such thing as a free lunch," which helps them win their point.

In summary, the neoclassicals say: The physics camp claims all its proposals are free lunches, but there's no such thing—we need taxes. The physics camp says: Call them free lunches if you like, but there are a lot of ways to save money and energy at the same time—who needs taxes?

The Energy Policy War

The neoclassicals dismiss the efficiency programs of the physics camp saying they are not free lunches; they cost more than they save, and that's a waste of money. But there is also a net cost to the efficiency gains from the neoclassicals' taxes, so why is one better than the other?

The neoclassicals reply that neither approach provides a free lunch, but that their approach provides cheaper lunches than the physicists' approach. They propose sending a price signal to the market and letting the market choose how to improve efficiency. Since, by assumption, markets always do better, the physicist proposals are always worse. So say the neoclassicals.

Because the neoclassicals see taxes as a more market-based approach and markets as better than government, they actively oppose all efficiency standards. Under the administration of George W. Bush, the neoclassicals helped to derail appliance-efficiency and fuel-economy standards—government-run, free-lunch programs all.

William Nordhaus, a Yale economist who has probably spent more time studying energy and climate-change policy than any other economist, simply calls such policies "fluff." Lovins is well aware of this view and enjoys talking

chapter 7

The Core Energy Plan

The entire carbon tax should be returned to the public. … Carbon emissions will plummet far faster than in top-down or Manhattan projects.

—James E. Hansen, NASA climate scientist, 2008

Previous chapters discredited these myths: that we will wreck the economy, that peak oil will herald doom, and that miracles are imminent. Other chapters explored why it is foolish to ignore climate change or shun money-saving policies. Leaving these misconceptions behind, I will now sketch a Core National Energy Plan that is cautious yet powerful.

Part 3 of this book lays out details of the plan. So if you find the workings of the untax, or the race to fuel economy, a bit puzzling, don't be surprised. There are a few tricks to good economics, and the full explanation will make more sense after a closer look, in Part 2, at how energy markets work.

The core energy plan flows from basic principles. A good design does not rely on incredible advances in technology. Instead, a good design requires that a plan be

- Simple.
- Cost effective—a bargain.
- A treatment for the disease, not just for the symptoms.

Simplicity helps prevent mistakes and gaming. I have learned this repeatedly in my work diagnosing and adapting electricity markets. I have

also learned that this principle is seldom respected in practice. But simplicity is still the right way to begin.

Asking for a bargain may seem superficial, but, in fact, that is exactly what economists mean when they call for "efficiency," their primary objective. The cost of saving a certain amount of oil or carbon should be as low as possible.

Unhealthy energy markets—ones that are inefficient and do not reflect social costs—develop symptoms such as gas-guzzling cars, too few wind turbines, and too many coal plants. The symptoms are the ways energy is wasted. The underlying disease involves "market failures"—basic problems with how the market works. Treating the symptoms—for example, by subsidizing ethanol—often causes unwanted side effects. And there are just too many symptoms to treat them all one by one. A better approach is to identify underlying causes—aspects of the market that are broken—and treat those rather than the symptoms.

Energy Policy: Mostly Sound and Fury

Yale economist William Nordhaus, writing in the *New York Times* in 1980, had this to say about fixing the cause of the problem:

> "A recent study by the Department of Energy, called Energy Programs/ Energy Markets, has estimated … what the impact of all current programs would be in 1990. … The central and surprising conclusion of the Energy Department study is that the energy programs add up to about zero. … By comparison, the rising relative prices of energy will probably lower energy use 20 to 30 percent by 1990."

What's Broken?

To avoid treating symptoms, we must identify the problems. Almost everyone has a list of things they find wrong with the market, so the trick is to decide which are worth fixing. Amory Lovins, the lead optimist in the physics camp, sees market barriers by the dozen and urges us to "clear them," "bust them," and "vault over them." Market "barriers," or "failures," as economists call them, are broken aspects of markets, such as landlords who buy inefficient appliances for tenants because the landlords do not pay the electric bills. I believe most economists are open to the idea that many little things go wrong with markets, but they take a cautious view of such problems.

Having seen many proposed and attempted market "fixes," economists tend to shy away from jumping on the fix-it bandwagon. Market fixes usually come with their own problems, and for minor market failures the cure is usually worse than the disease. Economists recommend identifying the worst problems and focusing policies only on those few. A good solution to an important problem puts us well ahead of a multitude of poor solutions to lesser problems. William Nordhaus identified the shortcomings of piecemeal policies in 1980 (see "Energy Policy: Mostly Sound and Fury").

Part 2

Energy-Market Realities

chapter 8

Learning from OPEC

After a decade's bonanza, the Saudis found their cartel losing its power; its soaring prices had shrunk demand.

—William Safire, January 1986

OPEC MEETS TWO OR THREE TIMES a year to set the amount of oil each of its fourteen member countries will produce. The cartel does not keep secret its market manipulations; you can find its "Crude Oil Production Allocations" right here on the Web:

www.opec.org/home/Production/productionLevels.pdf

OPEC, the Organization of Petroleum Exporting Countries, controls the world price of oil by controlling its production. Were OPEC to cut production 10 percent, the resulting shortage would send the world price of oil higher than we have ever seen. The organization doesn't do this for two reasons. First, its members find it hard to agree on which of them will cut back and by how much. They also know that the world would take one look at such high prices and begin to cut oil use, just as it did once before. Let's take a look back at this history to understand better the process of conserving oil and energy and why it frightens OPEC.

OPEC tripled the price of oil in 1974, then doubled the resulting price in 1979. By 1981, a worldwide reaction forced Saudi Arabia, OPEC's leading supplier, to cut production in order to keep the price from falling below

OPEC's target level. By the end of 1985, Saudi Arabia had cut its production 75 percent and could afford no more cuts. It abandoned the cartel rules, stole business from other cartel members, and let the price collapse. This ended a twelve-year price shock that is by far the largest experiment in energy policy ever conducted. The experiment did much harm and, quite by accident, much good as well. The results surprised people in three ways:

- The high prices triggered more conservation than most experts had thought possible.
- This conservation brought down the price of oil for eighteen years.
- High energy prices led to reductions in carbon dioxide emissions.

The importance of the carbon dioxide reduction did not become apparent until later.

High Oil Prices Drive Conservation

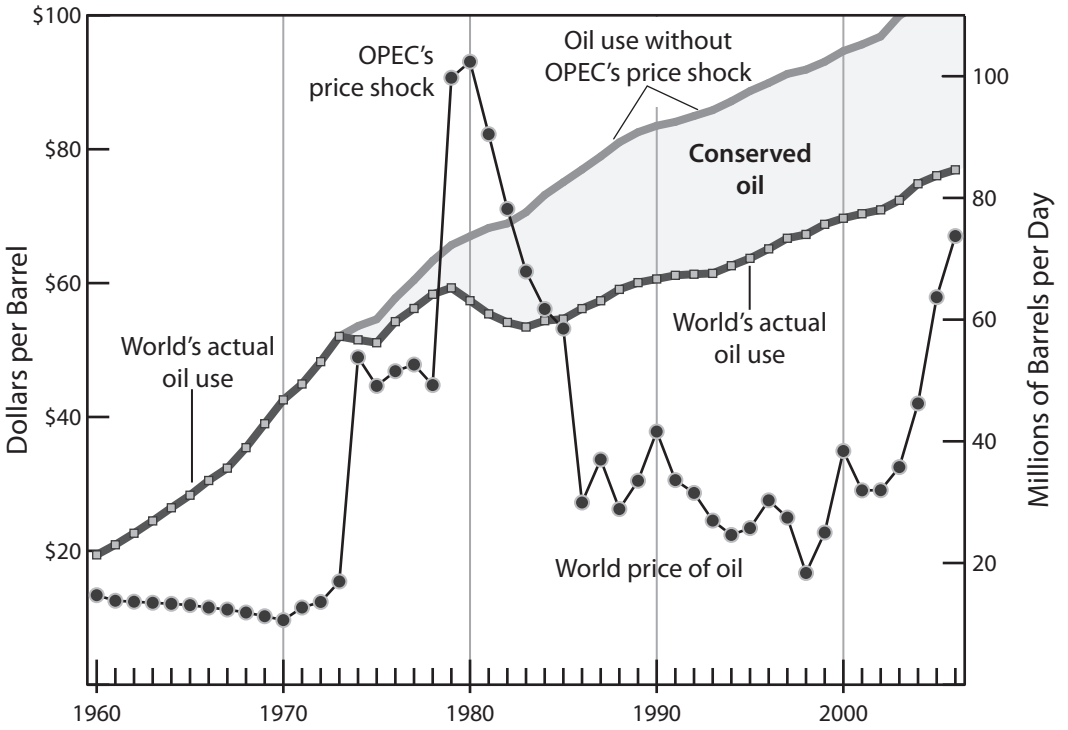
By 1986, "the Saudis found their cartel losing its power; its soaring prices had shrunk demand." William Safire, the well-known *New York Times* columnist and a self-described "right-winger," provides this analysis in the chapter's opening quote and goes on to make clear he's talking about conservation. Safire's remark demonstrates that in 1986, conservation was not a partisan concept. Conservation, with a little help from non-OPEC supplies of oil, defeated the mighty OPEC cartel. Conservation is the main way the world responds to high market prices. When price goes up, consumption comes down—but it takes a while for the full price effect to play out.

Market-driven conservation is a slow process—slow to get going and even slower to stop. Looking at recent high oil prices, people noticed that gasoline use was slightly higher in 2006 than in 2005, and many concluded that higher prices were not working to curb gas consumption. People thought the same in 1974, when the price of oil tripled and world oil consumption fell only 1 percent.

Market-driven conservation starts slowly because the best way to conserve is to switch to better technology. People don't buy cars and refrigerators until they need new ones, and companies take years to design new, more efficient models. It takes a while for changes in technology to pay off. But starting in 1980, with new technology in place and oil prices spiking, Figure 1 shows world oil use taking an unprecedented four-year nosedive. Figure 1 also shows that people kept conserving after the oil price collapse. In fact, changes made in 1980 are still saving us oil, otherwise the price of oil would have hit $100 a barrel years ago.

The Department of Energy (DOE) documented the unexpected size of the OPEC conservation effect back in 1980, and William Nordhaus, a respected Yale economist, discussed it in the *New York Times* that same year. Dale W.

Figure 1. OPEC Raised the Price, and the World Conserved Oil



The top line is estimated world oil use without the two OPEC crises. The line that branches off below it in 1974 is actual world oil use. The difference is the amount of oil conserved because of OPEC's high prices. Notice that changes made because of OPEC—things like fuel-economy standards and better insulation—are still saving an enormous amount of oil worldwide. Oil prices are in 2007 dollars.*

Jorgenson, whom I cited in Chapter 2, and Peter J. Wilcoxen are two of the country's best applied economists. They intensively studied the impact of the oil shocks on the United States and concluded that "over the period 1972–1987 U.S. emissions of carbon dioxide were stabilized by *price-induced energy conservation* [emphasis added]." Although carbon dioxide emissions worldwide did not stop increasing, they did stop increasing in the United States—for fifteen years. And during the crisis, global emissions also increased more slowly.

The Power of Price

The power of price lies in its ability to act in a million ways at once, many unexpected. Even when price directly affects people, they don't always recognize it. For example, consumers upset with high gas prices in 1975 lobbied for

chapter 9

The World Oil Market versus Energy Independence

Dependence on oil creates national security issues. There's too many people who have got oil that may not like us.

—George W. Bush, 2007

The world oil market controls the price you pay for gas at your neighborhood gas station. Taxes, gas station profits, and oil-refinery profits also take their toll, but when you see the price of gas go up twenty cents in one week, that's the world oil market in action. There's no escaping it. Even if your gas station sells gasoline made from 100 percent American oil, the price goes up exactly the same amount. Even if you buy American corn ethanol, the world oil market hits you just as hard.

This spells bad news for the most popular paths to energy independence: more drilling and alternative fuels. But the world oil market treats two other paths more kindly: energy conservation and electric cars. Conservation defeated OPEC from 1986 through 2002, and conservation wins again when it comes to protecting American consumers. But only electric, or perhaps hydrogen, cars can make us fully independent. They can provide non-liquid-fuel sources of transportation energy.

Oil Tankers Make the Market

Although oil tankers are expensive to build, they move so much oil so cheaply that they add relatively little to the price of oil. Cheap transportation of oil keeps oil prices aligned around the world.

For example, the United States buys more oil from Canada than from any other country, and Canadian companies can sell oil profitably for $60 a barrel. Did this help us when the world price went to $100 per barrel in early 2008? Unfortunately, it did not. Canadian companies, like all oil companies, can sell their oil anywhere in the world and pay only a small charge for transportation. So when China or Germany is paying $100 per barrel, Canada is not going to sell oil to the United States for $60 a barrel.

The ability of oil companies to sell anywhere with only a small transportation cost means no company sells oil at much below the world price. That creates a single world oil price. Because of this, it doesn't really matter who the United States buys from. Buying from Canada is no protection at all. When a shortage occurs, the price we pay goes up just the same.

A significant supply disruption anywhere in the world causes a price shock everywhere, so a world market may seem to increase the danger. But it also reduces the height of the price shock by spreading it over the whole world. In another way, having a unified world oil market provides excellent protection. OPEC cannot harm the U.S. supply of oil without harming the whole world equally.

Even if the United States bought most of its imported oil from OPEC, cutting us off would cause us no special harm. Here's what would happen. Our oil companies would immediately offer to buy oil at a bit above the world price from any oil company in the world. Since those other companies could make money by buying at the world price and selling to us for a bit more, many would be happy to do so. In fact, they would compete to get our business, and that would keep us from having to pay much more than the going price. For a small premium above the world price of oil, we would get all the oil we wanted, in spite of OPEC.

Put more simply, if OPEC cut 5 million barrels a day from the United States or Japan or any other country, the effect would be the same. The price of oil would rise, perhaps significantly, but the world oil market would assure that nations share the pain evenly. All countries would buy less because of the high price and not because of which countries OPEC favored or embargoed. OPEC can cause a shortage and raise the price, but it cannot effectively target any country.

The Military and Oil Security

> American forces … are in Iraq to prevent Iranian imperialism … from dominating the energy supplies of the industrial democracies.*
>
> —Henry Kissinger, 2007

~

In fiscal year 2005, the U.S. Department of Defense consumed 133 million barrels of petroleum. The U.S. Strategic Petroleum Reserve stands at 688 million barrels, enough to supply all the requirements of the Department of Defense for five years at its 2005 rate of use.

chapter 10

Corn Whiskey versus the Climate

For people in production agriculture, these soaring new sources of crop demand are pretty heady stuff. They are creating ethanol euphoria.

—Keith Collins, Chief Economist,
U.S. Department of Agriculture, 2006

The ethanol that replaces gasoline is 200-proof corn whiskey. If it stabilized the climate, there would be no shame in letting our cars drink good whiskey. But, as with most subsidies, the corn whiskey subsidy likely has more to do with local profits than with global policy. In fact, those who profit from growing corn or refining it to ethanol have experienced, as they say in the Midwest, ethanol euphoria.

In the last decade, a controversy has raged around whether corn ethanol is green. Do its production and use in place of gasoline reduce greenhouse gas emissions and help reduce global warming? This debate has consistently ignored one factor—the world oil market. As I show in this chapter, that changes everything.

As we have seen, conservation and an increased supply of non-OPEC oil forced the world price of oil down from $90 to $30 a barrel (in 2007 dollars) in the early 1980s. We have also seen that high world oil prices stimulated a huge reduction in the demand for oil. These two dramatic effects also apply to ethanol. Increasing the world's supply of ethanol works just like increasing the world's supply of oil. It reduces the price of oil, and that price reduction increases the world's use of oil. This is not rocket economics. If something gets

cheaper, people buy more of it. So the world oil market translates our good deed—replacing oil with ethanol—into more oil use by the rest of the world. Fortunately, the increased use of oil by others only cancels out about a quarter of our oil replacement. But that can tip the balance.

Subsidies and Ethanol Mileage

Before tackling the mysteries of the world market, let's take a look at ethanol as you might buy it at the local gas station. Ethanol will never save you money at the gas pump. On average it costs the same per gallon as gasoline, but you can drive only two-thirds as far—or slightly less—on a gallon of ethanol.

So it takes 1.5 gallons of ethanol to replace 1 gallon of gasoline. Or to put it another way, paying $3 a gallon for ethanol is like paying $4.50 for gasoline. But you also have to pay for the subsidies for ethanol, with your income tax. The federal subsidy is fifty cents per gallon, or seventy-five cents for a gallon and a half of ethanol. That brings us up to $5.25 to replace a gallon of $3 gas, and that doesn't count the subsidies for growing the corn. President George W. Bush set a production goal of 35 billion gallons of ethanol per year, which will replace about 23 billion gallons of gasoline at an extra cost of more than $2.25 per gallon. That's close to an extra $50 billion a year, and this goal is now law.

If we're going to spend that kind of money, it makes sense to shop around. The government should have made a list of all the energy policies we could implement and how well they work. Instead, the government barely evaluated corn ethanol before deciding to spend big bucks on it. The U.S. Department of Agriculture (USDA), whose staff knows a lot about corn subsidies but not too much about climate change and energy security, did what little evaluation was done. Not surprisingly, USDA staff looked at the wrong variable—net energy.*

What's Net Energy and Why We Don't Care

The net energy of ethanol is the energy in a gallon of ethanol minus the human-supplied energy it took to make that gallon. I say "human-supplied" because the calculations don't count the solar energy absorbed by the corn plants. The USDA found that it takes 0.73 units of input energy to make 1 unit of ethanol energy, so ethanol's net energy is 1 minus 0.73, or 0.27. So according to the USDA, the net energy balance of corn ethanol production is 27 percent positive.

Some anti-ethanol professors at Cornell University and the University of California at Berkeley say the net energy balance of ethanol is negative. But their calculations look biased to me, and I don't buy it. Others come up with a net-energy figure that's more positive than 27 percent. A brouhaha over net energy has resulted. But do we care?

chapter 11

Synfuels Again?

We have a vast, untapped oil resource right here in the West that could produce more oil than the Middle East.

—Senator Orrin Hatch, 2005

Synfuels are back. In 1985, President Ronald Reagan killed President Jimmy Carter's Synthetic Fuels Corporation. Twenty years later, President George W. Bush signed the Oil Shale, Tar Sands, and Other Strategic Unconventional Fuels Act of 2005. *Time* magazine defined *unconventional fuels* as "gas or oil from coal, shale and tar sands," and that's exactly what *unconventional fuels* means today. Thirty years later we are starting the synfuels process over again.

What Senator Hatch says in the chapter's opening quote is right, but the "oil resource" he mentions is shale oil, along with some oil from tar sands—100 percent synfuel. That's why he sponsored the synfuels bill that President Bush signed as Section 369 of the Energy Policy Act of 2005.

The new push for synfuels is backed by the Departments of State, Defense, and Energy, not to mention Big Oil and Big Coal. But where do synfuels fit into the big picture of climate change and energy security? In October 2007, President Bush said,

> "We have a comprehensive strategy to deal with energy security and environmental quality at the same time."

His comprehensive strategy consists of noncorn ethanol, clean coal plants, nuclear power, and efficiency standards for buildings. He also favors improved fuel-economy standards. He did not mention synfuels. He almost never does. They just wouldn't fit into a strategy billed as dealing with "energy security and environmental quality at the same time." Synfuels are a bit helpful for security but about the worst thing going for the environment.

The next thing Bush said was, "You can solve one, you can solve the other," emphasizing his promise to deal with both "at the same time." President Bush's political instincts were right on target with this one. That's what people want, and that's what will work, because "joint solutions," as I call them in Chapter 1, unite the two big energy constituencies: those for energy security and those for climate stability.

Synfuels—"unconventional fossil fuels"—are such a poor idea that Bush leaves them out of his "comprehensive strategy," and his name never appears with them on any White House Web page. So why have three government departments put their clout behind synfuels?

The Next Prize: Unconventional Fossil Fuel

First came coal, then oil, then gas. The United States led the world in oil production for nearly a century, until 1974, when the Soviet Union's production surpassed ours. Now the Middle East has about two-thirds of the remaining conventional oil. But the new fossil fuel is "unconventional"—oil shale, tar sands, and liquid coal.

Oil shale is a rock containing roughly 10 percent hydrocarbons. Heat it to about 700 degrees Fahrenheit for a month, and out come oil and natural gas. Shell Oil Company has tested a method of heating the shale in the ground with electricity and pumping out the oil and gas. It takes a lot of electricity, but it's probably cheaper and better for the environment than digging it out and cooking it aboveground, as producers have done in the past.

I consult a bit in Alberta for a client that generates electricity for a tar-sands operation. The company's ecologist explains that the tar sands he's seen are not even sticky. But like oil shale, the sands release oil when heated. The quality of this oil is poor, unlike the light quality of the shale oil that companies produce by slow heating underground. U.S. tar sands amount to only 4 percent of what we have in oil shale.

The world's supply of unconventional fuel is centered where Colorado and Utah meet Wyoming. Of the 2 trillion barrels of shale oil in the United States, the best 1.2 trillion are located in these three states. That's roughly the amount of oil the world has used since oil was discovered. The rest of the world has only about half as much shale oil as these three states.

chapter 12

China, Coal, and Carbon Capture

The Department of Energy … will embark upon a $1 billion initiative to design, build and operate the first coal-fired, emissions-free power plant—FutureGen.

—Secretary of Energy Spencer Abraham, 2003

The thing went south.

—Deputy Secretary of Energy Clay Sell, 2008

FutureGen is history. Secretary of Energy Samuel W. Bodman pulled the plug on "the thing," as his deputy called it, in January 2008. Five years earlier, Secretary of Energy Spencer Abraham had announced FutureGen would be "one of the boldest steps our nation takes toward a pollution-free energy future." He was talking about the world's first clean coal-fired power plant.

President George W. Bush touted the project for five years as big spending for clean coal—a cornerstone of his comprehensive energy strategy. "We're developing clean coal technology. We're spending over $2 billion in a ten-year period," he said in 2006. In fact, the Department of Energy (DOE) canceled FutureGen after five years, having spent only $40 million—2 percent of $2 billion. That's what the government spends on the military every forty-two minutes.*

Coal-fired power generation is the largest, fastest-growing contributor to global warming. The DOE is restarting the clean-coal project on a different track—no demonstration plant this time—but five years is a lot to lose in this race against carbon emissions. Also the new track does not include hydrogen production, so the DOE-subsidized plants will not have "zero emissions" as

previously advertised. They will cut carbon dioxide (CO_2) emissions by only about 40 percent.

China is at the center of the coal problem. It built one large coal plant nearly every other day in 2006. These plants will run until at least 2046. Between now and 2030, China will build more new electric power plants than the United States now has, and most of them will be coal fired. In 2007, China passed the United States as the most prolific emitter of CO_2. India is behind both but is following a similar path; by 2050, India is projected to have a larger population than China.

Here in the United States, the DOE predicts, coal-produced electricity will grow eight times more slowly between 2010 and 2030 than it will in China, but thirty times faster than electricity from renewable energy sources.

Although the coal problem is difficult, one somewhat new technology holds promise. Producers can capture CO_2 from power plants, pump it underground, and store it there almost permanently. No one has yet done exactly this. But commercial operations have tested all key parts of the system, and one old plant we will meet shortly has come surprisingly close to the FutureGen goal.

China: Villain or Hero?

Between 1990 and 2004, China's CO_2 emissions—mainly from coal—more than doubled, an increase of 110 percent, according to the DOE. In the same period, U.S. emissions grew only 19 percent. In this respect, China set the record as the worst of all the countries and regions the DOE tracks.

But wait. President Bush's Global Climate Change Initiative, announced on Valentine's Day 2002, is a promise to reduce U.S. CO_2 *intensity* by 18 percent in ten years. Before we condemn China as the worst offender, let us first rate China by intensity, Bush's scoring method. Carbon dioxide intensity is CO_2 emissions divided by gross domestic product (GDP).

$$CO_2 \text{ intensity} = CO_2 / \text{GDP}$$

Over that same time period, 1990 to 2004, China reduced its CO_2 intensity by 65 percent, according to the DOE. That's the best record among all the countries and regions tracked by the DOE. China was the fastest-growing producer of CO_2 but showed the most improvement in CO_2 intensity.

During that same fourteen-year period, the United States reduced its CO_2 intensity by only 40 percent. The changes in both the United States and China occurred at a time when neither country had an energy policy to speak of. How did this happen? Two factors can improve CO_2 intensity: Emissions can fall, or the economy (GDP) can grow. One helps the climate, and the other does not. So intensity does not tell us much about whether the climate is getting

chapter 13

Charge It to OPEC

Few things could more quickly arouse the exporters to outrage than the prospect of a tariff in the oil-importing countries, for such a levy would transfer revenues from their [OPEC's] *own treasuries back to the treasuries of the consumers.*

—Daniel Yergin, *The Prize,* 1991

The OPEC cartel is legal. Its thirteen members, major oil exporters all, agree to production limits about twice a year and post them on www.opec.org. These limits strongly affect the price of oil, and a $10-a-barrel price increase costs Americans an extra $70 billion a year. That's $40 billion extra profit for foreign oil and $30 billion for domestic oil. Forty billion dollars is a thousand times more than President George W. Bush spent on his clean-coal program in its first five years.

The Organization of Petroleum Exporting Countries, OPEC, is legal, but isn't there something we can do about it? As the 2001 recession got rolling, a reporter asked President Bush, "OPEC is about to cut production 1 million barrels a day [to raise the price]. What is that going to do to our struggling economy?" Bush replied,

> It is very important for there to be *stability* in a marketplace. I read some comments from the OPEC ministers who said this was just a matter to make sure the market remains *stable* and predictable [emphasis added].

Of course, the OPEC ministers always say they are just "stabilizing" the price. But for some reason, they usually stabilize the price up, not down. And by the way, Mr. President, in the United States, it is illegal for a cartel to "stabilize" prices. Instead, we prefer what we call free competition.

Today, the U.S. government has no plan to challenge OPEC and apparently no serious desire to do so.[1] Some people say the oil-consuming nations just can't agree on things, so we may as well let OPEC take us to the cleaners. Others, who know that cartels are not free-market institutions, think it would be wrong for us to organize a cartel—even though the OPEC cartel is eating our lunch. Surprisingly often, liberals take this point of view.

But America was not always like this. At one time, organizing a consumers' cartel to challenge OPEC was the highest priority of the U.S. government. It was only a partial success, but we can do better.

Could a consumers' cartel really work?

This book says it can. We can fix the climate and charge it to OPEC. To back up this claim, I must show that cutting the demand for oil will bring down the world price of oil—significantly. This is not as easy as it should be, because essentially no research is being done on designing a consumers' cartel.

But the estimates I need to show the power of a cartel are, in fact, buried in many official reports, and at the end of this chapter I expose several of these to the light of day. They show that the action of a consumers' cartel would have the required impact and perhaps much more.

Economists make such numerical estimates, so it would be reassuring to balance these numbers against the opinions of experts—preferably ones with deep roots in the world oil market. For such confirming testimony I turn to OPEC itself. Of course, they argue against a consumers' cartel, but in the process they tell us just what we need to know.

Although history provides useful lessons on how to organize a consumers' cartel, this chapter cannot answer the question of whether we can do better this time around. That answer must await Part 4 of this book. That will show that global warming has fundamentally changed the political climate. In fact, the Kyoto Protocol is a weak consumers' cartel, and success with the climate will require a stronger one. But first, we need to learn something about how cartels work and the history of America's effort to form one.

What's a Consumers' Cartel?

First, let's review the more common type of cartel, a producers' cartel—say, for example, OPEC. How does OPEC work? It could work in two ways—and in

1. A few legal challenges have been brought against OPEC, but all have either failed in court or failed to get off the ground. At most, OPEC might be violating a World Trade Organization (WTO) rule. If so, OPEC could just quit the WTO.

chapter 14

A Market-Based Carbon Tax?

Among policy wonks like me, there is a broad consensus … we need a global carbon tax.

—Former Council of Economic Advisers Chairman
N. Gregory Mankiw, 2007

"If all economists were laid end to end, they would not reach a conclusion." So said George Bernard Shaw, who knew that economists follow every recommendation with "On the other hand …" President Harry S. Truman, who instituted the Council of Economic Advisers, learned this too late and was soon begging for a "one-armed economist."

The propensity of economists to waffle makes N. Gregory Mankiw's claim all the more startling: "Among policy wonks like me [economists], there is a broad consensus." Economists can't reach a conclusion, never mind a consensus. But he's right—economists have reached a consensus in favor of his conclusion that "we need a global carbon tax." (See Chapter 6 for more on Mankiw's *New York Times* op-ed.)*

Because economists favor market-based approaches, their tilt toward a tax may seem paradoxical, especially since Mankiw explicitly argues against cap-and-trade programs. These programs are all about trading, which by conventional wisdom must be more market oriented than a tax. But Mankiw, George W. Bush's one time chief economist, has impeccable market-oriented credentials. With his backing and the consensus of all those economics wonks, a carbon tax must be the most market-oriented approach possible, and so it

is. To explain why, this chapter unravels some of the mysteries of carbon caps and carbon taxes.

Since I favor a carbon untax rather than a carbon tax, it may seem that I am not part of Mankiw's consensus. But an untax and a tax provide identical incentives for saving carbon, because they work the same on the tax collection end. Since the economics consensus concerns only the collection end of the tax, I consider myself part of the consensus. Economists disagree (as usual) over what to do with the revenues. I say just return them equally to all consumers—that makes it an untax. Because this chapter concerns only the collection end of a carbon tax or untax, every conclusion about carbon taxes applies equally to the friendlier carbon untax.

Politicians don't mind wasting money if that's what it takes to be popular, while economists are concerned mainly with cost-effectiveness. So when the extraordinary happens, and economists reach not just a conclusion but a consensus, it's worth listening. They are out to save you money. With Congress heading straight for the cap-and-trade programs that Mankiw warns us against, there's not much time to lose.

Future Caps

To avoid confusion, I'll tell you right off the bat that there is another type of carbon cap besides the cap-and-trade variety. Carbon caps come in two flavors, political and economic. The political kind typically caps emissions on some future date and lacks enforcement. Economists do not much analyze these future caps, as I will call them, but they deserve attention because they loom large in the public debate. Unlike future caps, the caps of cap and trade limit current emissions and are enforced with fines. Now, back to the future caps.

California initiated appliance standards, and that initiative led to federal appliance standards. California also led the way on efficient building codes and was the first state to require car companies to sell electric cars. The state tied for first in the race to open electricity markets. However, innovating is risky business. California's new climate initiative has opened doors nationally for other energy policies, but will it be a huge success like appliance standards, a fizzle like the electric-car mandate, or a disaster like California's famous experiment with electricity markets? The one that caused rolling blackouts.

On September 27, 2006, Governor Arnold Schwarzenegger signed AB 32, the Global Warming Solutions Act. The act caps California's greenhouse gas emissions in 2020 at the 1990 level. The Pew Center on Global Climate Change called it "the first enforceable state-wide program in the U.S. to cap all GHG [greenhouse gas] emissions" and noted that "comprehensive climate plans combined with enforceable GHG emissions targets provide the highest

chapter 15

Cap-and-Trade Politics

Virtually all allowances were handed out for free under the wildly successful sulfur dioxide trading program in the U.S.

—Nathaniel Keohane,
Director of Economic Policy and Analysis,
Environmental Defense Fund, 2008

Most economists, from left to right, agree that a carbon tax is best. But cap and trade still dominates political discussion. The public wants their emission reductions certain and their taxes hidden, or so I've heard. Understand this saying, and you will know the secret of cap and trade.

Under the sulfur dioxide trading program the government hands out 10 million 1-ton emission permits, corresponding to about half as much sulfur as their recipients emitted before the program.[1] The government gives these permits to coal plant owners in proportion to past pollution and lets them know they can emit what they want, but without a permit they'll be fined $2,000 a ton. No one emits without a permit, so this rule caps emissions. The outcome is certain, and the tax is hidden. Didn't notice any taxes, did you?

We'll find the hidden taxes shortly, but this chapter focuses on how such taxes will play out politically when the little $2-billion-per-year sulfur cap program is scaled up to a $345-billion-per-year carbon-cap program. The sulfur tax

1. This was the second cap-and-trade program. The first capped CFC emissions by handing out free CFC permits, which resulted in windfall profits. A tax was then imposed partly to recapture the windfall profits.

was easy to hide, but a program that taxes a family of four $4,454 per year—the price of the carbon cap program, according to one estimate—is likely to make headlines. This is especially likely when the tax increases, say, 50 percent within a single year because of speculation in the carbon permit market.

The chief way to hide the tax revenues, thereby hiding the tax, is to give away valuable carbon emission permits for free. But the European public caught on to this, and word has spread to the United States. Hence, many current proposals call for auctioning most of the permits. Auctions raise visible revenues, so current cap-and-trade bills all have ways of dividing these up, as well as ways of handing out some free permits.

But what if all the permits were auctioned and all the revenues were refunded to consumers? That would make the bitter pill of a $4,454 tax much sweeter. And the cap would still work perfectly.

Before considering the domestic politics of caps and the possibility of refunds, let us begin with a global perspective. After all, the purpose of cap and trade is to solve the global warming problem.

Do Good Caps Make Good Neighbors?

From Barack Obama to Arnold Schwarzenegger, politicians are advocating a greenhouse gas emission cap of 80 percent below the 1990 level by 2050. I'll call it the 80-by-2050 cap. This cap is meant to limit the cumulative global temperature increase to about 2 degrees centigrade, or 3.6 degrees Fahrenheit. The Council of the European Union agreed with the target of 2 degrees centigrade as far back as 1996, though it remains highly controversial among scientists and economists.

Of course, to cap global temperatures, the world must cap global emissions, not just U.S. emissions. So a policy to cap U.S. emissions only works if the rest of the world goes along. Perhaps if the United States stops dragging its feet and firmly commits to achieving this goal, other countries will follow. By implementing the 80-by-2050 cap, the United States could lead by example. But, to succeed, the example must make sense to those we hope will follow.

In a purely mechanical way, having all countries target an 80 percent reduction seems simple. But consider the 80-by-2050 cap from China's perspective.

In 1990, the Chinese were emitting about 2.5 tons of carbon dioxide per person per year, so they need to cut 80 percent from that level. In 1990, Americans were emitting about 23.4 tons per person per year. In fact, in 1990, the United States emitted more greenhouse gas than any other country. Starting out at the highest emission level gives us the highest 2050 target of any country in the world.

Part 3

Core National Policies

chapter 16

An Untax on Carbon

We suggest a tax on carbon dioxide in which all the proceeds collected by the government would be returned to Americans each year.

—Keith Crane and James Bartis, *Washington Post*, 2007

"There is a broad consensus in favor of a carbon tax everywhere except on Capitol Hill, where the 'T word' is anathema." So says the conservative American Enterprise Institute. The conflict between the antitax politics and the consensus creates a tension at the heart of energy policy. Capitol Hill politicians have blocked the world's best energy policy with antitax slogans.*

A carbon untax breaks the deadlock by dividing the carbon tax into two steps and fixing the expensive step. The first step of a carbon tax collects the money, and the second step gives it to the government. The first step, collecting the money, makes the carbon tax work and is the reason for the broad consensus. Collecting the carbon charge discourages fossil-fuel use. The untax does this, but it replaces the second step, "give it to the government," with "give it back." That's so different that I cannot call the untax a tax. The whole point of a tax is to collect money for the government.

The simplicity of the untax hides a number of puzzling subtleties. If consumers pay all the costs and receive all the refunds, why does it work? If it refunds 100 percent of what it collects, isn't it free? If it's free, how can it possibly be a powerful method of moving society away from fossil fuels? And if it has hidden costs, won't it be unfair to the poor? I will explain the basic workings

of the carbon untax and then consider these mysteries one by one, though I leave the question of fairness for Chapter 18.

How the Untax Works

A carbon untax (or tax) is simple because it collects revenues from very few players. For example, an oil tax does not charge 200 million drivers every time they buy gas. And it does not tax tens of thousands of gas stations. It simply charges oil refineries for the amount of carbon in the oil they buy. Taxing oil refineries, natural gas producers, and coal mines would cover almost all carbon.

Refinery operators will, of course, complain about being taxed and forget to mention they are passing the tax on to gas stations. Gas station owners will complain and forget to mention they are passing the tax on to consumers. So when you hear their complaints, remember who really pays the carbon charge—it is you and I, the final consumers, and no one else.

When truckers buy gas, they will claim to be consumers because they burn the gas in their trucks. But, in fact, they will pass the cost on in their trucking rates. Anyone who can pass the cost on will pass it on, and if they pass it on they are not a final consumer. When you buy gas for your car, unless you can bill someone else for your gas costs, you are the final consumer. In essence, you pay the carbon tax.

I do not intend to discourage a carbon tax or untax by pointing this out; rather, I am encouraging self-defense. Even though businesses will pass the cost of the untax right through to us, they will demand a slice of our refund checks in addition. In fact, the cap-and-trade laws before Congress, which are basically disguised carbon taxes, include long lists of who gets how much of the tax revenue. And let me tell you, you are scheduled to get little to none. That's right. You pay the tax, and business gets the refund.

It's important to remember that even though the government collects the money from refineries and coal mines, you and other consumers ultimately pay the full charge. So the refund belongs to you—or at least it should. All 100 percent of it. I hope I am making myself clear on this, because when it comes to big bucks—and we are talking about hundreds of billions here—business is going to fight hard and fight dirty.

All right, let's look on the bright side. Say we win that fight and secure the refund for consumers. How does the refund work? It's simple. I suggest we do as Alaska does. Everyone who has been a legal resident for the past year gets a check in June. How big a check? Count the revenues for the last year and divide by the number of checks. Everyone gets the same amount.

Alaska spends less than 1 percent of the money it returns on mailing out the checks. The overhead should stay low because everyone will want to

chapter 17

Untaxing Questions

*It seems to me a bit like buying indulgences from the ancient church. … I can waste all the energy I want and then justify it by writing a check.**

—Former Arkansas Governor Mike Huckabee, 2007

The climate is changing. The terrorists are coming. We've got to do something now. Grow more corn. Make hydrogen. Build nuclear reactors. Build solar roofs. Cap greenhouse gasses. Invent fusion reactors, zero-emission vehicles, nanotech this, and biotech that.

These ideas all sound so concrete and effective. But sound is about all we get. Ethanol makes things worse, the hydrogen bubble has burst, and zero-emission vehicles zeroed out. Still, there will always be new energy fads.

Carbon taxes and untaxes, on the other hand, are not fads. But it's hard to put your finger on just what they do. They quash the fads and accelerate ordinary, but effective, conservation and give wings to real breakthroughs. But I can't predict the breakthroughs, so it's hard to make an untax seem sexy. Still, perhaps I can at least rebut a few of the baseless criticisms that will surely hinder its acceptance

Indulgences from the Ancient Church?

Both carbon emission permits and a carbon untax let polluters buy their way out of the energy policy. If you have the money, you can emit as much as you

want—or even more just to be spiteful. This strikes many people as immoral, so they dismiss market-based policies. As Huckabee puts it in this chapter's opening quote, "I can waste all the energy I want and then justify it by writing a check."

Although as an economist I should probably not admit this, I feel much the same way. I dislike seeing the rich abuse the environment for selfish reasons. In spite of this, I favor policies that let them do just that. My motive is practical. I have taken a close look at every way I can think of—more ways than I discuss here—to curb rich polluters, treat the poor fairly, and still make large cuts in oil use and carbon emissions.

I see no way to do all three. This requires a choice, and my choice is to curb carbon emissions and treat the poor fairly. The rich are beyond our control, so I say we should at least sell them indulgences. But let's not give the money to the ancient church—or to the modern government either.

But why can't we force the rich to do their part? If we imposed a 30 percent cut in carbon use on everyone—no exceptions—the rich could not wriggle out of that. It does seem unfair to the poor, who are already getting by with very little. But the real problem is that it can't be done. How could we count up everyone's carbon every year? Heating, driving, flying, boating, lighting—how could we count all that for every person? It's just impossible. If you can't count it, you can't cut it 30 percent. The same problem applies if you require everyone to reduce their carbon use by the same number of tons. Plus, it would devastate the poor and not make much difference at all to the rich.

Since we can't keep track of everyone's carbon use, perhaps we should keep track of everything else. We could require that all cars get at least 30 miles per gallon. We could ban through-the-door ice makers on refrigerators, because they waste a lot of energy. We could restrict carbon use for heating and cooling to 1 ton of carbon per year per house. Or, if we don't like this one-size-fits-all approach, we could set a different limit for each size of house in each part of the country. But how many miles of plane travel and driving should we allow? Obviously, this approach is a nightmare of regulation.

It is possible, though not a good idea, to use command-and-control regulation on large industries, but when it comes to individuals it really does not make sense. The problem is that energy use reaches into every corner of our lives. Controlling the rich would require the government to check every corner. No one thinks that's right, and fortunately, it's completely unnecessary. We can actually do something that's fair to both the rich and the poor—and that's the untax. It lets the rich write checks, and when the refunds are given out equally the poor get back more than they pay. I explain, in the next chapter, why this is exactly fair.

chapter 18

Why Untaxing Is Fair

The guys with money will still be able to afford as much gas as they want. Only the little guys will suffer.

—Rita Gibson, Boston delicatessen owner, 1977,
quoted in *Time* magazine

"Slap a 5¢-per-gal. tax on gasoline each year if conservation goals are not met." That's how *Time* magazine described President Jimmy Carter's proposed gas tax shortly after he took office and declared the energy crisis to be the "moral equivalent of war." But people had adjusted to OPEC's tripled price and were getting complacent. No one foresaw that the Iranian revolution would soon trigger a doubling of the already high oil price.

Intense lobbying by the oil and gas industries derailed Carter's proposals, but America's sense of fairness also played a role. Carter saw that, higher though they were, oil prices were not yet high enough. And he proposed several corrections, one of which was the five-cent gas tax. That's similar to the carbon tax I've been discussing. Taxes are never popular, but the gas tax struck people as particularly unfair, and they were right.

According to the Congressional Budget Office, a carbon tax would cost the poorest one-fifth of families twice as much in terms of percentage as those in the upper fifth. The low-income group emits only a third as much carbon as the high-income group but suffers more under a carbon tax. Rita Gibson was right: "Only the little guys will suffer."

Many economists recognize the fairness issue and attempt to solve it with some form of tax relief. Harvard economist N. Gregory Mankiw, for example, advocates a "rebate of the federal payroll tax on the first $3,660 of earnings for each worker." Such a tax rebate would distribute the carbon tax revenues in a way similar to the untax refund, so in spirit Mankiw is close to my position. But as I will show, his carbon tax with payroll tax reduction is not quite as fair as the untax. And as the headline of an op-ed he wrote for the *New York Times* proclaims, it's "a new tax"—a huge new tax that will never fly.

Mankiw's op-ed captures the economist's dilemma perfectly. It's about the extreme difficulty of passing a carbon tax, simply because it's a tax. But the headline emphasizes only this problematic quality. Why is Mankiw beating his head against this wall? Why not suggest refunding the tax revenues, turning his new tax into an untax? Is the untax so novel an idea? Hardly. Economists habitually model a carbon tax as an untax. It's an old and venerable idea. So why avoid it? Because economists think they have an even better idea.

Most economists believe that using the carbon-tax revenues in place of regular tax revenues is better, because it is the most efficient approach. They say this approach provides a double dividend: we use less carbon, and taxes are more efficient So politics be damned. These economists want to recommend the best approach—even though they know it is political suicide. I admire this insistence on doing things efficiently, and for twenty-five years I bought the standard analysis that using the carbon-tax revenues in place of other tax revenues is a great idea. But this chapter shows it's not, and that's a great relief. There's no need to keep banging our heads on the no-new-taxes wall.

But could most economists really have missed this point for so many years? Yes, and for a reason. According to economics, we should judge a carbon tax or untax on two counts: efficiency and fairness. Efficiency just means cost-effectiveness. Fairness concerns taking money from one group and giving it to another. Unfortunately, fairness is usually difficult to assess, so economists usually ignore that issue and focus instead on efficiency. Economists have done just that with the carbon tax, proving that Mankiw's approach is a bit more efficient than an untax. Efficiency is the sole reason Mankiw and other economists bang their heads on the no-new-taxes wall.

But a complete comparison between a carbon tax and a carbon untax requires considering fairness as well as efficiency. I have never seen anyone attempt this, but I will in this chapter. By a stroke of good luck, it turns out to be possible. I say good luck because I know of only one other policy that economists agree is wrong because it is unfair, even though it improves efficiency. Let's call it policy X. Surprisingly, policy X is exactly the difference between a carbon tax and a carbon untax.

In a nutshell, this chapter shows that an untax is completely fair and that a carbon tax is just an untax plus policy X. Since economists agree that policy

chapter 19

Taxing Oil—Double or Nothing

Bush is dead wrong. … Vice President Bush was resolved on arriving in Saudi Arabia to plead with the sheiks to restrict the production of oil. … Mr. Bush would do better to announce to Sheik Yamani that … any oil coming this way … is going to cost X plus $10 per barrel.

—William F. Buckley, *Atlanta Journal*, 1986

When George Bush senior, then Ronald Reagan's vice president, decided to help his friends in the oil business by nudging the price of oil back up, he knew what was needed. So off he flew to Saudi Arabia.* It was the Saudis who had, as William F. Buckley explained in 1986, "cost us something on the order of $400 billion or $500 billion." And it was the Saudis who had burst the price bubble at the end of 1985—not that they could have held out much longer, but they picked the time and opened the spigot.

Both Bush senior and Buckley understood that the Saudis, not American oil producers, controlled the price of oil and gasoline. However, in the short run, both Bush and Buckley lost. Bush urged the Saudis to restrict output and raise the price of oil, but the Saudis refused. Buckley recommended that the Reagan administration tax foreign oil to hold down the world oil price, and Reagan refused. Still, American oil interests won out in the long run. The absence of an effective energy policy restored OPEC's power, and beginning in the early 2000s prices returned to a level oil companies prefer.

For thirty-five years, grassroots American politics has gotten the whole picture pretty much backward, which is one reason we have made little progress in saving energy—except for the changes OPEC forced on us. Conventional

wisdom holds that we need to fix "market manipulation" by domestic oil companies, tax their excess profits, and lower gasoline prices. I picked up today's newspaper, and every one of those issues was in it, but not OPEC. The same would have been true on a thousand days in the last thirty-five years.

But it's what's not in the news—OPEC and the world market—that matters most. Lower gas prices sound appealing, but if an addict is having trouble paying the high cost of drugs, should we make the drugs cheaper? An addict would think so. The only way to reduce oil addiction is to use less oil—pretty simple to understand, unless you're addicted.

Now, oil use is best reduced by high prices, and that's what confuses people. High prices reduce oil use, which causes low prices. So to get lower prices we need higher prices. No wonder people don't trust economics. But there's a method to this madness, and this chapter explains how to make the high-price method work with minimal pain.

I first resolve this seeming paradox by explaining that there are two different prices, the world market price and the domestic price. We raise the domestic price to lower the world price. Lowering the world price means Big Oil and OPEC get less of our money, but what can be done about the high domestic price, which we must pay at the pump? That's easy—use an untax to keep the domestic price high. That way, we get the cost increase back in our annual untax refund checks.

Refund checks are great for reducing the pain of high domestic prices, but there's even more help for high prices—that's the double-or-nothing principle. When OPEC has pushed prices high enough, we don't need to up the ante, so the right level of untax is zero—we pay nothing extra. But when we succeed and knock down the world price to a low level, then the untax rate on oil should be roughly twice as high as it is on coal—double. That will keep our oil usage and world prices low.

The OPEC wolf has returned to our door, but our chances are better this time than ever before, for one simple reason: global warming. Carbon caps are now a global phenomenon, and oil is mostly carbon. Carbon taxes are also gaining more acceptance.

As I explain in Chapter 13, the best antidote to OPEC is an international consumers' cartel. The national policy that I discuss in this chapter is less effective, but it provides the basis for the kind of cooperation that a consumers' cartel requires. Part 4 of this book tackles how to organize a cartel.

The New Oil Prices Aren't Like the Old Ones

In 2008, oil prices exceeded their 1980 record by more than a third, but that's only one reason they're more dangerous now. We are up against a new, and likely tougher, opponent.

chapter 20

A Race to Fuel Economy

GM has unveiled cars that on average are nearly a foot shorter and 700 lbs. lighter.

In 1974 the Olds 98 managed only 7.6 m.p.g. on city streets and 11.2 m.p.g. on the highway. In 1977 it posts marks of 16 and 21 m.p.g., respectively.

—*Time* magazine, 1976

"Hell, the people have been telling us for years that they wanted smaller, lighter cars," said the vice president of American Motors in 1975. "This industry just has not been listening." But with the oil crisis, people were speaking a little louder. In 1977, the model year before fuel-economy standards went into effect, General Motors raised the average mileage of its fleet by 10 percent in one year.[1] Standards shouldn't get all the credit.

Fuel-economy standards first passed in 1975 when they were set to gradually tighten from 1978 until 1985. From 1985 through 2008, the fuel-economy standard for cars has stayed constant at 27.5 miles per gallon. But the weighted-average fuel economy of cars and light trucks combined has decreased, because most SUVs are classified as trucks, which gives them a lower fuel-economy standard. With a lower standard, the shift to SUVs has brought down the combined average.

In 2006, legislators set the standards to tighten again—starting in 2010. But between 1985 and 2006, with oil prices lower, the automakers had their

1. These fuel-economy improvements were actually planned before the oil crisis, but were accelerated by it.

way. As the *Wall Street Journal* explained in 2002, "A national advertising and lobbying campaign led by U.S. auto makers and unions flattened a coalition of safety, environmental and consumer groups—briefly supported by Honda Motor Co.—that had hoped to get the Senate to raise Corporate Average Fuel Economy standards for the first time since 1975."

The fact that automakers and unions "flattened" the standards was a sure sign they were poorly designed. Yes, it also shows the power of automakers, but their power was understood from the start, and a good design would take that into account. Instead, the Corporate Average Fuel Economy (CAFE) standards provoke giants and practically beg to be tampered with.

Imagine a footrace that does not award a prize to the winner. Instead, the race committee, after holding extensive hearings, sets a minimum time for runners. At the hearing, the runners are expert witnesses. They are mad about the cost of the race and have influential friends. For twenty-two years, the runners have said the minimum time was fast enough, and the race committee has accepted it. That's a poor design for a race. But it's a pretty accurate description of CAFE standards, in which the runners—the auto companies—haven't improved for twenty-two years.

In this chapter, I suggest that an old-fashioned race would inspire better performances. If carefully designed, it would also reduce or eliminate the threat to the profits of the Big Three automakers. Best of all, a real race would cut through the red tape that entangles CAFE standards. A race needs no standard at all; it simply relies on competition—just like a market. That's why it beats command-and-control standards.

Getting Rid of Standards

If we stick with standards, how tough should they be by 2020? That all depends on how much is costs for better mileage. So how much does it cost? For any serious level of improvement, no one knows. The automakers may have a rough idea, but they only divulge their most cautious estimates. So how do we end up setting the standard? Cautiously.

There's a better way. It's not particularly new or innovative. Amory Lovins, among others, has been advocating it for years, and it goes by the unlovely name of *feebates*. I like to think of the scheme as a race, and it works like this: Each year, the Environmental Protection Agency (EPA) evaluates the mileage of all the new car models—just as they do now with CAFE standards. Then the EPA hands out prizes. The better the mileage, the bigger the prize—say, an extra dollar for each gallon saved over the life of the car. (The prizes are called rebates in feebate jargon.) The EPA charges the manufacturers of below-average cars comparable fees—in this case, a dollar for each extra gallon used.

chapter 21

Crash Programs

This is still the only country where people say with a straight face that anything is possible—and really believe it.

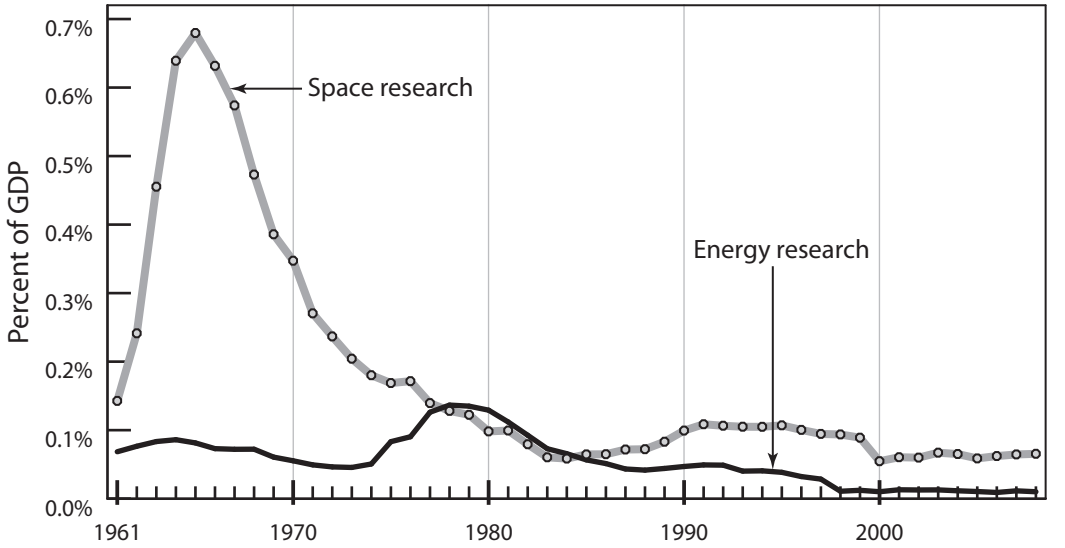
—Senator Lamar Alexander, 2008

With present technology, we could save a lot of fossil fuel at little cost. But eventually the world must switch to energy sources that have not yet been invented, and the sooner the better. So what will speed the invention of new technology? Some say only the government, and others say only the private sector.

The advocates of a crash government research program point to the Apollo program, which put a man on the moon in July 1969, or the Manhattan Project, which produced the two atom bombs dropped on Japan in 1945. On the other hand, venture capitalists and economists advocate private-sector research, though neither group is opposed to a role for government. They just don't want to put all the research eggs in the government's basket.

The fourth part of my Core National Energy Plan is a proposal that the government ramp up its research program to at least ten times its present level. But the government should spend the money on research, not production subsidies. And we should not bet the farm on breakthrough technologies produced by crash government programs.

Figure 1. Federal Energy Research Has Fallen to 1/100 of 1% of GDP



The Apollo program dwarfs the energy research that occurred during the OPEC crisis. Space research still exceeds energy research several times over. As a percentage of GDP, energy research is far less than before the first OPEC crisis. Data from the National Science Foundation.*

The Government Drops the Ball

The federal budget for energy research, including nuclear energy and fossil fuel research, is 1 percent of 1 percent of our gross domestic product (GDP). That's one ten-thousandth of GDP. In 2007, we spent six times that much exploring outer space.

As I write this in 2008, we are spending 340 times more importing foreign oil than on figuring out how not to. Compare the great mountain on the left of Figure 1, which represents money spent on the Apollo program as a percentage of GDP, with the barely visible line at the bottom right of the graph, which represents today's federal energy research budget. One percent of 1 percent is about how much richer the country gets every day. If we permanently doubled federal expenditure on research, it would cost the same as delaying the country's economic growth for one day.

President Bill Clinton ramped down spending on energy research to its present low rate while the price of oil was low. That's no excuse, but it probably explains quite a bit. But continuing at such a low level while oil prices rose from $30 a barrel in January 2001 to over $100 a barrel in 2008—what explains that?

chapter 22

The Great Cost Confusion

Opponents say it's going to cost so much money to address. And I say, well, hell, go ahead and spend it.

—Oilman T. Boone Pickens on climate change, 2008

Never has civilization switched energy sources as quickly as we may need to now. Never has American energy policy made much difference on balance, with pluses roughly canceling minuses. Success requires a powerful and coherent policy. Of the many obstacles blocking the adoption of such a policy, two loom largest: subsidy politics and the great cost confusion. Both distort the roles of the government and the private sector in ways that lead to wasteful subsidies and, ultimately, failure.

Subsidy politics is a dance of meddlers. The government uses subsidies to meddle in the market, trying to pick and foster winners. Industry lobbies the government for subsidies and, in doing so, meddles with policy.

The great cost confusion makes it easier for lobbyists to coax subsidies out of government. The confusion occurs when policy makers assume carbon pricing revenues are net costs to the nation. Having assumed this, they feel free to spend the revenues, and the lobbyists are ready with suggestions. The meddlers dance to the tunes of the great cost confusion.

The government's proper role is not to subsidize technologies but to identify market failures and fix them with minimal intervention. This approach takes full advantage of the market's power and maximizes the government's

impact. The proper role of the private sector is to respond to market forces, not to lobby for subsidies.

Subsidies: Fuel for Meddlers

Markets cannot do certain jobs. For example, the market cannot, on its own, evaluate and take into account the cost of military expenditures to protect oil trade routes. So the government should intervene to fix this problem.

Suppose the international chocolate trade, like oil, needed government protection, and the protection cost was not factored into the price of chocolate. Free protection is a subsidy to chocolate, and it keeps its price too low. With the price too low, people eat too much chocolate, and the government spends too much money protecting global chocolate routes. After a bit of lobbying by other candy makers, the government might decide to subsidize peanut brittle and licorice to reduce chocolate consumption and save on the military costs of protecting chocolate.

This would "work." But it's a distraction. The government has ignored the real problem, the chocolate subsidy, and focused instead on inventing new subsidies to distract people from the cheap, subsidized chocolate. Peanut brittle is like ethanol, and licorice is like synfuels. Soon, they will be subsidizing candy canes (solar roofs) and who knows what. But just make chocolate pay its own way, and people will switch to other candy exactly to the extent they should. Don't let lobbyists design balanced subsidies—they can't and they won't even try.

Meddling by the government usually takes the form of subsidies. But instead of meddling the government should follow the fossil philosophy I described in Chapter 1 and treat the problem, not the symptom. An untax on chocolate or oil would do just that and completely eliminate the need for subsidies.

Some proponents of subsidies dislike them but think they are a necessary evil. Business, they think, will never do the right thing without a bribe in the form of a subsidy. I would like to offer another perspective. Energy policy is just too big for this approach to work. The subsidies would be too big to hide, and once visible to the public, would discredit any energy plan. Of course the main reason to avoid most subsidies should still be that, in practice, they are largely a waste of money.

Too Big to Hide. Moving away from fossil fuel will shift hundreds of billions of dollars from oil, gas, and coal to high-tech cars, super-high-tech coal plants, and the like. You can't hide any policy that affects what happens to that much money.

Because a policy that drives a substantial shift to cleaner energy sources cannot be hidden, it needs to be cost-effective so people feel they are getting

Part 4

Global Policy

chapter 23

Kyoto: What Went Wrong?

Clearly, more work is needed [on the Kyoto Protocol]. In particular we will continue to press for meaningful participation by key developing nations.

—Al Gore, *New York Times,* 1997

Ninety-five U.S. senators rejected a Kyoto type of treaty in July 1997, five months before 150 nations completed the text of the Kyoto Protocol—the actual rules for curbing emissions. The senators said they would not sign a treaty based on the protocol unless it imposed commitments on developing countries. They took a reasonable position, but one that closed the lid on a box the United States had built around the Kyoto process. No one conspired to build this box; it was just the result of unintended consequences.

Ironically, a great environmental victory in the early 1990s was the first step in constructing the box. As I discuss in Chapter 15, environmentalists and then-President George Bush ended a multiyear stalemate over acid rain by getting coal-fired power plants to accept emission caps imposed under a cap-and-trade policy. That success earned cap and trade the title of most successful market-oriented approach to emissions control. So when the U.S. team went to Kyoto, that was its proposal—to cap and trade greenhouse gas emissions. In the abstract, it made a lot of sense. But the countries of the world proved to be more complicated than coal-fired power plants.

Countries vary enormously in their levels of greenhouse gas emissions, so it's impossible to cap them all at the same level, and no one suggested that.

Instead, the treaty gave every country its own cap. That caused a lot of squabbling and naturally enough led to no caps for countries with low levels of per capita emissions—the poor countries. In effect, China, India, Brazil, and others argued that just because the rich countries started polluting first, they should not get to emit ten times more than poor countries, which have done less damage.

They have a point. But this leaves the Kyoto Protocol with an impossible contradiction. It's unfair to give poor countries caps that are five, ten, or even twenty times lower, on a per-person basis, than those of rich countries. But without such caps, poor countries have no obligation at all, and unfortunately, developing countries have the fastest-growing levels of emissions. China by itself emits more carbon dioxide than any other country, although its per-person emissions are low. Cap and trade sets up a clash between fairness and effectiveness. What is fair doesn't work, and what works is not fair. This is the box that the United States has built around the Kyoto Protocol.

This part of the book explains how to break out of the cap-and-trade box safely and effectively. In this chapter, I explain why we must abandon cap and trade as a global system before the world can solve the problems of climate change and energy security.

Not Fair

Caps on emissions are a burden, and the tighter the cap, the bigger the burden. On the other hand, getting a high cap can be worth a lot of money. That's because each country issues carbon permits up to its cap and can sell extra permits to companies in other countries for hard cash. In Europe people call this "selling hot air," and some Eastern European countries, including Russia, have lots of it to sell.

Russia gained a lot of its hot air by holding out and not signing the treaty until the country received an extra helping of free permits—that is, a higher cap. Because the United States would not sign the treaty, it could not go into effect without Russia's signature, which gave Russia a lot of leverage. This was a double win for Russia—the extra permits are valuable and they loosen the overall cap. As the world's number-two oil producer, Russia will be hurt by tight caps, which inevitably reduce world oil use and the price of oil.

The architects of the Kyoto Protocol may have issued permits unfairly, but this does not mean caps can't be fixed. Let's check to see if there's a way to patch things up.

The Kyoto Protocol sets emission caps relative to a country's emissions in 1990. In that year, the Chinese were emitting about 2.5 tons of carbon dioxide per person per year, and Americans were emitting about 23.4 tons per person. Even in 2008, India emits only 1.1 tons per person. I'm not criticizing Americans

chapter 24

Global Carbon Pricing

We have everything we need to get started, save perhaps political will, but political will is a renewable resource.

—Al Gore, Nobel lecture, 2007

Half the world will not accept carbon caps but might accept a carbon price requirement. Such a requirement would not put a lid on growth in developing countries. And, if the requirement was too burdensome on poor countries, they could be compensated by international payments. Individual countries could choose caps, taxes, or untaxes at the national level.

Countries that are particularly dependent on oil would be free to target carbon from oil. Targeting oil would decrease political resistance and increase the policy's effectiveness at reducing oil prices. As Al Gore says, the world may not yet have the political will to get started. But that could change if people begin to see the benefit of cooler global temperatures combined with the benefit of lower oil prices. Political will is most effectively renewed with a dollop of financial self-interest.

Switching from Kyoto's caps to a new, global-carbon-pricing policy will require a major reorientation of the Kyoto Protocol. In this chapter, I describe a basic design that, because of its flexibility, requires only minor adjustments to existing national carbon control policies. I present a simplified version of the design in this chapter, adding modifications for fairness and enforceability in Chapters 26 and 27.

The Price of Carbon

Global-carbon-pricing policy sets a target global carbon price and then makes sure the world achieves it on average. To make the policy flexible at the national level, the global carbon price must be defined to work with any type of national carbon policy—cap and trade, gas tax, untax, or any other method of making carbon expensive. To achieve this flexibility, global-carbon-pricing policy defines the national carbon price as the average carbon price over all fossil fuels and does not apply the requirement to every individual purchase of fossil fuel.

Price is just revenue divided by quantity sold. Collect $100 from selling ten items, and we know the average price is $10 per item. The national average price of carbon is total annual revenues from carbon charges divided by total carbon emissions during a year. So if the United States collects $60 billion in carbon charges in a year and emits 6 billion tons of greenhouse gases, our national price of carbon is $10 a ton. That's all there is to it.

Well, not quite. Suppose a nation's carbon cap-and-trade program gives away all its permits to coal-fired power plants—not a good idea, but just suppose. How should a global-carbon-pricing policy give that country's program credit for carbon pricing? The global policy must work with any national carbon policy to avoid giving any country an excuse to opt out.

Because free permits given to coal plants collect no carbon charges for the government, it seems as if they should not contribute to the national carbon price. But if permits given out for free cost $20 a ton in the private market, they put just as much pressure on companies that need them as a $20 carbon tax. So these permits should get just as much carbon pricing credit. This is fair and easy to arrange. Carbon permits receive carbon pricing credit equal to their value at the time they are retired to cover emissions. If a million permits are retired in May and the average price in May is $30 per permit, the country receives credit for $30 million of carbon pricing revenues.

Carbon taxes, gas taxes, and untaxes all collect revenues that are easy to count. Subsidies for ethanol and wind will be unnecessary once fossil fuel costs more. However, if countries still offer such subsidies, they should not be counted, because the track record of subsidies around the world, including in the United States, is dismal. In fact, an enormous benefit of global carbon pricing is that it dramatically shrinks wasteful energy programs.

Carbon or Greenhouse Gas?

Fossil fuel accounts for about 70 percent of greenhouse gas emissions. However, we should not ignore the other 30 percent. Carbon dioxide is the greenhouse gas emitted when people burn fossil fuel. Since this book is about energy policy, I'm most concerned with carbon.

But sometimes people use carbon to refer to all greenhouse gases. For example, Europe's greenhouse gas markets are called carbon markets. In that tradition, when I speak of carbon, in most cases I mean all greenhouse gases.

chapter 25

Does the World Need a Cap?

The Intergovernmental Panel on Climate Change says we must reduce carbon emissions 80 percent by 2050.

—Environmental urban legend[1]

Environmentalists of a certain stripe are saying there's a scientific consensus that we must reduce carbon emissions 80 percent by 2050. But the Intergovernmental Panel on Climate Change (IPCC)—the U.N.'s climate science group—has said nothing of the kind.* The IPCC does predict the global, but not national, emission levels that would hold greenhouse gas concentrations down to 450, 550, or 650 parts per million (ppm). But they haven't said which target we must shoot for. The current carbon dioxide level has already reached 380 parts per million from a historic starting level of 280.

The legend contains a nugget of truth, reflecting a popular environmentalist choice of 450 parts per million as a target. Some reports, which the IPCC has summarized but not endorsed, say that the developed countries must push their emission levels down to 80 percent below 1990 levels by 2050 to make up for what the rest of the world is likely to do—if we want to stabilize greenhouse gas concentrations at 450 parts per million.

1. Because the author of this quote has recanted, I will not disclose his or her identity. But a large number of people still believe the legend.

While the IPCC does not recommend any particular level of GHG concentration, it does tell us something about what the levels mean. In particular the 450 ppm target corresponds to an equilibrium temperature increase of 2.1 degrees centigrade. What goes unmentioned by those advocating this target is that the this equilibrium increase will only be attained after about 500 years. If we were satisfied with what the IPCC calls scenario B1, which corresponds to a temperature increase of 2.3 degrees centigrade in about 2100, a global emissions increase of 40 percent in 2050 above 2000 levels would be feasible (see endnotes).

Yes, that's a 40 percent global increase in emissions under the B1 scenario, and an 80 percent decrease for developed countries under the 450-ppm equilibrium scenario. Under the first, the temperature increases 2.3 degrees by 2100 and under the second, 2.1 degrees eventually. These are a bit difficult to compare because, even if the world increases emissions by 40 percent, the developed countries might need to reduce emissions to compensate for increases in the developing countries.

Now, I'm not saying the 80-by-2050 target isn't fair or that it's not a good idea. Perhaps it is. But it is wrong to say there is a scientific consensus for the very-long-run 450 ppm target. It is popular with quite a few scientists, but this popularity is based on value judgments as well as on science. The IPCC itself simply lists this target as the most stringent one studied among all targets studied in the 177 reports it reviewed.

Chapter 23 concluded that national caps are out of the question as a comprehensive method of global organization. So, as long as so many people in developed countries feel caps are the only means to achieve success, we will probably make little progress toward a workable solution. In this chapter, I argue that internationally-set national caps are not necessary and, in fact, do not provide the kind of certainty that people hope for. Since they are out of reach, this is not bad news. The good news is that carbon pricing would work about as well as caps are imagined to work, if we did agree on where we're going.

When Is a Cap Not a Cap?

Cap and trade is supposed to work by setting one big cap for all emitters combined. With a national cap-and-trade program, individual companies don't have caps. With a global cap-and-trade program, you'd think individual nations would not have caps. You'd think the whole world would just have one big cap.

But we don't have a world cap. Instead, we have lots of caps for individual countries. What's going on? Under the Kyoto Protocol, it's a bit mysterious, with some countries capped and others not. But suppose every country had a cap. Would that make a world cap? It would, and the sum of all the country caps would be the world cap. But what is the effect of the "national caps"? Do they do

chapter 26

International Enforcement

What you cannot enforce, do not command.

—Sophocles (496 B.C. to 406 B.C.)

WHY DO PEOPLE DRIVE ABOUT 70 MILES AN HOUR on the freeway? Because the speed limit is 65. Actually, that's not exactly why, and the little 5-mile-an-hour discrepancy gives us a clue. It's the police and the courts that keep most of us from speeding, not the limit itself. The police don't usually ticket you till you are driving about 10 miles an hour over the limit. That, and a bit of caution, explains the 5-mile-an-hour discrepancy.

You may be thinking this is pretty obvious, and it is. But people constantly forget about it in discussions of international policy. The authors of the Kyoto Protocol set speed limits—caps—but forgot about the police and the courts. This works to some degree with a small group of cooperative players, such as about half the nations of the European Union. But bring an outlaw nation such as Canada into the mix, and speed limits without police are a joke.

OK, Canada is hardly an outlaw nation, and that's my point. Canada is one of the most cooperative nations in the world, and a liberal, pro-Kyoto government was in power during the crucial period when nations were hammering out the protocol. But the country is still exceeding its Kyoto limit by something like 20 percent. Think what will happen once we include a lot of

countries that are less cooperative and enthusiastic than Canada and when the requirements get tighter.

Keeping 180 nations in line requires an effective enforcement mechanism. Doing without one is completely irresponsible. But enforcement need not be heavy-handed. The penalties only need to be strong enough to compel an average level of compliance, because only average emissions and average oil consumption matter for global climate change and energy security. In this chapter, I show how to enforce a global carbon price effectively but with the lightest possible touch.

Before we discuss how to enforce a global "speed limit," though, we need a clear picture of exactly what a carbon speed limit looks like. The global carbon price determines the "speed limit" for each nation. If that price is $20, and a country emits 1 billion tons of carbon dioxide per year, its annual target revenue is $20 billion dollars. That's all that must be enforced on average for all nations—their target revenues.

Light but Effective

The first principle of gentle enforcement is that it's OK for a country not to achieve the target price. However, in that case, the country must pay a fine. In other words, countries can buy their way out. Some people will prefer a more moralistic approach, but as we saw in Chapter 17, this benefits no one and complicates the system. A carrot-and-stick approach of fines and rewards will make the system more popular with both those buying their way out and those getting rewards. And this flexibility will not hurt the outcome one bit.

The second principle of gentle enforcement requires that fines exactly pay for rewards. Revenue from fines should not be used to pay for other projects, because this will prove costly and cause resentment. This is, of course, the classic feebate mechanism—that ugly word again—which I have recast as a race. You also hear this approach called a revenue-neutral mechanism. It's a popular design because it works so well and so simply; it causes no fights over where the money comes from or who should get it.

Enforcement as a Race

As with the race to fuel economy, it helps to think of the enforcement rule as a race—in this case, a race to higher carbon prices. The winners earn rewards, and the losers pay for the prizes, so everyone is motivated. In this race, each country's score is its actual revenue collection minus its target revenue collection—that is, actual carbon revenues minus what the country would collect if it set its carbon price equal to the global target carbon price. Collecting too little revenue gives a country a negative score.

chapter 27

International Fairness

It is reasonable that every one who asks justice should do justice.

—Thomas Jefferson

About one-quarter of the earth's population has no access to electricity or fossil fuel. It seems presumptuous to ask them to share, even in proportion to their small incomes, in solving problems that they have played no role in causing.

The Kyoto Protocol imposes no obligations on developing counties but allows them to sell carbon credits—for use in countries with caps—to developed countries. This addresses fairness, but it goes too far, as the U.S. Senate agreed when, in 1997, it passed a resolution by 95-to-0 opposing any treaty lacking obligations for developing countries. Also, as I explain in Chapter 23, selling credits for *not emitting* leads to gaming. This makes the Kyoto Protocol ineffective and expensive, as well as unacceptable to the United States.

Global carbon pricing is more fair to begin with than emission caps are, but it too will need adjustment. Poor countries should not have to tax their low rates of carbon emissions at the same rate as wealthy countries tax their high rates of emissions, unless we give the poor countries some financial assistance. Since the enforcement mechanism that I described in the previous chapter tends to make all countries set their price near the global carbon target level, assistance is in order in the form of fairness payments.

Fairness payments are calculated in two steps and are based on the (somewhat incorrect) assumption that all countries set their carbon price exactly at the target.[1] The first step is to use a sliding scale that transfers revenue from high-emission countries to low-emission ones. The second step prevents low-emission countries from collecting fairness payments if they don't comply with the policy or if they comply only minimally.

Although the purpose of these payments is simply to make the system fair, they confer additional benefits. First, the fairness payments make poor countries want to comply, which takes considerable pressure off the enforcement mechanism described in the previous chapter. Second, fairness payments encourage nonprice approaches to reducing emissions. I'll return to these effects after I explain how fairness payments work.

Step 1: The Sliding Scale

The sliding scale determines "fairness prices," which are used to calculate the fairness payments. It assigns higher fairness prices to countries that are richer and use more fossil fuel.

Fairness prices can be thought of as the carbon prices countries "should" adopt to be fair. It's more cost-effective, though, for all countries to use the same carbon price. That's why the sliding scale determines payments and does not push countries to actually implement the fairness prices. The only purpose of fairness prices is to calculate fairness payments.

The sliding scale assigns higher fairness prices to richer countries—more or less. It's not exact in this regard, because the sliding scale is based on carbon emissions rather than income. Richer countries emit more carbon, but not exactly in proportion to their income.

I have based the scale on emissions instead of income for two reasons. First, measuring income is difficult and contentious. Second, linking the payments to emissions provides a helpful incentive—which, as I said, I'll return to later. Emissions must be measured per person so that a large country is not unfairly assigned a high fairness price simply because it is large. Although other designs are possible, the simplest one—the one I describe—makes the fairness price proportional to a country's emissions per person.

Fairness Payments

It's easiest to explain fairness payments with an example. To keep it simple, I'll use approximate, round numbers. Suppose India emits 1 ton per person per

1. This is not done for simplicity, and it is not an approximation. It is done to prevent incorrect incentives. Fortunately, it also simplifies the design.

chapter 28

Carbon Pricing: What Counts?

Taxpayers are being asked to provide huge subsidies to oil companies to produce oil—it's like subsidizing a fish to swim.

—Massachusetts Congressman Edward J. Markey, 2006

No one likes to pay full price. And nations are no different when it comes to carbon. That's why we need a global policy. Because leaders don't like pricing carbon (or capping carbon), they will look for the easiest way that still counts to comply with global policy. So it matters what counts. If taxing vodka counts—alcohol does contain carbon—then countries will tax liquor more and gasoline a little less. That won't help the climate, because vodka, though a fuel of sorts, is not a fossil fuel, it's a biofuel.

For the most part, deciding what counts is about as simple as not counting the vodka tax. But a few subtler questions remain. In this chapter, I show how to resolve some of them.

Subsidies

Subsidizing oil is the reverse of taxing it. So in calculations to determine a nation's carbon price, fossil-fuel subsidies reduce the carbon price. A sensible carbon pricing policy deducts fossil-fuel subsidies from carbon revenues. Because of this, as I explain in Chapter 24, global carbon pricing takes a big step beyond the Kyoto Protocol, even if the global target price is zero.

Energy subsidies are common in developing countries, especially in those rich in fossil fuel. China spent over $20 billion in 2007 subsidizing gasoline. That means it has put a negative carbon price on gasoline. But even the United States still subsidizes fossil fuels, and pressure is mounting to extend even larger subsidies to fossil synfuels.

Counting subsidies properly—that is, negatively—shines a spotlight on them and removes most of the political incentive to provide them. For every dollar of subsidy, the government would need to collect a dollar of carbon tax. Why bother?

Cap-and-Trade Permits

Cap-and-trade permits sell at a price even when governments give them out for free. I discussed this in Chapter 23, but it is worth revisiting. What matters with permits is their market price, even when companies get them for free. If the owner of a coal plant needs 1,000 permits and gets 1,010 for free, it might seem as if the company would not have any incentive to use its coal more efficiently. But, in fact, it has exactly the same incentive as it would if it had to buy all its permits at the market price. Suppose the market price is $30 for a 1-ton permit. First, the company sells its 10 extra permits for $300. Then the plant manager thinks, "If I could save 100 tons of carbon, I would need 100 fewer permits and could sell them for $3,000."

So the motivation to save carbon depends on the market price of permits and nothing else. A $30 carbon tax provides the same incentive as requiring permits with a market value of $30. Coal plants save the same amount of carbon under either scheme, so both plans should count the same under a global-carbon-pricing policy.

Even if a company receives free permits, when it forfeits those permits to cover its carbon emissions, it is like paying a carbon tax. So administrators of a global-carbon-pricing system can check the market price of permits each month to estimate the value of permits forfeited. This value counts as carbon pricing revenue, just the same as carbon-tax revenue does.

Existing Carbon Pricing

What if a nation already has an oil tax or a cap-and-trade system in place when a carbon pricing system starts up? Is that counted? There is no need to punish good habits started in the past, so all carbon charges are counted, new or old.

Caps tend to punish the good and reward the bad. The better a country has done in the past, the more reasonable it seems to assign it a tighter cap—which is, in effect, a punishment. The same holds true when a program resets caps. If a country has "not been able to" meet its cap, that is an argument for a less aggressive cap in the future. A major problem with individually negotiated

chapter 29

A Consumers' Cartel

Foreign oil is costing us $500 billion a year. In 10 years, $5 trillion goes out of the country. It's nuts. It's the greatest transfer of wealth from one area to another in the history of the world.

—Oilman T. Boone Pickens, 2008

The two great energy challenges—climate change and energy security—are converging in the political arena. Oil addiction is now seen as central to both challenges, and many other energy questions are now seen to overlap. But only one broad approach can meet both challenges at once. The world must reduce its use of fossil fuel. And by historical standards, it must do so with unprecedented speed.

Without deliberate action, change will come too slowly to meet the climate challenge and too dangerously to meet the challenge of energy security. Without deliberate action, we will unnecessarily transfer trillions of dollars to the exporting nations, which, by blind luck, own the majority of the world's oil and gas.

Both challenges are global, and to solve both requires an international organization. Such an organization is inevitably an oil consumers' cartel. It is also a gas and coal consumers' cartel.

Any organization of producers aimed at reducing supply is a producers' cartel. Any organization aimed at reducing demand is a consumers' cartel. A consumers' cartel brings precisely the changes we seek. By definition, it reduces consumption, as fixing the climate requires. And as the law of supply

and demand predicts, it reduces the market price—the world price—of oil, gas, and even coal.[1] Reducing imports and lowering the price of oil lead to energy security.

To succeed we have no choice but to form a consumers' cartel. We can remain blind to this fact or we can embrace it. We can let the Organization of Petroleum Exporting Countries (OPEC) intimidate us into not saying "the dread words," as the *New York Times* called them in 1980. Or we can take full advantage of a cartel's benefits to unite the constituencies who most want to meet these two challenges—energy security and climate stability. So I say them again: Form a consumers' cartel. Learn to love those words and stop fearing OPEC. Protect our wealth and protect the climate.

Which Cartel Is Right?

OPEC has been a proud cartel from the start. Its purpose: to gouge the world, rich and poor alike. Moreover, at best its members make poor use of their spoils. *New York Times* columnist, and author of *Hot, Flat and Crowded*, Thomas L. Friedman has pithily described the result with what he calls the First Law of Petropolitics: "The price of oil and the pace of freedom always move in opposite directions in oil-rich … states."

The purpose of an oil consumers' cartel would be to stop the gouging and save the climate. Between OPEC and a consumers' cartel, there is no question which one is right. Yet the policy of the United States for thirty years, ever since Henry Kissinger threw in the towel, has been "Don't bother OPEC, and no, no, no, we must never even mention the idea of having our own countercartel—a consumers' cartel."

Are we idiots?

Or is some powerful anticonsumer force actively influencing policy from behind the scenes—some force that would lose tens of billions of dollars a year if the price of oil returned to a conscionable level? I'm not one for conspiracy theories, but I have a hard time swallowing the idea that politicians and the public keep going so far wrong without a lot of "help."[2]

Is It OPEC, or Is It Nature?

As explained in Chapter 19, the Saudis, in 1979, cut back on their plans to increase oil production, and they have not increased their production since.

1. International coal shipments have been increasing rapidly and are now affecting the domestic price for coal.
2. It may be of interest that the National Petroleum Council, funded by the fossil-energy industry, is an advisory committee inside the U.S. government. It is part of the Department of Energy (DOE), brought in at the DOE's inception in 1977.

Part 5

Wrap-Up

chapter 30

Finding the Path

More than any other time in history, mankind faces a crossroads. One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wisdom to choose correctly.

—Woody Allen, commencement address, 1979

The United States, once the world champion oil producer, is now in third place for production and twelfth place for reserves. As a nation, we are still the world champion oil consumers—by almost three times. In 2008, the price of oil is starting to shrink that gap but at a national cost of roughly half a trillion dollars a year. Our national energy policy costs a hundred times less and is doing very little.

We must choose: We can pay exorbitant tribute to the Saudis, the Russians, and the big American oil companies. Or, at long last, we can develop an effective energy policy. That shouldn't be a hard choice. If we decide to remain stuck in our fossil past, we will only end up paying more tribute. Instead, we should claim a new title, this time as champion of the next energy era—the low-carbon age. A good energy policy can do that and may save as much as it costs. At the same time, it limits the damage that the waning of the age of fossil fuel might cause.

But should policy discourage fossil energy, or should it promote carbon-free energy sources? Fortunately, the two tasks are flip sides of the same problem, and smart policy—carbon pricing—takes care of both sides at once. Carbon pricing raises the cost of everything fossil and raises the profitability of carbon-free energy at the same time.

Modern economics shows how the government can harness the market. A combination of government and market gives us the power to accomplish all that we need—but only if we combine the two properly. And therein lies the real problem—politics.

Only political action can balance government and the market for a quick and relatively cheap transition away from carbon. So good policy must concern itself as much with political barriers as with effective economics. Four political barriers play crucial roles:

- Ignorance of the need for change.
- The power of fossil profit centers.
- Ignorance of modern policy tools.
- Fear of the costs of change.

The first barrier, ignorance of the need, is crumbling. Most of the world understands the danger of climate change, and we all dread the price of oil.

The fossil profit centers—OPEC, Big Oil, and Big Coal—will be against us for decades to come, although the coal industry might switch sides if it embraces carbon-capture technology. But OPEC and Big Oil, with hundreds of billions of dollars at stake, will remain implacable foes of good policy. Worse, they are brilliant opponents and will continue to disguise their attacks as helpful policy suggestions. The only useful approach is to eliminate them from policy discussions, except as providers of data. This may sound harsh, but with so much at stake we cannot truly trust anything they say—though of course they will tell the truth when that suits their purposes. In any case, good policy does not require meddling in their industry; it requires only putting a price on their carbon. Consequently, they have little specialized knowledge to contribute.

This leaves two political barriers on which to focus: ignorance of policy tools and the fear of policy costs. These two barriers coincide because the guiding principle of modern policy design is cost minimization. And the best way to relieve the fear of cost is to minimize cost. In the end, the popular subterfuges for hiding cost will fail. Put simply, good policy means maximum bang for your buck. That's good economics, and it's even better politics.

That's the central point, but it's not the whole picture. Fairness matters, both internationally and nationally. And international cooperation is essential.

So far in this book, I've laid out policies and their rationale. This chapter lays out the step-by-step thinking behind the assembly of these policies in the hope this will provide a coherent framework in which to view them.

Walking the Path

To successfully navigate the path to climate stability and energy security, we must accomplish six major tasks along the way:

chapter 31

The Complete Package

Let this be our national goal: At the end of this decade, in the year 1980, the United States will not be dependent on any other country for the energy we need.

—President Richard Nixon, January 1974

In *Carbonomics,* I present a complete framework of national and international energy policies. The two sets of policies complement each other by design and address issues of both energy security and climate stability. In this chapter, I describe all the policies together, simplified for easy reference, along with a list of their advantages.

Previously, I have described national polices before explaining international policies as a way of starting on more familiar ground. Here I start with international policies, because they are essential and provide one reason for adopting an untax at the national level.

Think Globally First

If global energy policy is ineffective, we cannot make up for it with a good American policy, no matter how much we sacrifice.

I sometimes hear people say that if the United States does its part and adopts an emissions cap, China will follow. We tried that. At Kyoto, we agreed, subject to ratification, to cap our emissions near the 1990 level. China and all other developing countries said, "Fine, and you can pay us if you want us to

help you out." In the issue of caps they have not budged since, and there is no indication they will if we adopt a cap now.

The Kyoto system is not working. No one is enforcing the caps (though a few are cooperating fully), and payments for helping out are subject to fraud and abuse, exactly as economics predicts. Expanding the Kyoto Protocol will exacerbate, not eliminate, existing problems. It was useful to get started, but it's time to learn from past mistakes.

While I cannot guarantee outcomes, this book presents the set of policies with the best chance of circumventing international roadblocks. The heart of the policy, global carbon pricing, is a standard idea and one advocated by top international experts concerned with Kyoto's failure. I have pushed it forward a bit to give it more flexibility, to make it more fair, and to broaden its incentives. The policy's purpose is to induce all nations to adopt a similar level of carbon pricing and to align the global average carbon price with a global target price, *P*. In a nutshell, here is the global carbon pricing plan:

The Global Target Carbon Price

- Each country gets a neutral score of zero if its average carbon price is the global target *P*. Higher or lower carbon prices generate positive or negative scores equal to the extra or missing carbon revenues.

Flexible Enforcement

- Each country receives a reward of *Z* times its score. This means that countries that underprice and thus have negative scores pay a fine.
- The reward rate, *Z*—say, 10 percent—is adjusted from year to year to a level that causes countries to price carbon at target *P* on average.

Fairness

- A country with average per-capita emissions is assigned a "fairness price" equal to target carbon price, *P*. Other countries are assigned higher or lower fairness prices in proportion to their emissions. These prices are used only to calculate fairness payments.
- Fairness payments are zero for a country with average per-capita emissions. Higher-emission countries pay lower-emission countries.

Ultimate Enforcement

- Once the process is in operation, countries that refuse to pay fines or join the system are punished via international trade sanctions.

This may appear complicated. But compared with repeated negotiation of caps for 180 countries, or global carbon permit and carbon credit markets, the plan is trivially simple. Fairness payment will be small compared with the

benefit an entire industry. When successful, such research is often underrewarded by the market. The plan funds only these types of research, which the market dramatically underfunds.

The Choice Is Ours

For over thirty years, the United States has neglected energy policy, chosen policies that fail, and subsidized those who profit from our addiction. Inevitably, our dependence on foreign oil and our emissions of carbon dioxide have only increased—but with two notable exceptions.

Between 1978 and1985, the United States cut its use of oil more than 18 percent and its oil imports 46 percent. In spite of paying OPEC and Big Oil nearly $2 trillion extra to change our behavior, our national income grew 21 percent—faster than in recent years.

Together with the rest of the world we crushed OPEC, sharply cut fossil-fuel use, reduced carbon emissions, and kept the economy growing. So how did our president convince the country that implementing a policy as weak as the Kyoto Protocol—which would have reduced, not increased, our payments to foreign and domestic oil companies—would wreck our economy?

Once again we are cutting our use of oil, not because of our own policy but because we are being forced to pay extraordinary tribute to the oil barons of the world. In 1975, we ignored the potential of Kissinger's countercartel to reduce the world's dependence on oil and to avert the second (1979) oil crisis. This time, we have obstructed, rather than supported and improved, the Kyoto process, which has formed a weak consumers' cartel to limit the use of fossil fuels.

Partly as a result, oil prices have set new records, and in 2008 they are pumping half a trillion dollars a year out of the American economy. But again this foreign energy policy is working, and oil use is dropping. Money talks. Prices change minds and behavior. But there is no reason on Earth we should hand all that money to Big Oil companies, either foreign or domestic.

We have a choice. Since 1975, we have known enough to protect ourselves. But over the intervening years, we have learned much more about good policy, and the world has changed. Discoveries about the effect of fossil fuels on climate have united the world in a desire to reduce its dependence on fossil fuel. All we lack is effective leadership.

America could provide that leadership—if we choose wisely.

But effective world leadership requires wisdom, commitment, and the respect of the world community. We have the wisdom, and a growing number of our country's best minds are working to replace the misguided policies of the past. But they will not succeed without the help of an informed citizenry.

The United States must choose between solid economic policies and tough talk about what we will achieve in fifty years. What will work is exactly what OPEC rails against year after year. We must tax oil and tax carbon. This will slacken the world's thirst for fossil fuels. Then reduced demand will, as OPEC fears, slash the price we pay. And the revenues from our own oil and carbon taxes will remain at home.

So our choice comes down to this: continue to pay tribute to those lucky enough to own the world's fossil energy supplies, or charge ourselves the real costs of using fossil fuel—including the costs of climate change and energy security.

Why not charge ourselves so we can keep the revenues? If we lead the world in this direction, reduced demand for fuel will lower the world price for all. The excess profits we capture from OPEC and Big Oil will fund our transition to clean energy, a stable climate, and energy security. The choice is ours.

Full endnotes available in the printed book.

Endnotes

Each note is referenced by an asterisk in the main text.

Additional documentation is available at stoft.com under Carbonomics.

Chapter 1

Once upon a Time

Saving twenty Years' worth of U.S. Oil use. Although the price of oil changed more than the price of natural gas or coal during the OPEC crises, the United States began conserving all types of fossil energy. Twenty years' worth of U.S. oil use is a measure of all the energy saved, not just the energy saved by conserving oil. To verify that value, we can simply look at Figure 3 in Chapter 8—a graph from the Department of Energy. Note that, in 2000, consumers saved about 65 quadrillion Btu of energy, whereas they used only 40 quadrillion Btu of oil. Hence, in that year alone, U.S. consumers saved 1.6 times as much total energy as they used in the form of oil.

Saving Eight Years' worth of World Oil use. In the ten years from 1963 till the Arab oil embargo in 1973, the world's oil use more than doubled. The next year, the trend reversed direction, and during the next twenty-five years, through 2008, oil use increased only 50 percent. This appears to indicate that consumers saved much more than eight years' worth of oil production. But see the endnotes to Chapter 8 to read how I constructed a more cautious estimate. Of course, that caution means that my estimate may be too low.

Chapter 2

Wreck the Economy?

Figure 1. This figure is based on a study by MIT's Joint Program on the Science and Policy of Global Change, "Assessment of U.S. Cap-and-Trade Proposals" (report number 146), April 2007. The study found that, by 2050, gross domestic product would be 0.97 percent lower with a cap-and-trade policy than without, consumer welfare would be 1.79 percent lower, and "market consumption" would be 2.35 percent lower. To be cautious, I chose to show market consumption in the figure. (Consumer welfare, a slightly more meaningful number, includes the value of a small increase in leisure time.) The values are in 2005 dollars

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