INVESTING IN RENEWABLE ENERGY

Making Money on Green Chip Stocks

JEFF SIEGEL
WITH
CHRIS NELDER AND NICK HODGE

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PREFACE

In 2005, I received the following e-mail:

> *Dear Jeff,*
> *Why the hell would you invest in renewable energy? You have no idea what you're talking about. No one's ever made money from solar and no one ever will!*

Certainly we can look to the solar bull market of 2007 to counter the last sentence of that e-mail. Whether it was the 900 percent gain that First Solar (NASDAQ:FSLR) delivered or the 1,700 percent gain that World Water & Solar Technologies (OTCBB:WWAT) delivered, green chip investors who were properly positioned last year made an absolute fortune.

Still, even with all the money we've made in the past by investing in renewable energy, the question "Why would you invest in renewable energy?" is still quite valid, especially when you consider the fact that there really is a lack of easily accessible and credible information regarding the current state of the overall energy marketplace.

For instance, while the local news has made a habit of reporting on high gas prices every time the summer driving season kicks into high gear, rarely do we hear how these so-called high gas prices are actually quite cheap. The true cost of gasoline is probably closer to about $11.00 a gallon. You may not be paying that price at the pump, but you are paying it. You'll see how in Chapter 1.

We also hear a lot about how the United States is the "Saudi Arabia of coal," boasting a 250-year supply. However, rarely do we hear how these coal-supply numbers are highly inflated, or how the United States most likely passed its peak of coal production nearly 10 years ago. You'll read more about this in Chapter 1, as well.

And what about nuclear energy? President Bush is behind it, and it doesn't have the same CO2 emission issues that are associated with coal. Some have even mistakenly (or intentionally) referred to it as "renewable." But whatever you call it, nuclear capacity is actually set to decrease over the next 25 years. In this book, we'll explain why.

Overall, our once-vast supplies of cheap, conventional, nonrenewable energy resources are shrinking at an alarming rate, while our demand for electricity and transportation fuels is dramatically increasing. As a result, we have created fertile ground for a very real crisis situation, but also a massive opportunity for renewable energy investors.

Just in 2007 alone, venture capital and private equity pumped $8.5 billion into clean energy. Even as the market began to feel the effects of a full-blown mortgage and credit crisis, the clean energy sector totaled more than $117 billion in new investments last year. That's about $20 billion ahead of predictions and 41 percent more than 2006 numbers.[1]

With this kind of big money in play, we have to ask ourselves, "Why are all these people investing in renewable energy?" The answer is quite simple.

The basic fundamentals of supply and demand dictate its profitability!

ONE CHOICE, ONE OPPORTUNITY

Within the next few decades, our increasingly limited access to cheap, nonrenewable energy resources will present a serious economic crisis. Even today, while the oil is still flowing with few interruptions, gas prices rise with every major or minor refinery disruption, causing the cost of nearly everything else to rise as well. Virtually everything we use and consume today relies on oil. It's the diesel in the trucks that ship our food, clothing, and medicine. It's the gas in our cars that get us to work, school, and the grocery store. It's used in fertilizers, cosmetics, and plastics. It's the stuff that keeps the world's biggest and richest corporations running, providing employment for millions of people around the world. It is the slippery glue that keeps the world moving.

There's also the issue of coal and natural gas. Nearly our entire energy infrastructure, which is aging at an alarming rate, was built around the utilization of these finite resources that are being consumed faster than we can supply them.

Whether we like it or not, the age of conventional fossil fuels is quickly coming to an end. So we have two choices: We can continue to chase an energy economy that's simply unsustainable, and ultimately a long-term failure, or we can use this coming energy crisis as an opportunity to profit from the only other choice we have for power generation: renewable energy.

Renewable energy—which is essentially energy produced from sustainable resources that are naturally replenished—is the only form of energy that will exist beyond oil, coal, natural gas, and nuclear, because the resources used for renewable energy generation are infinite. Moreover, despite the avalanche of misinformation that's constantly spewed from naysayers and mainstream media, we can actually generate enough renewable energy to satisfy *all* of our energy needs. Take a look:

- *Solar:* Enough electric power for the entire country could be generated by covering about 9 percent of Nevada with solar power systems. This is a plot of land roughly 92 miles by 92 miles.
- *Wind:* According to the U.S. Department of Energy (DoE), wind could provide 5,800 quads of energy each year. That's about 15 times the current global energy demand.
- *Geothermal:* According to MIT, there are over 100 million quads of accessible geothermal energy worldwide. The world consumes only 400 quads.
- *Marine energy:* The Electric Power Research Institute has estimated the wave energy along the U.S. coastline at 2,100 TWh per year. That's half the total U.S. consumption of electricity.
- *Biogas:* Your local landfill could be powering your home right now with biogas.
- *Conservation and energy efficiency:* Aggressive energy conservation can save enough electricity every year to avoid building 24 new power plants.
- *Hybrids:* If all cars on the road were hybrids and half were *plug-in hybrids* by 2025, U.S. oil imports could be reduced by about 80 percent.

Of course, most of this information won't be found on any of the dozen or so cable news networks. You'd also be hard-pressed to read about this stuff in most newspapers or magazines. But this is the information that green chip investors (investors who consistently profit from the integration of renewable energy) have been using for years to make smart investment decisions—decisions that have ultimately produced fortunes.

In this book, you, too, will have an opportunity to review the same objective and peer-reviewed data that the most successful green chip investors have been using and still use today. More important, you will also learn about the latest renewable energy projects and technologies that will usher in the next generation of green chip profits, such as:

- Super-efficient, large-scale solar farms that will replace coal-fired power plants. (Chapter 2)
- Offshore wind turbines that could soon power the entire East Coast of the United States, though they're so far removed from shore you'll never even see them. (Chapter 3)

- Geothermal power plants that haven't even been built yet, but already have long-term power-purchase agreements with the utilities. (Chapter 4)
- Dam-less hydropower systems generating electricity in New York City's East River. (Chapter 5)
- Commercial-scale renewable energy systems that produce biogas from agricultural livestock. (Chapter 6)
- Energy management systems that conserve enough energy to close down dozens of coal-fired power plants. (Chapter 7)
- Future biofuel feedstocks that can grow in the desert for years, with little or no water. (Chapter 9)
- Hybrid vehicles that will *never* require a single drop of gasoline or diesel! (Chapter 10)
- A new commodities market that delivers profits by trading CO2. (Chapter 12)

Green chip investors are investing in all of this right now—and making a lot of money in the process. Reading this book will enable you to do the same. But you must read it in its entirety, as this book also clearly outlines the proof any smart investor needs to validate the claim that our fossil-fuel-based energy economy is coming to an end. It may not be the most popular claim to make, but when you're on the receiving end of massive profits from renewable energy stocks, does it matter?

Here's to a new way of life, my friend—and a new generation of wealth!

INVESTING IN RENEWABLE ENERGY

PART I

TRANSITIONING TO THE NEW ENERGY ECONOMY

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that."

—Thomas Edison

CHAPTER

1

THE GLOBAL ENERGY MELTDOWN

The world is now facing its most serious challenge ever. The name of that challenge is *peak energy*.

If decisive and immediate action is not taken, peak energy could prove to be a crisis more devastating than world wars, more intractable than plagues, and more disruptive than crop failure. We're talking about a crisis of epic proportions that will change *everything*. And rest assured it will not discriminate. Conservative or liberal, black or white, rich or poor, this will be a crisis of equal-opportunity devastation. That may sound hyperbolic to you now, but by the end of this chapter, you will understand why we say it.

Everything we do depends on some form of energy. Our entire way of life, and all of our economic projections, are built on the assumption that there will always be more energy when we want it. But global energy depletion has already begun, although few have realized it.

You're one of the lucky ones, because after reading this book, you will understand both the challenge of peak energy and some of the solutions early in the game—allowing you the opportunity to be well-positioned to not only profit from the renewable energy revolution that is already under way, but to thrive.

By the time you've completed this chapter, you will have a full understanding of what peak energy is, how it affects the future of the entire global economy, and why it is imperative that this challenge of peak energy is met head-on with renewable energy solutions. This will ultimately lead you to profits via the companies that are providing the solutions both in the near-term and well into the future.

PEAK ENERGY

Before we begin discussing the particulars of peak oil, gas, coal, and uranium, we must first discuss what we mean when we use the term *peak energy*.

The production of any finite resource generally follows a bell curve shape. You start by producing a little, and then increase it over time; then you reach a peak production rate, after which it declines to make the back side of the curve. Between now and 2025, we could see the peak of *every single one* of our finite fuel resources. But why is the peak important? Because after the peak, we witness the rapid decline of these fuels, leaving us vulnerable to what could amount to the biggest disruption the global economy has ever witnessed. This would be a disruption that could spark an international crisis of epic proportions.

Peak Oil

The first resource that will peak is oil, which is also our most important and valuable fuel resource. We have an entire chapter devoted to oil—Chapter 8—so we will merely summarize here. Here are some simple facts about peak oil:

- The world's largest oil reservoirs are mature.
- Approximately three-quarters of the world's current oil production is from fields that were discovered prior to 1970, which are past their peaks and beginning their declines.[1]
- Much of the remaining quarter comes from fields that are 10 to 15 years old.
- New fields are diminishing in number and size every year, and this trend has held for over a decade.[2]

Overall, the oil fields we rely on to meet demand are old, and their production is shrinking, thereby bringing the oil industry closer to the peak and our entire global economy closer to the brink of catastrophe. Because when these fields dry up, so does everything else. And unfortunately, while today's oil fields are struggling at this very moment to keep pace with demand, new field discoveries are diminishing.

Before you can tap a reservoir, you must discover it. Here, too, the picture is clear: The world passed the peak of oil discovery in the early 1960s, and we now find only about one barrel of oil for every three we produce.[3] The fields we're discovering now are smaller, and in more remote and geographically challenging locations, making them far more expensive to produce. And the new oil is of lesser quality: less light sweet crude, and more heavy sour grades. These trends have held firmly for about four decades, despite the latest and greatest technology, and despite increasingly intensive drilling and exploration efforts.

This should be no surprise to anyone. It's the nature of resource exploitation that we use the best, most abundant and lowest-cost resources first, then move on to smaller resources of lower quality, which are harder to produce.

Global conventional oil production peaked in 2005. For "all liquids," including unconventional oil, the peak of global production will likely be around 2010.

With a little less than half the world's total yet to produce, which will increasingly come from ever-smaller reservoirs with less desirable characteristics, peak oil is not about "running out of oil," but rather running out of *cheap* oil.

The outlook for oil exports, on which the United States is dependent for over two-thirds of its petroleum usage, is even worse. Global exports have been on a plateau since 2004. This poses a firm limit to economic growth.

In sum, demand for oil is still increasing, while supply is decreasing; the absolute peak of oil production is probably within the next two years; and net importers like the United States are not going to be able to maintain current levels of imports, let alone increase them. This is a very serious situation, because without enough imports to meet demand, we simply cannot function. We will find it increasingly difficult to transport food, medicine, and clothing; to fuel our planes, trains, automobiles, and cargo ships; to provide heat in the winter and cooling in the summer; and to manufacture plastics and other goods that rely on petroleum as a key ingredient.

While the world's top energy data agencies have all commented on the threat of peak oil, along with many of the leaders of the world's top energy producers, the U.S. Government Accountability Office (GAO) may have said it best:

> *[T]he consequences of a peak and permanent decline in oil production could be even more prolonged and severe than those of past oil supply shocks. Because the decline would be neither temporary nor reversible, the effects would continue until alternative transportation technologies to displace oil became available in sufficient quantities at comparable costs.*[4]

Even so, peak oil is just the first hard shock of the energy crisis that will soon be unfolding. Right after peak oil, we will have peak gas.

Peak Gas

In many ways, the story of natural gas is similar to that of oil. It has a bell-shaped production curve (although compared to oil, it hits a longer production plateau, and drops off much faster on the back side), and the peak occurs at about the halfway point.

Like oil, new gas wells are tapping smaller and less productive resources every year, indicating that the best prospects have already been exploited and that we're now relying on "infill drilling" and unconventional sources, such as tight sands gas, coalbed methane, and resources that are deeper and more remote.

Like oil, the largest deposits of gas are few in number and highly concentrated. Just three countries hold 58 percent of global gas reserves: Russia, Iran, and Qatar. All other gas provinces have 4 percent or less.[5]

And like oil, there is the quality issue. It appears that we have already burned through the best and cheapest natural gas—the high-energy-content methane that comes out of the ground easily at a high flow rate. We're now getting down to smaller deposits of "stranded gas" and the last dregs of mature gas fields, and producing gas that has a lower energy content.

Assuming that world economic growth continues, that estimates of conventional reserves are more or less correct, and that there will not be an unexpected spike in unconventional gas, the world will hit a short gas plateau by 2020, and by around 2025 will go into decline.[6]

To illustrate our argument, consider the forecast for natural gas and oil combined, from Dr. Colin Campbell of the Association for the Study of Peak Oil (ASPO), which is shown in Figure 1.1.

However, the local outlook for natural gas is far more important than the global outlook. Natural gas production is mostly a landlocked business, because it's difficult to store and expensive to liquefy for transport. In the United States, we import only 19 percent of the natural gas we use, of which 86 percent is transported by pipeline from Canada and Mexico, both of which are past their peaks. Imports from Canada account for about 17 percent of our total gas consumption,[7] but Canada may have as little as seven years' worth of natural gas reserves left.[8]

Because it's difficult to store, there is little storage or reserve capacity in our nation's web of gas pipelines and storage facilities. In the United States, we have only about a 50-day supply of working storage of natural gas.[9] There isn't much cushion in the system; everything operates on a just-in-time inventory basis, including market pricing.

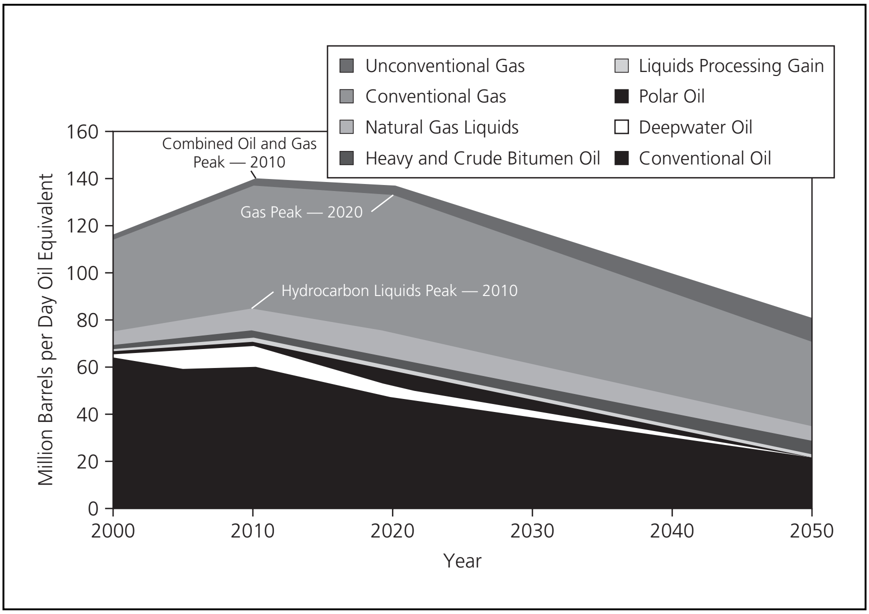

FIGURE 1.1 *Campbell's (2003) Forecast of World Oil and Gas Production*

Sources: Data: C.J. Campbell and Anders Sivertsson, 2003; chart: David J. Hughes slide deck, "Can Energy Supply Meet Forecast World Demand?," November 3, 2004.

Therefore, our main concern with gas is the domestic production peak. North America reached its peak of gas production in 2002, and has been declining ever since—the inevitable result of mature gas basins reaching the end of their productive lives.[10] (See Figure 1.2.)

The onset of the U.S. production peak was in 2001, and production is now declining at the rate of about 1.7 percent per year—far below the projection of the Energy Information Administration, as shown in Figure 1.3.

The declining plateau of production has held despite the application of the world's most advanced technology, and a tripling of producing gas wells since 1971, from approximately 100,000 to more than 300,000. (See Figure 1.4.)

The same is true for Canada, where they've been drilling more than ever, but production is still declining. Consequently, in recent years, gas rigs have been leaving Canada, and going to locations elsewhere in the world where rental fees are higher.

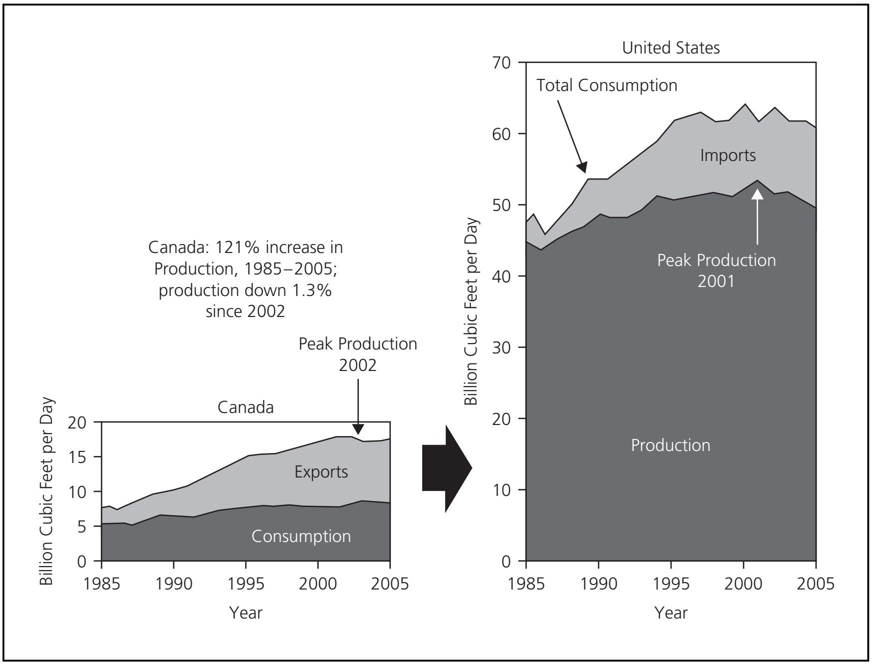

FIGURE 1.2 *North American Gas Production, 1985–2005*
Source: J. David Hughes, "Natural Gas in North America: Should We Be Worried?," October 26, 2006, http://www.aspo-usa.com/fall2006/presentations/pdf/Hughes_D_NatGas_Boston_2006.pdf.

In North America, the best and cheapest natural gas at high flow rates is gone. For the United States, this is again a very serious situation. Current supply-and-demand forecasts indicate that a shortfall in natural gas supply is looming, possibly by as much as 11 trillion cubic feet (tcf) per year by 2025, or *about half of U.S. current usage* of 22 tcf/year.

When we passed the North American gas peak, as seen in Figure 1.5, the price of gas imports skyrocketed. Yet demand has continued to increase, in part due to increased demand for grid power, but also in part due to switching over to gas from petroleum, which has increased in price even more rapidly than gas. Now we're needing more imports every year, but getting about the same amounts, and paying more for them. This trend shows no signs of abating.

Therefore, North America will increasingly have to rely on *liquefied natural gas* (LNG) imported by sea.

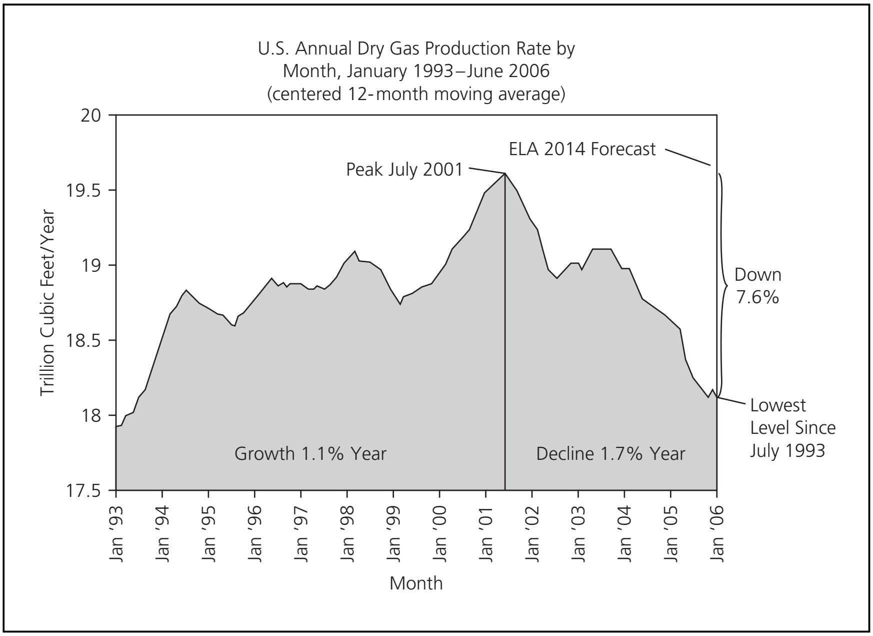

FIGURE 1.3 *U.S. Gas Production Rate, 1993–2006*

Source: J. David Hughes, "Natural Gas in North America: Should We Be Worried?," October 26, 2006, http://www.aspo-usa.com/fall2006/presentations/pdf/Hughes_D_NatGas_Boston_2006.pdf.

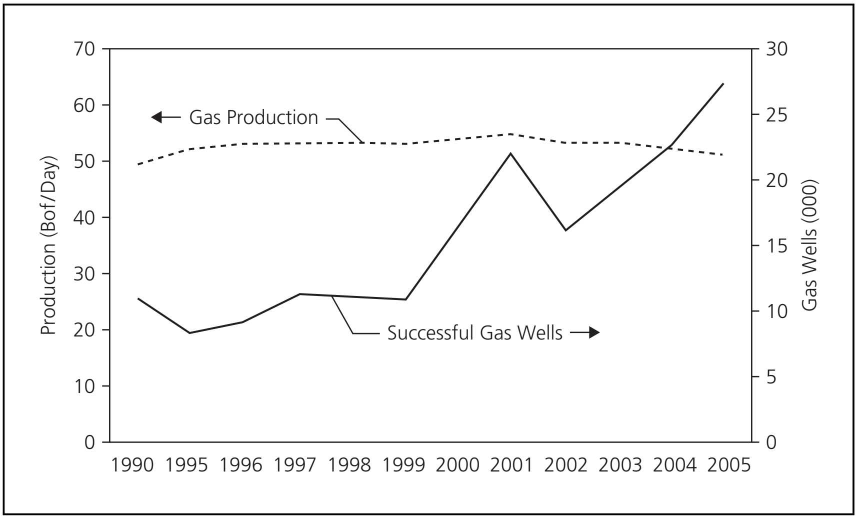

FIGURE 1.4 *U.S. L48 Gas Production versus Successful Drilling*

Source: "Balancing Natural Gas Supply and Demand," notes from Department of Energy Meeting, December 2005, http://www.fossil.energy.gov/programs/oilgas/publications/naturalgas_general/ng_supply_overview.pdf.

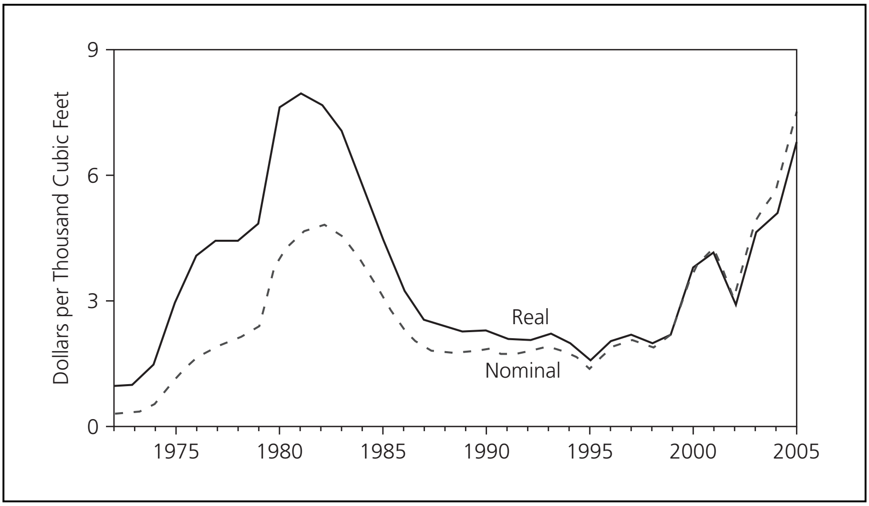

FIGURE 1.5 *Cost of Gas Imports, 1970–2005*
Source: EIA *Annual Energy Review,* 2005.

Liquefied Natural Gas LNG is made by carefully cooling natural gas to minus 260 degrees Fahrenheit, at which point it condenses into a liquid. It then must be kept under controlled temperature and pressure to stay liquefied, with some of it "boiling off" along the way, and transported in superinsulated, very expensive, pressurized tanker vessels. Then when it reaches its destination, it must be slowly *regasified*—warmed back up—before it can be sent through a pipeline to the end-user.

All of this requires significant inputs of energy and large facilities for both liquefaction and regasification. The whole LNG process, from cooling to transporting to regasification, entails a 15 to 30 percent loss of the energy in the gas. It also makes the gas more expensive than domestic gas.

What is the potential LNG supply for the United States? At present, it's uncertain. Consider the outlook for the three countries with the largest gas reserves: Russia, Iran, and Qatar.

In Russia, the investment climate for international energy companies has turned less than hospitable after a vicious round of resource renationalization under President Putin in recent years, and the outlook for LNG exports is dubious. Russia's planned gas exportation capacity appears to be focused on pipeline transport, and a dispute with Royal Dutch Shell over the rising costs of Russia's very first LNG plant at the Sakhalin II field has delayed progress on the project.

As for Iran, it seems unlikely that the geopolitical standoff over its nuclear development program will be resolved any time soon, such that it might become a hospitable investment climate for gas exportation projects. So we can probably rule out Iran as a major source of LNG for North America, at least for now.

That leaves Qatar, which is friendly to the United States and making significant investments in its LNG export capacity. Unfortunately—again due to rising costs—plans to build several much-anticipated LNG export facilities in Qatar were canceled in February 2007, such as a proposed $15 billion LNG facility in partnership with ExxonMobil. “Right now, everyone around us is postponing and delaying projects,” Qatari Oil Minister al-Attiyah commented.[11]

At the same time, a rising sentiment of NIMBYism (Not In My Backyard) has nixed planned LNG import facilities in the United States, from Louisiana to Long Beach.

This is not a scenario to inspire hope for a dramatic increase in LNG imports. But according to respected Canadian geologist J. David Hughes, who provided the figures referenced earlier on gas, to cover the projected 2025 gas shortfall of 10 to 11 tcf/year in the United States alone, we would need to *double* (or, after competition sets in, *triple*) the *world’s* current LNG capacity. Hughes estimates that this would require:

- Two hundred new LNG tankers, each with capacity of three billion cubic feet (bcf).
- Thirty new North America–based receiving terminals, each with capacity of one bcf per day.
- Some 56 new foreign-based 200 bcf/year liquefaction trains.
- Capital investment on the order of $US100–200 billion.
- Time to build total capacity = 10 to 20+ years.[12]

Even if we had no difficulty at all in building new gas liquefaction and receiving plants, this stretches the imagination and is virtually impossible.

The End of the Line Where does this leave us? In short, when it comes to natural gas, we’re on our own in the United States. Although new drilling in the Lower 48, the Gulf, and, eventually, in Alaska will produce some additional gas, it won’t be nearly enough to change the basic peak production profile. At best, it will thicken and extend the tail. That leaves one remaining option: switching fuels.

Natural gas is commonly used for heating and cooking, because it is safe, clean burning, efficient, and easy to control. Switching those uses to something else, like coal, wood, or fuel oil, means really stepping backward in time and technology, and comes with high carbon emissions.

But 29 percent of the natural gas used in the United States is for generating grid power, and accounts for 20 percent of the grid power produced.[13] That portion we can shift: to renewables!

Recognizing the serious threat that the natural gas supply poses to grid power generation, and the importance of renewables to fill the gap, former IEA chief Claude Mandil remarked in May 2007:

> *A heavy investment cycle in power generation is looming in most IEA countries and governments need to play an assertive role in reducing uncertainty and making sure appropriate investment takes place. . . . A window of opportunity now exists to push for a cleaner and more efficient generation portfolio that will have significant impact on the energy sector and the environment for the next 40–50 years.*[14]

This window is yawning wider every year, as we approach the end of the line for natural gas–fired power plants.

The next obvious choice would be to increase our reliance on coal, the dominant fuel used for grid power. However, there may be a slight problem with that.

Peak Coal

Coal is by far the dirtiest form of fossil fuel we use, but it's also the most readily usable fuel that we still have in relative abundance. Coal provides about one-quarter of the total energy the world uses. Worldwide electricity production is 40 percent powered by coal. Two-thirds of the steel industry relies on it for fuel, and that coal must be high-energy "black coal."

Like oil and gas, the best deposits of coal are highly concentrated. The major deposits of coal—about 90 percent—are located in just six countries: the United States, which has the most, plus Russia, India, China, Australia, and South Africa.

The United States has 496.1 billion tons of demonstrated coal reserves, 27 percent of the world total,[15] and thus is often called "the Saudi Arabia of coal." Our coal endowment has been widely estimated to be a 250-year supply. But that estimate was based on a USGS study from the 1970s, which assumed that 25 percent of the known coal could be recovered with current technology and at current prices. Now the USGS believes that only 5 percent is recoverable with today's technology and at current prices.[16]

This startling conclusion came from a 2007 study by the National Academy of Sciences. The researchers looked at recent updated surveys from the

United States Geological Survey (USGS) and determined that some of the old assumptions were wrong. "There is probably sufficient coal to meet the nation's needs for more than 100 years at current rates of consumption," the study says. "However, it is not possible to confirm the often-quoted assertion that there is a sufficient supply of coal for the next 250 years."[17]

Note that the 100-year estimate is based on our *current* consumption rate: about 1.1 billion tons a year. By 2030, due to users switching over to coal from other rapidly depleting fuels, the rate of coal consumption could be as much as 70 percent higher than it is today, in which case that "100-year" supply could be depleted much more quickly.[18]

Similarly, a separate study of world coal reserves in March 2007, which was conducted by a German consultancy called the Energy Watch Group (EWG), found that the United States does not have anywhere near its claimed 250-year supply of coal.[19] Indeed, EWG claims that in terms of energy content, the United States passed its peak of coal production in 1998!

The distinction is based on the fact that various types of coal contain different amounts of energy. Anthracite (also known as black coal) from Appalachia and Illinois has 30 megajoules of energy per kilogram (30 Mj/kg), but it has long been a tiny fraction of our overall coal production, and has been in decline for over half a century.

Our supposedly vast reserves are mainly of lower-quality bituminous coal, delivering 18 to 29 Mj/kg, and subbituminous coal and lignite ("brown coal"), delivering a mere 5 to 25 Mj/kg. (See Figure 1.6.)

For comparison purposes, EWG translated the energy content of the coal produced into *tons of oil equivalent*. In terms of *volumes of stuff mined*, they found that U.S. coal production can continue to grow for about another 10 to 15 years. But in terms of *energy*, which is the only metric that really matters, U.S. coal production peaked in 1998 at 598 million tons of oil equivalent, and had fallen to 576 million by 2005.

Just as we have burned through the world's best sources of oil and natural gas, we have burned the best sources of coal. The remaining coal we produce will be of progressively lower quality, and will be progressively more expensive to transport due to the escalating cost of diesel.

In a replay of the well-worn debate about oil reserves, it appears that the global reserve numbers for coal have been vastly overstated. The information we've had for the world, like the U.S. data, is decades old and unreliable, and modern reassessments by nice, transparent countries like Germany and the United Kingdom have resulted in 90 percent reductions!

The reserve numbers from Asia are particularly suspect, some dating back to the 1960s. China hasn't reduced its reported reserve numbers in

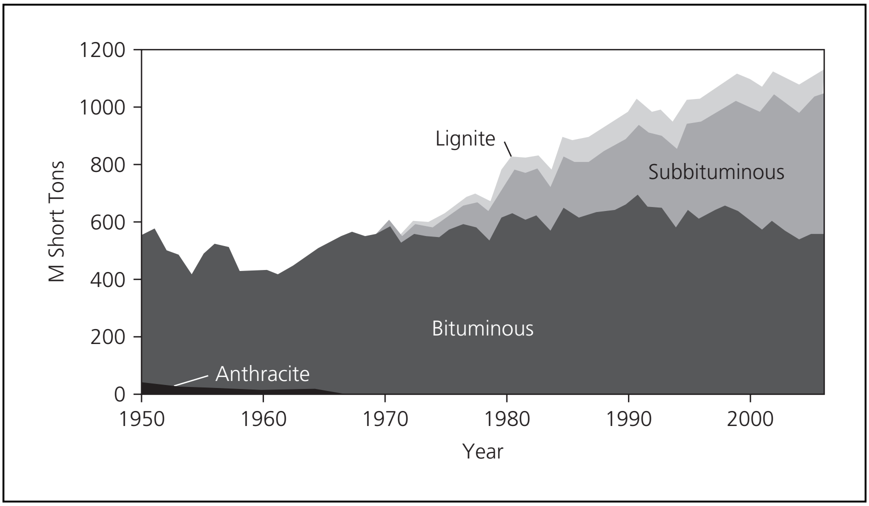

FIGURE 1.6 *Coal Production in the United States*
Source: Energy Watch Group.

15 years, even though we know it has produced some 20 percent of its reserves since then.

In fact, for the past 20 years, *all* major coal-producing nations that have updated their reserve numbers have adjusted them downward. And in the past 25 years, the global total reserve estimate has been cut by 60 percent.

The EWG report concludes, "The present and past experience does not support the common argument that reserves are increasing over time as new areas are explored and prices rise."

Let's look at the data.

- Total global reserves stand at about 909 billion tons.
- The world's largest producer of coal is China, which will likely peak between 2012 and 2022, followed by a steep decline.
- The next-largest producer is the United States, which will likely peak between 2020 and 2030.

Figure 1.7 is EWG's chart of possible worldwide coal production. Based on this scenario, the EWG estimates that the absolute peak of global coal production will occur around 2020, about 10 years after peak oil, and at about the same time as peak gas!