

CHAPTER 1

Catalyzing into Green

WHY, AND WHY NOW?

Everything's fine today, that is our illusion.

—Voltaire

So, why green, and why green now?

I've heard some people say that the greening of just about everything these days is simply a business ploy to sell more products. I've also heard the more cynical crowd tell me that green energy and green products are just feel-good marketing and public relations tools designed to make certain companies appear as though they're good citizens and caring custodians of the world.

Now I am not so Pollyannaish that I don't see that there is often more than a hint of truth to these claims. But despite the many companies and public officials engaging in green propaganda, there are real companies helping to solve real-world problems.

And what is catalyzing the world into a greener place. It is the massive challenges of what I call the "Big Three":

1. Rising global energy demand (particularly from China and India)
2. Energy security: the New Cold War
3. Carbon concerns

To be sure, covering the intimate details of each of these factors could take up an entire book on its own. So I'll restrict the discussion to the primary issues as to why the world is seeing the virtue of all things green.

Rising Global Energy Demand

So, we've heard a lot about this new era of the "global economy," and for the most part this is a fantastic circumstance that is helping many of the 6.6 billion residents of the planet to enjoy better living conditions. Of course, with the yin there's always a yang, and the yang here is a voracious and growing appetite for energy.

According to the Energy Information Administration (EIA)—a division of the U.S. Department of Energy (DOE)—in its *International Energy Outlook 2007* report, worldwide energy demand from 2004 to 2030 is projected to increase from 447 quadrillion Btu (British thermal units) in 2004 to 559 quadrillion Btu in 2015. That number then climbs to 702 quadrillion Btu in 2030—a 57 percent increase over the projected period (DOE/EIA-0484, 2007).

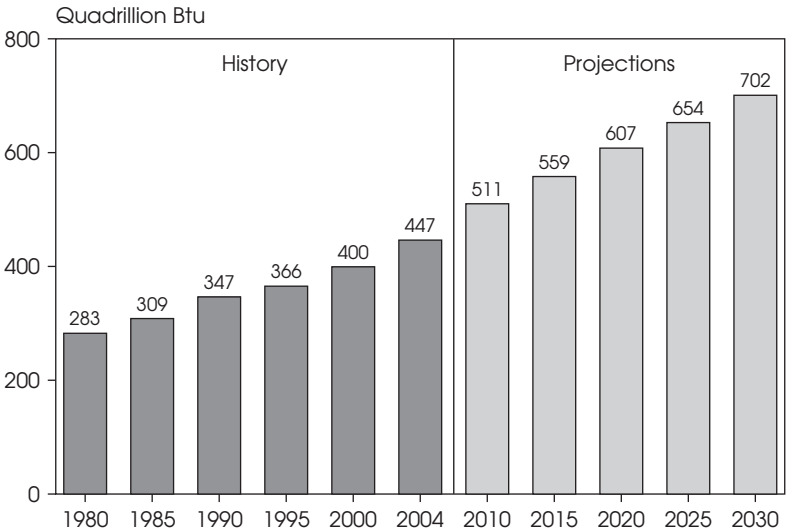


Figure 1.1 World Marketed Energy Consumption

Source: Figure 8 from EIA, *International Energy Outlook 2007* (Washington, D.C.: U.S. Department of Energy, May 2007), p. 5.

Figure 1.1 shows both historical demand trends worldwide, as well as the projections made by the EIA all the way out to 2030.

The largest projected increase in energy demand is for the non-OECD (Organisation for Economic Co-operation and Development) region. Countries outside the OECD, that is, developing countries such as China and India (more on them in a moment), have projected economic growth rates and more rapid population growth than the OECD nations. The appetite for energy in the non-OECD region is projected to grow at an average annual rate of 2.6 percent from 2004 through 2030. Growth in the developed and mature economies of the OECD region—Europe, the United States and others—is expected to be slower by comparison (DOE/EIA-0484, 2007).

Here the EIA projects energy use will grow at the much slower average rate of 0.8 percent until 2030. Interestingly, the energy appetite for the non-OECD region is projected to surpass that of the OECD region by 2010. By 2030 it could be as high as 35 percent greater (see Figure 1.2).

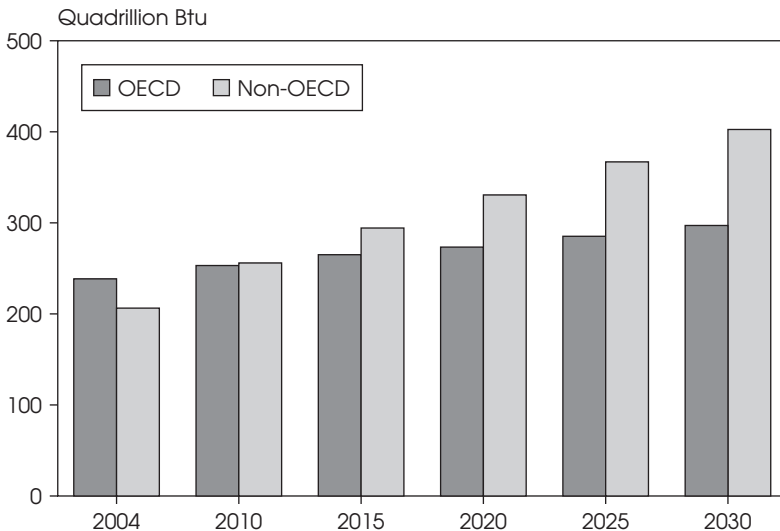


Figure 1.2 World Energy Use 2004-2030

Source: Figure 9 from EIA, *International Energy Outlook 2007* (Washington, D.C.: U.S. Department of Energy, May 2007), p. 6. What the EIA data projections mean is that the world will be consuming energy at a blistering pace for at least the next two decades, and likely well beyond that if the past is any kind of prelude to the future.

The Chindia Syndrome

The combined economic transformation going on in both China and India—or *Chindia* as I will refer to them in this book—is going to have a massive impact on the world’s demand for energy.

In the case of Chindia, size definitely matters.

Growth in Chindia is occurring at breakneck speed and so has its appetite for fuel. As these countries become more capitalistic, richer, and increasingly industrialized, they are going to require the lifeblood of a flourishing society—and that lifeblood is more and more energy.

In fact, it’s a general rule that the more industrialized a country is, and the richer it is, the greater the energy use on a per-capita-basis. That’s why the very richest countries in the Western world have the highest per capita energy use.

And while we here in the West, and particularly in the United States, are accustomed to just flipping the light switch, jumping into our cars for a ride, and booting up our laptop computers, cell phones, and other modern conveniences, the citizens of Chindia are really just beginning to feel what’s this is like on a society-wide basis.

The fact is that as Chindia grows, it will require more energy to power its offices, factories, homes, and cars. Now, on balance, I think this growth in Chindia is fantastic, especially for people who’ve largely spent nearly the entire twentieth century without the conveniences of the modern world.

According to the International Energy Agency (IEA), worldwide energy demand will be at least 50 percent higher than current levels by 2030 (note these levels are similar to the EIA, albeit slightly lower). I say at least, because that is the agency’s most conservative projection. The interesting thing here is that because of its tremendous population and industrialization, Chindia is likely to account for 45 percent of this projected increase in demand.

It’s hard to imagine anyone arguing that Chindia’s growth won’t lead to more energy consumption, but at what rate is this likely to occur? The answer depends on numerous factors. The biggest factor really depends on how quickly the region’s economy expands.

The IEA projects China’s primary energy demand will more than double from 2005 to 2030. That translates into an average annual rate of growth of 3.2 percent. Keep in mind that China has approximately four times as many people as the United

States, and that demographic element—along with the nation's industrialization—will make it the world's largest energy consumer by about 2010. Compare that to just a few years ago in 2005, when U.S. demand was more than one third larger.

China's growth will be particularly intense in the period up to 2015. The IEA says by then, China's energy demand will grow by 5.1 percent per year. Once again, this will be largely driven by that country's industrial boom.

The other element to the Chindia contraction is, of course, India. Here too, we see huge economic expansion that will continue increasing energy demand. That increased demand will also continue boosting the country's share of global energy consumption.

Like China, the IEA projects energy demand in India will more than double by 2030, growing on average by 3.6 percent per year. So, as Chindia becomes a global megawatt vacuum, more and more energy will be needed. This increased demand will be with us for a while, and the only problem with it is that the energy will come primarily from one source, namely fossil fuels.

Where Does That Energy Come From?

An energy-hungry world needs to be fed, and for the next several decades, the primary feedstock for the world's energy is fossil fuels.

I know some of the more green-oriented readers will be upset by this. The reality is that the world will rely heavily on traditional carbon energy sources for as far out as we can see. This carbon cloud does, however, have a green lining, a lining we'll look at in great detail as this story unfolds.

Right now I want to show you where the world gets its energy and just how carbon dominant the energy landscape really is. In Figure 1.3, we can see precisely where the world has historically gotten its energy, and where we are likely to get that energy from out until 2030. As you can see, it's a carbon-oriented world, with fossil fuels continuing to supply most of the world's energy needs.

According to the EIA (2007), liquids here (which include oil and other petroleum products) will continue providing the largest share of world energy consumption over the projection period. But their share falls from 38 percent in 2004 to 34 percent in 2030. Why the decline? Well, one reason is that rising world oil prices are likely to curtail demand for liquids after 2015.

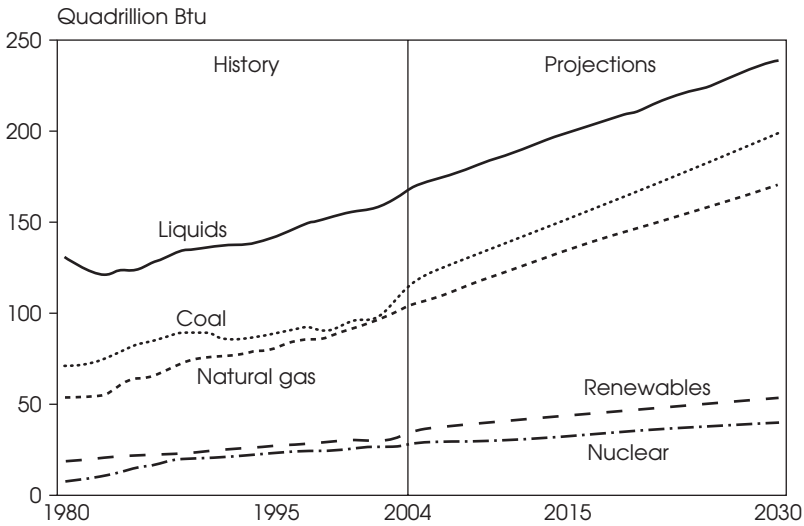


Figure 1.3 World Energy Use by Fuel Type

Source: Figure 11 from EIA, *International Energy Outlook 2007* (Washington, D.C.: U.S. Department of Energy, May 2007), p. 7.

Why will oil prices rise? See the box titled “The New Age of Oil.”

Natural gas consumption is projected to grow about 1.9 percent per year on average until 2030, from about 100 trillion cubic feet in 2004 to 163 trillion cubic feet in 2030. In fact, natural gas will likely be the world’s fastest-growing energy source for electricity generation.

Natural gas prices are much more of a regional issue than oil prices due to the availability worldwide, but at least in the United States, the price of domestic supplies is likely to continue trending higher.

Coal is yet another fossil fuel likely to increase in usage among the world’s energy consumers. The EIA predicts coal use worldwide will increase by 37 quadrillion Btu from 2004 to 2015, and by another 48 quadrillion Btu from 2015 to 2030. The United States, China, and India will experience the vast majority of this increase in coal usage, accounting for about 90 percent of the total increase from 2004 to 2030.

Worldwide, electricity generation in 2030 is projected to total 30,364 billion kilowatt hours, nearly double the 2004 total of 16,424 billion kilowatt hours, according to the EIA. That is a whole lot

The New Age of Oil

The 2005 film *Syriana* is an extremely interesting treatment of the not-so-pretty geopolitical and corporate intrigue surrounding the battle for the greatest natural resource the world has ever known—oil.

In what would turn out to be an ironic coincidence, I happened to tune in to this film on cable TV. This was in March 2008, when oil prices hit new all-time highs of more than \$100 a barrel. This confluence of events prompted me to ask myself if, years from now, I will look back at \$100 oil as the good old inexpensive days.

Frighteningly, I think the answer is yes.

Why do I think we are in for more pain in the oil patch? Well, the simple answer is supply and demand. Diminishing supplies of low-cost oil coupled with a voracious world appetite for energy is an Economics 101 recipe for higher oil prices. Of course, the issues surrounding oil aren't simply a matter of supply and demand.

There are many other factors influencing oil prices, including geopolitical turmoil, geology, science, the emergence of China and India as economic power players, and the development of alternative energy sources.

To get a basic understanding of what is perhaps the most fundamental issue shaping this new age of oil, we must first understand the concept of peak oil. I suspect this may be a new idea for many of you, as the issue doesn't get the kind of attention in the mainstream media I think it deserves.

The term *peak oil* is widely used amongst petroleum industry observers as a way to basically describe the global maximum in conventional crude oil production. This peak in conventional crude oil production is predicted to happen in the not-too-distant future, and some analysts actually think we are now past the point of peak oil.

The peak oil theory states that once the global maximum in conventional crude oil production has been reached, global oil production will generally decline forever afterwards. That's forever, as in for the rest of time. What is scary about this theory is that its veracity will only become apparent some time after the point of peak oil has actually occurred.

According to some analysts, peak oil will occur when approximately half of the world's total oil reserves have been used up. The model used to think about the big picture is essentially an extrapolation from what happens to every individual oil field over time. You see, when you first start drilling in an oil field the costs of extracting that oil is relatively modest.

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As the supply of oil in a given field dwindles, it becomes increasingly difficult to get the oil out of the ground. The more difficult the extraction process, the more costly it becomes. As the cost of extraction escalates, the less cost-effective it becomes to remove that oil from the ground. This increasing cost spiral continues until it becomes economically unfeasible to extract any more oil from a given field.

Apply this individual model to the entire world's oil supply and you begin to get a handle on the global peak oil theory. As you might expect, oil companies have to a great extent already extracted the easy-to-reach, cheap oil first. This was the oil found on land; near the earth's surface; under pressure so as to make it easy to tap; and the light and sweet crude (i.e., low sulfur content), which can easily be refined into gasoline. The remaining oil, sometimes offshore, far from markets, in smaller fields, and/or of lesser quality, was left for "later."

Well my friends, "later" is now.

According to *The Oil Drum* (www.theoil Drum.com), on a world-wide basis the phenomenon of peak oil can be thought of as a crisis in resources needed to produce oil. As we deplete the large, easy-to-produce fields and move to ever-more-difficult fields, oil extraction takes more and more equipment like drilling rigs, more brain power in the form of petroleum engineers, and more investment capital to keep the whole ball game going. Eventually, we will reach a point where we deplete our equipment, trained and experienced personnel, as well as the dollars that make extraction viable.

When production begins to drop as a result of this combination of factors, we will have reached peak oil.

of energy needed in the coming years, and the fact is that only a fraction of that energy will come from renewable, green sources. But the fact that the market right now is relatively small for green energy sources—not to mention related green products—shouldn't be disconcerting to anyone. Rather, it should be seen as a huge opportunity. Chapter 2 features more about the market potential for green energy generation and products.

Energy Security: The New Cold War

If there were ever a more politically charged commodity than oil, then I would like someone smarter than I to explain it.

Oil is at the fulcrum of what is, in my opinion, the great global conflict of our lifetime.

I think most people fail to really understand the significance of energy security issues, or what I call the new cold war. This new cold war isn't a war in the traditional sense, although we have entered into armed conflict many times to a significant degree because of oil issues (Gulf Wars I and II are the most recent). This new cold war is, in fact, an energy war. It's an oil war.

Those of you old enough to remember the cold war climate in the 1950s, '60s, '70s, and '80s will understand the nature of this conflict best. This was the constant presence of tension between the communist Eastern bloc states and the capitalist West over who would essentially be the dominant world influence. This conflict went away a couple of decades ago, and the reason why was that the West won. The Soviet evil empire crumbled, and with it the communist influence on eastern Europe and other satellite states.

In the case of the cold war, we were fighting against a specific opponent, and it was a war that you could actually win. Unfortunately, I think when it comes to the current battle for global energy resources, we are in a battle for control that we really cannot win. It's nearly physically impossible—barring a U.S. invasion of the rest of the world, which I'm fairly sure is not going to happen—for Western military power to literally take control over the world's oil supplies.

The unfortunate fact for most of the free world is that the greatest natural resource the world has ever known is tied up largely in countries that at best tolerate the West as trading partners, and at worst think of the West as the Great Satan that deserves to be struck down by the vengeful wrath of Allah. With peak oil either already upon us or only a few years into the future, the implication for oil prices is profound.

The Usual Suspects

Iran, Iraq, Saudi Arabia, Russia, China, Venezuela, and Nigeria: This is the short list of usual suspects when it comes to countries in control of the world's oil supplies. With the possible exception of Iraq and the potential for a U.S. friendly government in that new-born and still unstable country, the primary oil-rich nations here each have an axe to grind with the West.

Sure, we've had friendly relations with Russia and China since the end of the cold war, but both countries still have a vested interest in remaining strong military and economic powers that can influence their respective regions as well as the rest of the world. One way to exert this influence is to control as much of the world's oil as possible.

Over the past several years, China has gone on a global oil grab that's seen the country secure long-term contracts for both oil and natural gas. This isn't as much of a bellicose move against the world as it is a need to supply their young and exponentially growing industrialized economy with the energy it needs to continue expanding.

This oil grab from China might be necessary for that country's future prosperity, but its effect on the rest of the globe is to lift the price of a barrel of crude. The higher demand, coupled with a restricted peak oil supply, means higher energy costs. It's just that simple.

Another front in this new cold war over oil is Russia. The former Soviet Union may not look at the West with the kind of hostile intent it once had, but the country still sees itself as a world power. The difference is that now, the Russian government's weapons have become their oil and natural gas reserves.

Perhaps the two biggest thorns in the side of the West come from Iran and Venezuela. Both of these countries' respective leaders, the fanatical but cunning Mahmoud Ahmadinejad and the boisterous and belligerent Hugo Chavez, have at their disposal a large portion of the world's crude oil supplies. These are men who have philosophical as well as strategic interests at odds with the West, and their hold on oil supplies is just one more reason energy security is one of the Big Three catalysts driving our push toward green energy sources.

You see, the key here is that if we can wean ourselves off of petroleum sources that exist in hostile territories, we can increase our energy security and decrease our vulnerability to energy supply disruptions. One way to do this is to have more homegrown renewable energy sources.

The less we have to rely on others for our energy needs, the less we have to fear, and the more energy secure we will be.

Carbon Concerns

Now we've come to what I think is perhaps the biggest social awareness driver fueling the green movement, and that is the growing

concern over the deleterious effects on the planet of carbon emissions. Of course, the corollary to this concern is global climate change, or global warming, which is now a concept burned into the minds of just about everyone on the planet.

We all know about former Vice President Al Gore and his book and documentary film, *An Inconvenient Truth*. Mr. Gore garnered an Academy Award for the film and won a Nobel Peace Prize—along with the Intergovernmental Panel on Climate Change—for their part in bringing the prospective dangers of global warming to light. But just how much carbon is emitted by the world, and how much more carbon will an energy rich world spew out in the next several decades? For those projections let's return to data from the Energy Information Administration (2007).

According to the EIA, world carbon dioxide emissions are projected to rise from 26.9 billion metric tons in 2004 to 33.9 billion metric tons in 2015 and 42.9 billion metric tons in 2030.

That's a lot of carbon, so it's no wonder that it is such a big concern.

And where is that carbon coming from? Well, in 2004 CO₂ emissions from petroleum and other liquids' combustion made up about 40 percent of total emissions. By 2030 its share is projected to be 36 percent. Carbon dioxide emissions from natural gas combustion accounted for 20 percent of the 2004 total. That share is projected to rise to 21 percent in 2030. Coal's share in 2004 was 39 percent, but its share of total CO₂ is projected to increase to 43 percent by 2030.

Figure 1.4 shows the projected totals of CO₂ emissions by fuel type up through 2030. As the growth of Chindia occurs over the next few decades, it will become a huge contributor to global CO₂ emissions. In 2004 China and India combined for 22 percent of world emissions. The EIA predicts that by 2030, carbon dioxide emissions from China and India combined are projected to account for 31 percent of total world emissions.

Finally, what is the rate of growth of these carbon emissions?

The EIA projects that world energy-related carbon dioxide emissions will grow by an average of 1.8 percent per year from 2004 to 2030. For the OECD countries, total emissions are projected to average 0.8 percent annual growth. For non-OECD countries, total carbon dioxide emissions are projected to average 2.6 percent annual growth. This emissions extravaganza is lead by China, where that country's emissions are expected to rise by 3.4 percent annually

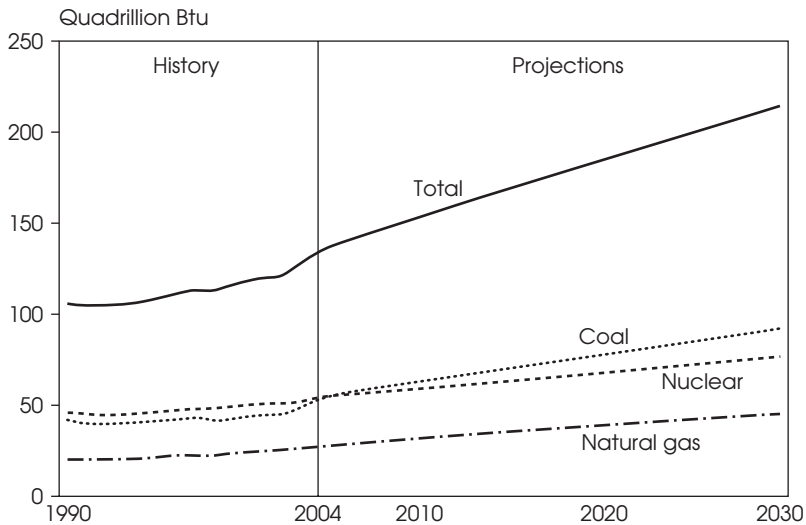


Figure 1.4 World Related CO₂ Emissions

Source: Figure 78 from EIA, *International Energy Outlook 2007* (Washington, D.C.: U.S. Department of Energy, May 2007), p. 73.

from 2004 to 2030. The bottom line here is that CO₂ emissions will continue growing and that means a greater chance of global warming and its potentially devastating environmental effects.

Now this book does not take on the scientific debate concerning global climate change. What is important to understand for you, the individual investor, is that there is a consensus in the scientific community that anthropogenic (human-caused) carbon emissions are causing a rise in greenhouse gases, and this is causing a rise in global temperatures.

To combat this condition, something has to be done, and it has to be done soon. Why? Well, because the atmosphere has a long memory. It effectively accumulates all CO₂ and emissions we put up every year, and that's why CO₂ concentrations rise over time.

What is most disturbing about this long atmospheric memory is that even if you manage to make a modest change in emissions, it would only delay and not prevent the concentration from crossing what scientists suspect are dangerous CO₂ thresholds.

Some scientists argue that we have to make drastic reductions in emissions by the end of the century if we have any hope of stabilizing CO₂ concentrations. One way to reduce emissions is to

be green, and fortunately for you, the investor, this is your ticket to making green. You see, the world will need technological solutions to assuage its carbon concerns. It is going to need new ideas, new products, new financing, new research, new brain power—in fact, it's going to need a whole new way of looking at the world.

We've already started to look through green-colored glasses, and that's what's so great about this whole field. That new need for green will make you green, if you know where to find it.

