FOSSIL FUELS VS. RENEWABLES:
THE KEY ARGUMENT THAT ENVIRONMENTALISTS ARE MISSING

By Kurt Cobb

Which of the following can we count on to act as a "bridge fuel" to a renewable energy economy?

A. Oil
B. Natural Gas
C. Coal
D. None of the above

The correct answer is: D. None of the above.

Mark Twain is reported to have said: "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." What most environmentalists think they know for sure is that oil, coal and natural gas are all abundant—so abundant, in fact, that many environmentalists believe they are forced to make a Hobson's choice of natural gas as a so-called "bridge fuel" to a renewable energy future.

Though natural gas produces fewer greenhouse gas emissions per unit of energy than coal or oil when it is burned, it still contributes mightily to climate change. In fact, according to research by a Cornell University team, natural gas from shale, which will make up an increasing share of U.S. gas supplies, is worse than conventionally produced gas which is now declining. Because shale gas wells are drilled in a way that releases considerable volumes of unburned methane into the atmosphere, shale gas is probably also worse than coal.

Methane is about 25 times more potent than carbon dioxide as a greenhouse gas, and it leaks into the environment over the lifecycle of natural gas from drilling through delivery. In addition, hydraulic fracturing or fracking in the country's vast shale formations pollutes the air and surface waters surrounding drill sites and threatens the groundwater because the process uses toxic chemicals.

It turns out, however, that what most environmentalists know about the future supply of natural gas and other fossil fuels is based more on industry hype than on actual data. And, that means that they are missing a key argument in their discussions about renewable energy, one that could be used to persuade those less concerned about pollution and climate change and more concerned about energy security: **There is increasing evidence that no fossil fuel will continue to see its rate of production climb significantly in the decades ahead and so none of them is a viable "bridge fuel," not natural gas, not oil, not coal.** This means that global society must leap over fossil fuels and move directly to renewables as quickly as possible. In advanced economies this leap must be combined with a program of radical reductions in energy use, reductions which are achievable using known technologies and practices.

Okay, perhaps you are wondering about the data. Let's discuss each fossil fuel separately:

Oil

The first thing you should know about oil is that worldwide production has been on a plateau since 2005. This is despite record high prices and furious exploration and drilling efforts. There have been

From *Sierra Atlantic*, Winter 2011, a publication of the Atlantic Chapter of the Sierra Club serving New York state. Permission is hereby granted to reprint this piece with attribution.

well-publicized finds here and there that may seem large. However, at the current worldwide rate of consumption, one billion barrels of oil lasts only 12 days. Thus, the multi-billion barrel finds announced in the last decade or so will have little impact on the longevity of world supplies.

Another key issue is one that oil companies do not want to emphasize: depletion. The worldwide average for production declines in existing oilfields has been estimated to be about 4 percent per year. That means that *each year* just to stay even, the industry must develop new oil production capacity equivalent to the current capacity of the North Sea, one of the world's largest fields. To grow production, it must, of course, exceed this amount, and that hasn't been happening.

When you mention these hard facts in polite company, you will undoubtedly be met with skepticism. But the data are available to the public from the U.S. Energy Information Administration (EIA) website. The agency is the statistical arm of the U.S. Department of Energy and is widely considered the gold standard of energy information in the world.

Now, don't be deceived by shifting definitions of oil. When the petroleum glut long predicted by the optimists failed to appear, they started lumping in ethanol, biodiesel and natural gas liquids with petroleum and calling them all "oil." These other products are useful, but they are not as energy-rich, versatile or easily transported as oil. Our current infrastructure is heavily dependent on oil inputs with no real substitutes available in the quantities required.

You will also likely be met with protestations that we still have lots of oil: tar sands in Canada, heavy oil in Venezuela and even oil shale in the American West, primarily Colorado. Well, this represents the difficult-to-get oil. We extracted the easy stuff in the first 150 years of the oil age. And, while it is true that these resources and others like them represent an immense store of hydrocarbons, what matters is the rate at which we can produce them.

Because of the high-cost, capital-intensive nature of such production, the rate of production will be slow to ramp up and difficult to maintain. The hydrocarbons locked in the tar sands and the Orinoco oil belt in Venezuela aren't what we call oil and must be heavily processed at high cost using enormous amounts of energy. As for the oil shale in the America West, the amount of commercially produced oil we are currently getting from that oil shale is zero. No one has figured out how to extract it profitably. Partly this is because oil shale contains no oil. Instead, it contains a hydrocarbon-rich waxy substance called kerogen which must be heavily processed to turn it into oil.

An analogy might be useful: If you inherit a million dollars with the stipulation that you can only take out $500 a month, you may be a millionaire, but you will never live like one. Increasingly, this is the situation we will find ourselves in when it comes to oil. The key issue is the rate of production, not the size of the resource. The hard-to-get oil resources are large, but they take a long time to develop and require strenuous, expensive and energy-intensive methods to extract. All this, when combined with the relentless depletion of existing fields, spells little or no growth in the worldwide rate of oil production in the coming years.

Natural Gas

By now you've been told so many times in television ads and news articles that we have a 100-year supply of natural gas in the United States that you assume it must be true. While the claim itself is suspect, even if we accept it, there is a very serious omission. The claim in its entirety reads: a 100-year supply of natural gas *at current rates of consumption.* If natural gas is to be used as a so-called "bridge fuel"—a fuel that will power society with the least environmental cost while we deploy nonpolluting, renewable energy—then its rate of production will have to grow considerably if we expect it to displace coal and oil.

Simple spreadsheet calculations will tell you what happens to such long-term supply claims under the pressure of a little exponential growth. At just 2 percent per year growth, the 100-year U.S. domestic natural gas supply is exhausted in 56 years. If we assume that production peaks when about 50 percent of the resource is exhausted, this puts the peak within 35 years. Think about it. Even if the optimists are correct, with a production growth rate of just 2 percent per year, the country reaches a peak within 35 years! What will we do after that?

The picture gets acutely worse as the rate of production growth rises. A 3 percent growth rate implies exhaustion in 47 years and peak in 31 years. A 5 percent growth rates means exhaustion in 37 years and a peak in just 26 years.

As it turns out, the EIA projects a growth rate of just 0.4 percent per year in U.S. natural gas supplies through 2035 with production jumping from about 24 trillion cubic feet (tcf) in 2010 to about 26.5 tcf in 2035, hardly a bonanza.

Beyond this consider that the vast resources of natural gas from deep shale layers, commonly called shale gas, may not be so vast. A U.S. Geological Survey assessment pared the EIA's original estimate of "technically recoverable" natural gas in the largest of the shale deposits, the Marcellus Shale, from 410 tcf to just 84 tcf, an 80 percent reduction. And, this says nothing about whether the gas will be economically recoverable.

The 100-year figure was based on inflated estimates of recoverable natural gas and on ignoring the fact that the rate of natural gas consumption would have to rise exponentially to displace other fossil fuels. These two facts suggest that natural gas will not be the bridge fuel environmentalists are looking for.

Coal

Among the environmental community, the big fear is that coal will displace clean natural gas and even become a source for liquid fuels as oil supplies wane. That fear is founded on industry claims of vast coal supplies in the United States and elsewhere. But four studies suggest that coal may not be nearly as abundant as once believed.

A 2007 National Academy of Sciences report concluded that claims of 250 years of coal reserves in the United States at current rates of consumption could not be supported. The number was more likely to be 100 years. However, it said that a comprehensive survey was necessary to determine a more accurate figure.

But if coal consumption were to grow beyond the current rate, then the 100 years of supply would quickly shrink as in the case of natural gas. And, data from EIA shows that the total heat content of coal mined in the United States has been declining since 1998 despite roughly level production. This means that coal grades are dropping and that the actual energy the United States gets from domestic coal peaked in that year.

A second study by David Rutledge at the California Institute of Technology concluded that worldwide reserves are probably half of those currently stated. Rutledge noted that unlike oil reserves, coal reserve estimates have been steadily dropping over time as unwarranted assumptions were stripped away and the focus was put on what is actually minable.

A third study in 2007 by an independent group of analysts in Germany, the Energy Watch Group, suggests a worldwide peak in the rate of coal production as early as 2025. The authors noted that poor quality data hampered their efforts. One of the troubling gaps was China, a country thought to have some of the largest coal resources in the world. Chinese coal data, however, have not been updated since 1992, and 20 percent of China's reserves have supposedly been mined since that date.

A fourth study published in the international journal *Energy* last year came to the shocking

conclusion that the rate of worldwide coal production from existing fields would peak in 2011. The authors did acknowledge that vast coal fields in Alaska and Siberia remained to be developed, but doubted that these difficult-to-extract and therefore expensive reserves would be developed in time to forestall a decline. They also wrote that production from existing mines is expected to fall by 50 percent over the next 40 years.

The researchers explained that this has serious policy implications. One such implication was that money currently being spent on carbon capture and sequestration technology—a technology that assumes vast additional supplies of coal—would be better spent on outfitting existing coal-fired power stations with supercritical steam turbines, lifting efficiency from 35 percent to 50 percent. This would reduce the rate of greenhouse gas emissions while stretching out the available coal supplies so as to aid an energy transition.

Conclusions

No one knows the future. But making public policy based on industry hype could turn out to be disastrous. Keep in mind that it is the job of fossil fuel industry executives to make sure they can sell their in-ground inventories. And, of course, it's not their job to make good public policy. Our current energy policy, which I refer to as the Good-To-The-Last-Drop Policy, has already meant a huge windfall for oil producers and to a certain extent coal producers. And yet, both regale us with tales of plenty even as constrained supplies send prices skyward.

It is certainly possible that yet-to-be-invented technologies will extend the life of fossil fuel supplies. The question is whether such technologies can be deployed before overall rates of production for oil, natural gas and coal begin to decline. Modern industrial society depends for its proper functioning on the continuous input of high-grade energy resources. If those inputs start to decline or even fail to grow, the system will falter. Some believe we are already seeing the effects of constrained oil supplies on the economy as record high prices suppress economic activity and pressure an already fragile financial system.

It seems doubtful at this time that future technologies for exploiting fossil fuels will be able to do much beyond softening the inevitable declines. And, given the known trends and data, it seems foolish to wait for these yet-to-be-invented technologies to appear. That means that leapfrogging now past fossil fuels to renewable energy is not just desirable but probably inescapable. The only question is whether we as a society will do it with a focused plan for a rapid transition or whether the transition will be chaotic and marked by violent swings in the economy as the world lurches from one energy-induced crisis to another.

Kurt Cobb *is a columnist for the Paris-based science news site* ***Scitizen*** *and author of the peak-oil-themed thriller* ***Prelude****. His work has also been featured on Energy Bulletin, The Oil Drum, 321energy, Common Dreams, Le Monde Diplomatique, EV World, and many other sites. He maintains a blog called* ***Resource Insights****.*

Sierra Atlantic *is a publication of the Atlantic chapter of the Sierra Club serving New York state.*