

## 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.

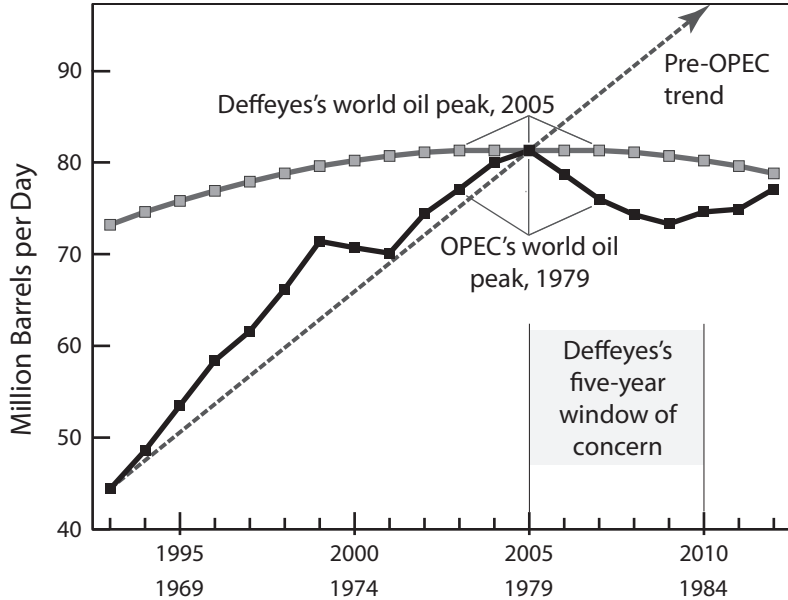
### What Happens after the Peak?

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

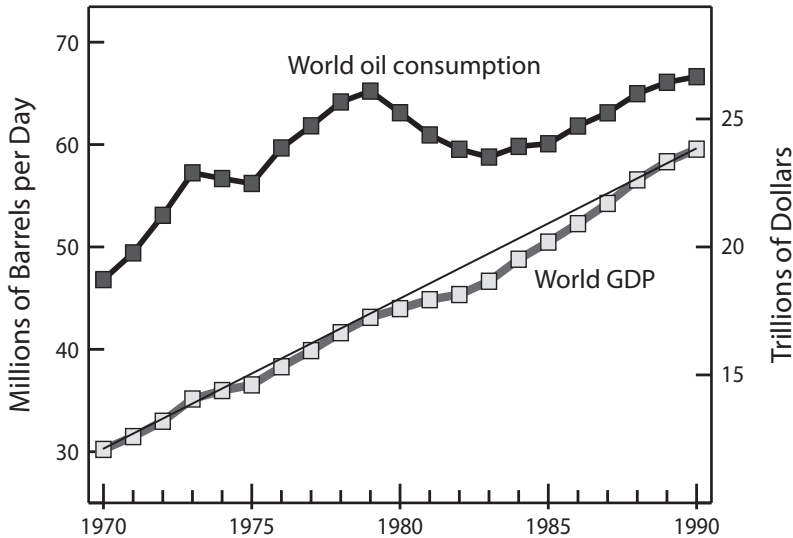


The graph aligns the 1979 peak in world oil production caused by OPEC with the world's final oil production peak, as predicted by Deffeyes, so that the two can be easily compared. Peak-oil theory predicts a smooth peak. Consequently, the shock to the world economy was much greater during the first six 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

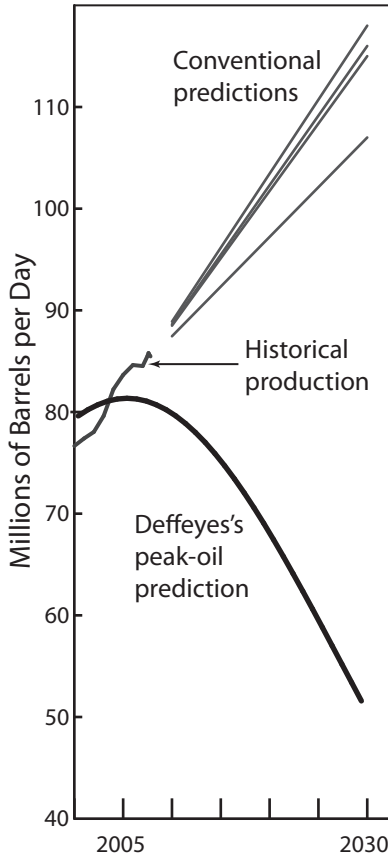
Although the 1979 peak in oil production and consumption was sharp, it did not have a catastrophic effect on world economic production. The final peak in oil production will not cause a global economic crisis killing billions, as predicted by a number of peak-oil proponents.

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

### Peak-Oil Economics Unscrambled

History shows that the world economy did not collapse when oil supply peaked sharply in 1979, so where have the peak-oil geologists gone wrong in their economic thinking? Peak oil's *Mad Max* economics assumes markets work like this:

The demand for oil increases as wealth and population increase. After the peak, the supply of oil will fall. Therefore, supply will not meet demand, and a crisis will destroy the world economy.

However, basic economics predicts that unless the government interferes, markets will work like this: The demand for oil increases as wealth and population increase. After the peak, the supply of oil will fall. Falling supply will cause the price to rise, and that will cause people to use less. Demand for oil will fall until it equals supply.

That is what happened in the early 1980s. Deffeyes, the Princeton geologist, knows both theories and explains in his book *Beyond Oil* why he thinks basic economics is wrong. “For the first time since the Industrial Revolution,” he begins, “the geological supply of an essential resource will not meet the demand.”

This could contain a grain of truth if Deffeyes's conjecture on government intervention is right. Markets have worked for all essential resources. But Deffeyes is worried that the law of supply and demand is about to break down for the first time in 250 years. Deffeyes remembers that: “Virtually all economists visualize it as price increases that bring supply and demand into a new equilibrium.” Exactly. By equilibrium he just means supply equals demand. But after remembering the reason supply will equal demand, he rejects it.

“That outlook is widespread,” Deffeyes says. “It must be something that Gerber puts in baby food.” He doesn't believe that price will do the job. Instead, he has another theory, which he supports with two examples from history:

- ▶ “Historically, President Nixon regulated the oil price.”
- ▶ “President Roosevelt had us carrying little red and blue gasoline ration coupons.”

Deffeyes is right that, if the government intervenes, it can break the market and then demand will fail to equal supply. According to Deffeyes, this is why, after 250 years, the market for oil will break down when oil production peaks. This will cause peak-oil's economic collapse.

Deffeyes argues that the government will intervene because “when the situation gets serious, there will be immense political pressure to ‘do something.’” But Deffeyes overlooks what happened after Richard Nixon regulated the price of oil. By the end of the OPEC crisis, virtually the entire elaborate system of oil price controls, gasoline price controls, and quantity rationing had been eliminated. This took immense political wrangling, but eventually there was widespread agreement. The country learned something back then, and I don't think it's about to forget it and cause the collapse of the American economy—or the world economy.

### What If the Price of Oil Went to \$200?

The market will keep demand equal to supply, as it always has—except under price controls. But if supply falls, the price of oil will increase to reduce demand. The whole question of peak oil boils down to one not-so-easy question: How high will prices go?

In August 2005, Matthew R. Simmons, chairman of an energy investment banking firm in Houston and author of a book about peak oil, bet \$5,000 that oil would average \$200 a barrel in 2010. A recent book on peak oil is entitled *The Coming Economic Collapse: How You Can Thrive When Oil Costs \$200 a Barrel*. What would happen if this prediction is right?

In 1979, the price went to \$90 (in 2007 dollars), but back then the world was using almost twice as much oil per dollar of income, so a \$90 price then was almost as hard to take as a \$200 price now. At \$200 per barrel today, the United States would spend 11 percent of GDP on energy, instead of 10 percent as in 1980. But gasoline would still cost less in the United States than it does now in some European countries. If the oil price suddenly shot up to \$200, it would cause a world recession, as it did before. But as before, economic growth would soon resume.

than expected, supply stayed flat through 2007. This fits with Deffeyes's flat peak. But in early 2008, oil supply is on the rise again.

Peak-oil geologists suggest that although the oil industry officially predicts the peak is years away, industry insiders actually know better. In fact, there is one good reason the industry might not want to admit the peak is near. The oil industry remembers what happened to it when the price collapsed in early 1986. The entire oil industry fell on hard times. Exxon's profits fell almost to zero. The world had partially kicked the oil habit. That's the last thing a pusher wants to see. And if the addicts knew oil production was about to peak and then decline forever, they might decide to look for a rehabilitation program sooner rather than later.

But perhaps the oil industry has a different angle. What if the industry could find a new but expensive supply of oil? Take, for example, the oil shale that Presidents Ford and Carter wanted to turn into synfuels. Converting coal to oil is another possibility. The United States leads the world in both these resources. "We could be the New Middle East." Does that sound far-fetched? The words belong to Theodore K. Barna, assistant deputy undersecretary of defense.

### Liquid Coal: The Dark Side of Peak Oil

Peak-oil proponents deny that more oil will be forthcoming at higher prices. But one surefire path leads to more gasoline. Chemists discovered the dirtiest antidote for peak oil eighty years ago: the Fischer-Tropsch process, which turns coal into gasoline.



This is not a theory. This is what powered the German Luftwaffe during World War II, as well as much of South Africa when the United Nations adopted an oil embargo against that country in 1987. In 1938, Germany consumed 44 million barrels of “oil,” of which 10 million was synfuels from coal. By 1943, the country’s synfuels output had reached 36 million barrels per year. Think of it as Germany’s response to peak oil—the country’s own personal peak and decline, which the Allies caused by cutting off Germany’s oil imports.

Of course, chemists and engineers have refined the process over the years. Today, Montana, whose governor has been pushing liquid coal in recent years, could produce gasoline for the equivalent of about \$55 per barrel of oil. This has not yet happened because investors are afraid the price of oil will fall back below \$55 as soon as they build a coal-to-gasoline plant. In addition, they might have to pay a global warming charge.

The last time oil was this expensive, the price did drop back to \$20 a barrel for more than a decade, so the investors’ fears are warranted. But if we truly start running out of oil, the price will never again drop below \$55, at least not for long. Then investors will build synfuel plants, just as the Germans did seventy years ago.

Making gasoline is possible, but is there enough coal? Deffeyes assures us that “the world has at least a 300-year supply of coal.” To his credit, Deffeyes admits that coal will come in as oil runs out. “I hate to say it,” he writes, “but we likely will be forced to choose either increased pollution from coal or doing without a significant portion of our present-day energy supply.” There can be no doubt that between these two, people would choose “increased pollution from coal.” That is why scaring people about running out of oil could be disastrous for climate change.

## **The Air Force Wants Liquid Coal**

On October 22, 2007, an Air Force C-17 Globemaster III took off—not usually a newsworthy event. But the Globemaster is the biggest user of jet fuel in the military, and it was using a 50 percent blend of Fischer-Tropsch fuel.

The flight was a test of whether liquid coal might work for the U.S. Air Force as it worked for Germany’s air force. It did. The test flight was part of the Assured Fuels Initiative, which the Department of Defense set in motion in 2001. One of the initiative’s objectives is for the Air Force to get half its fuel from domestic sources by 2016. It would take 110,000 barrels per day of domestic fuel to reach this target level. Since the United States currently pumps about seventy times this much domestic oil per day, it would be easy to accomplish this goal without a synfuels program. So what is the real reason for this initiative?

The initiative appears to provide one legitimate benefit: Synthetic fuel should work better across a wider variety of vehicles than standard gasoline,

### **Predictions, Predictions**

In 2003, geologist Deffeyes said, “World oil production may have peaked in the year 2000.” Campbell had been naming that as the peak year for quite some time. In 2004, Deffeyes switched his prediction to 2005, and later that year, so did Campbell. Campbell has taken all his old predictions off his Web site, but Deffeyes has not.

diesel, or jet fuel. But this is unlikely to be an argument that wins support for major new subsidies to Big Oil. Of course, the military might also have in mind reducing the need to defend Middle East oil supplies, but replacing less than 2 percent of imports does not amount to much.

This leaves the fear of a peak-oil crisis as the major lever for gaining public support. And indeed, proponents of this initiative have not hesitated to play that card. “World petroleum supply trends indicate that the days of inexpensive oil may be over,” says a report of the Task Force on Strategic Unconventional Fuels. The Energy Policy Act of 2005 mandated the formation of this task force, and the secretaries of Energy, Defense, and the Interior implemented it. The report continues, “Peaking global production ... is already causing competition for supplies.” An accompanying graph echoes those in the peak-oil literature and seems to show “world remaining oil reserves” shrinking to zero in about 2030.

The U.S. synfuels industry, which is just another name for the oil industry—Exxon, Shell, and the like, wants to regain its old subsidies and more. A military rationale, combined with a peak-oil scare, could be just the ticket. The oil companies are beginning to see peak oil as less of a threat and more of an opportunity. If the public is frightened into conserving, it’s a disaster for Big Oil. If the public is frightened into subsidizing synfuels again, it could be a bonanza for the oil companies. Although most peak-oil proponents favor sustainable approaches in theory, they tend to dismiss conservation and alternative fuels as too little too late. All that remains is coal, shale oil, tar sands, and the fear of gasoline shortages. Big Oil owes the peak-oil proponents a great big thank-you, not for predicting the peak, but for helping frighten the public into subsidizing a move into synfuels and unconventional oil.

### **Peak Oil and the Southern States Energy Board**

The Southern States Energy Board (SSEB), originally the Southern Interstate Nuclear Board, is an interstate compact that Congress approved in 1962. Sixteen states and two territories have also approved it. A July 2006 SSEB report recommends a list of subsidies for Big Oil, similar to those recommended by the federal Task Force on Strategic Unconventional Fuels. Here’s how the SSEB justifies the subsidies: “America now faces a crisis of historic proportion: a liquid transportation fuels crisis. This Study shows that immediate implementation of ‘crash’ programs to ramp up production of domestic alternative liquid transportation fuels is the only way to insure against peak oil.”



Sooner or later, the production of cheap conventional oil will peak. What should we do? We must not let predictions of doom either paralyze us or prompt us to

take rash action. Rather, we should simply do what we should be doing anyway: taking measures to prevent climate change and end oil addiction. That will be sufficient. Conservation will work the most quickly and robustly in the short run, but we will need new technology for the long run. I sketch out a clear plan of action, aimed at both conservation and new technology, in Chapter 7.

If we fail to take such action, the market will do the job for us. But it will cost us far more. The world may see an extra recession or two, OPEC and the oil companies will make a killing, and the world will burn far too much fossil fuel while converting coal, tar sands, and shale oil into gasoline. Climate change will accelerate.

Should we choose to subsidize Big Oil, this will worsen our addiction at taxpayer expense, just as it always has. Our oil companies will make a slightly larger killing, and OPEC will make a bit less. Climate change will be even worse than if we let the market work alone, and the world price of oil will be just a bit lower due to the extra supply. The Chinese, who are very short of oil, will thank us.