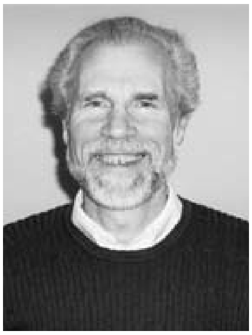

Oil: How Much is Left?

William Zebuhr

It may seem strange that a magazine advocating new energy would discuss oil issues, but the question of how much oil remains is very germane to the new energy business. There is a great deal of controversy about the urgency of discovering alternatives for oil, at least as an energy source. Having a realistic idea of how much time is available helps to properly go about the process of discovery and development. An atmosphere of panic, for example, is not conducive to pursuing years of research and discovery before engineering a production version of a new energy machine. Instead, it leads to pursuing whatever might work, even if in the long run it is a poor choice that leads only to another set of problems. A rush to pursue, for example, nuclear power, wind power, and solar power in a big way in anticipation of running out of oil in a few years might saddle us with huge environmental and maybe aesthetic issues and divert huge amounts of man-hours, capital, and material from pursuing much better alternatives. Serious new energy researchers seem to be on the threshold of discovering ways of extracting energy either from the "vacuum" or from low-energy nuclear reactions. Production of useful machines might take a few more decades, but the result would be so much better that it would be the wiser path even though we might be dependent on oil a little longer.

Oil has fueled the greatest growth of civilization in known history, both in technology and population. The problem is that we have gotten hooked on it and are absolutely dependent on it for survival as we know it. For decades it has seemed like an almost perfect "miracle" fuel for this growth. It is abundant, easy to get, easy to transport, easy to use, has high energy content, and can be used to make an endless variety of products—so it is low in cost and used with abandon all over the world. In the last few decades, however, its dark side has become apparent. It has ravaged the environment, including land, water, and air. Many of the products made from oil wind up filling landfills and littering endless miles of roads and waterways. Its excessive use is impacting the climate, although how and how much is hotly debated. *Today we can't live without oil, but the question now is how long do we have to live with it?*

This question is of great interest to all mankind, but is especially interesting to the very few that actually might be able to do something about it. These few are likely to be among the readers of *IE*, because the best way to kick the oil habit is to find something that renders it obsolete as a source of energy.

It is very important at this stage of our development to have a fairly good idea of how much oil remains—because of our extreme dependence and the extreme consequences of running out before alternatives are available at a cost that can be borne by a major part of the population. Many doomsday scenarios have been proposed about the consequences of suddenly running out of oil. The most extreme say that most of the people on Earth will die and it will happen in this century. One of these is Matt Savinar, a young lawyer who has written a book about peak oil. The first line of the introductory letter on the homepage of his website (www.lifeaftertheoilcrash.net) says: "Civilization as we know it is coming to an end soon." The premise of his book, *The Oil Age is Over: What to Expect as the World Runs Out of Cheap Oil, 2005-2050*, is based on this statement made in the beginning: "The Earth is endowed with about 2,000 billion barrels of oil. We have used about 1,000 barrels. As of 2003, we consume 28 billion barrels per year. 1,000 billion barrels divided by 28 billion barrels per year = 35.7 years of oil left. If one accounts for increased demand resulting from population growth and economic demand, that estimate is slashed to a paltry 25 years. . .The problem, however, is not 'running out of oil' as much as it is *running out of cheap oil*, which is the resource upon which every aspect of industrial civilization is built."

When I was about Savinar's age in 1974, I co-founded an energy conservation company and some of our planning was based on oil going to $100 per barrel and the predictions that oil would run out in 30 years. The company was successful but never grew to the size we envisioned because oil got cheap again and, of course, 31 years later is not only in much greater use but is still cheap. I didn't really believe we would be out of oil in 30 years back then and I certainly don't believe it now. Things are just not that simple.

Oil consumption can be reduced by conservation or by using other sources of energy. Conservation cannot do the whole job and it takes time to implement on a scale that can make a major impact. The time is reasonably predictable because most of the technology is known and just has to be implemented. The very much unknown part of the transition process is how long it will take to invent and develop viable energy alternatives. Invention is virtually unpredictable and development of new technology is at best twice as long and twice as expensive as the estimates, often much more. There are many technologies discussed in the new energy field that might take over for oil and many inventors and discoverers have made wild business plans, at least in their heads, that make them billionaires. Some of these ideas will eventually be developed, but all indications are that it will take quite a few years. It is very important to keep things in the proper perspective. Of course, any developer wants to go as fast as possible, but real life issues such as cost, ease of use, safety, and environmental impact must be considered. It is a good idea to keep the supply and cost of the conventional sources in mind while planning for the new paradigm.

The concept of peak oil is backed up by a lot of data, as pointed out by Michael Ruppert in his article (p. 15). The Association for the Study of Peak Oil and Gas has a mission to evaluate the reserves of oil and gas, study the depletion, and raise awareness of the serious consequences. They have studied the data from many countries and their evidence shows a world production peak at about 2005. This peak is called Hubbert's peak, after Dr. Marion Hubbert, who successfully predicted that U.S. oil production would peak in 1970. This data is confined to conventional oil and gas found and extracted in conventional ways. However, this oil may represent a small fraction of the true world reserves of hydrocarbons, so even though this is a very important point it is just one of many that must be considered to fully assess the world's energy situation in the long run.

The doomsdayers greatly underestimate how much oil is now wasted on trivial or even destructive uses and how much is simply wasted because energy is so cheap. A lot of oil is burned heating houses and running cars. Properly designed cities are much more efficient than suburban or rural living. Heating and transportation costs can be cut by roughly 80% or so without reduction in comfort or luxury. A lot of natural gas is used to make fertilizer that is either not needed or downright destructive. Farmers use natural gas to fertilize fields and then struggle to dispose of thousands of tons of natural fertilizer created every day in feed lots. There is something drastically wrong with this picture and there are plenty of other poor uses of energy that will be changed when oil and gas gets expensive.

A lot of this waste is a consequence of incredibly poor energy policy in this country and in most of the rest of the world. Consumption is encouraged by keeping prices artificially low. This is done by subsidizing oil companies via tax breaks and low cost access to land and by great military expenditures on behalf of oil that are paid for by taxpayers and not the oil companies. Politicians buy votes with cheap oil. So the problem really comes down to the price of oil and how a large price increase will effect the world.

In the developed world we have a distorted view of the importance of oil. The richest one billion people use far more oil than the remaining five billion. A farmer in India uses natural fertilizer and travels by foot or animal of mass transit. He is little affected by the price of oil. The people most affected are the richest and most of them can handle a drastic price increase without disaster. At $2 per gallon and 20 miles per gallon fuel cost, that equates to 10 cents per mile. If gas cost $10 per gallon, the cost is 50 cents per mile. That is high if a lot of miles are driven, but it is well within today's technology to get 50 miles per gallon, which brings the cost per mile back down to 20 cents per mile. The cost of a bottle of water is about $1. Of that, the bottle—which is made from oil—is about 4 cents. If the bottle goes to 20 cents, most people won't notice and those that do have plenty of alternatives. One area of concern is space heating. Even a modest house can cost over $1,000 per year to heat. If that went to $5,000 it could be a serious burden to many. Given that a five times increase would probably take years to happen, improvements could be made to the insulation, windows, heating system, etc. to reduce energy consumption. It is often possible to reduce energy consumption by a factor of two or better, which would result in a $2,500 per year bill. That could still be a problem for some, but it is not so serious as to be endangering. Toys and other consumer goods will get more expensive, but the economy won't collapse and people won't die because of it. Ten dollars per gallon gas sounds very high but it is only about twice what Europeans pay now. Americans only spend about 6% of their income on food. This indicates a lot of elasticity in the way income is spent. We can handle a five times price increase in fuel without disaster. But that increase would do amazing things to promote all the actions necessary to greatly cut consumption and find more oil if it exists.

There is great controversy over the question of how much oil remains and the cost of getting it. That would seem odd if the subject was restricted to science and engineering, but the issue is also tangled up in an unsavory web of governments, politics, and competing commercial interests, resulting in wars, corruption, waste, and great economic distortion. In an enlightened market economy, the price of oil would be a good indicator of how much of it was left in comparison to demand. As supply ran low the price would climb, alternatives would be found, and a smooth transition would be made. We don't have an enlightened economy in oil or any other natural resource, not only for the above unsavory factors but because we do not properly account for the depletion of resources. Changes in gross domestic product do not show reductions in a country's net worth as its resources are used up. We also do not account for destructive side effects of extraction or use of resources. The cost of wars that have been fought to directly or indirectly protect the supply of oil is also not included. Proper accounting would result in a much higher oil price now and a much more active search would already be on to find alternatives.

The technology has also grown immensely more complex since the first oil was essentially pumped from a simple hole in the ground and used much as it was found. We discuss some of the technical issues involved in this issue (John Rudesill, p. 18) and how they impact oil production even if supply is not the issue. It also seems that the old idea of "the more you know, the more you know you don't know" is in force. We have "known" for over a hundred years that oil is a fossil fuel resulting from just the right sequence of biological and geological events over a span of millions of years. That is now being questioned. There is compelling evidence that oil is not really a fossil fuel and there could be a lot more of it than we now assume. This theory is discussed in David Zebuhr's article (p. 11) and it adds a big new factor to the question of how much oil there really is. This oil is quite deep—wells over 30,000 feet deep have been drilled to get it. This makes it a lot more expensive but at least it is there to ease the transition to alternatives.

There are other alternative sources for the fuels we get from oil (and gas). Billions of barrels of oil can be extracted from tar sands in Alberta, Canada and other areas. The process is very disruptive to the environment and expensive and I suspect it would be much more expensive if the true environmental costs were included and proper accounting was done. Millions of barrels of oil have now been extracted from these sands and the process is being refined, but it will remain disruptive and relatively expensive. Shale is another source of oil that has similar problems, but the oil can be extracted in great quantities if really needed (see Les Case's essay, p. 26). Another hydrocarbon source is hydrated methane that seems to lie in great abundance on much of the ocean floor.

Hydrates are compounds in which a molecule of a chemical gets trapped within molecules of water without chemically bonding. Methane hydrates are ice-like compounds of methane and water. They are formed at temperatures of less than 7°C and at pressures greater than 50 atmospheres and occur in deep ocean sediments and permafrost. They are believed to exist along the continental shelves in many areas around the world. According to the United States Geological Survey, two small areas off the coasts of North and South Carolina contain the equivalent of 70 times the annual amount of natural gas used in the U.S. The energy available from this source probably far exceeds that available from the proven reserves of oil and gas.

In the 1930s it was discovered that natural gas pipelines in cold environments were getting plugged by gas hydrates. This stimulated a low level of research that greatly accelerated in the 1960s when the hydrates were discovered in gas fields in Siberia. Exploration began around the world, leading to an international research and development effort to discover the production potential for the hydrates. Japan and India began major projects to explore the production potential in the mid-1990s. The U.S. followed in the late 1990s by drilling experimental wells in northern Canada. This activity resulted in the signing of the Methane Hydrate Research and Development Act of 2000 to set the structure, goals, and timing for a DOE-led R&D program. This is a development that is still in its early stages but is rapidly gathering momentum.

It will take a long and intense effort to safely extract commercial quantities of gas, but when it makes economic sense it will happen. Many people downplay the importance of hydrates because of the great difficulties involved, but many of our current technologies have been developed at great expense, often involving billions of dollars, many years, and sometimes many lives.

Another source of natural gas is coal beds. There is enough coal to keep the world supplied with energy for hundreds of years, but it is difficult to extract, handle, and use in ways that are friendly to the environment. In some coal fields a lot of methane is released in the process of mining the coal. It is now realized that this is a significant source of gas and that its capture and use is important not only to be able to use the gas but to prevent its release into the atmosphere, where it is a powerful greenhouse gas.

In some areas natural gas is abundant but oil is not. Gas is difficult to transport, except by pipeline. If a suitable market is not in range of a pipeline, the gas cannot be used except by first turning it into a liquid. The most common method is to liquefy it by refrigeration and transport it by well-insulated ships and trucks. Then it is re-gasified and transported to its final destination by pipeline. This whole process is not only expensive but potentially very dangerous. A fire in any of these steps can be serious enough to threaten an entire city. Another way of creating a liquid from the gas is to turn it into oil. It is then much safer to transport and can be used for vehicles, especially in diesels. There is a huge plant being built in Qatar in the Persian Gulf to turn natural gas into an ultraclean diesel fuel. Exxon Mobil, Royal Dutch/Shell, ChevronTexaco, and others have committed $20 billion to build this plant in an industrial park twice the size of Manhattan. This is a risky investment that will only pay if costs are well-contained and the price of oil stays high. A project of this magnitude is an indication that money and technology can extend the supply of oil.

Ethanol is a very good fuel to use as a substitute for oil, but at this point it is made mostly from corn. Not only does that make it expensive, but in times of crisis it does not seem to make good sense to work on converting a good food source into fuel. There is now an effort underway to extract ethanol from agricultural waste. It has the potential of significantly reducing the dependency of the U.S. on foreign fuel and reducing greenhouse emissions at the same time. The greenhouse emissions are reduced because if the waste is left to decay in the fields it releases CO_2 and the methanol when burned releases less greenhouse gas than gasoline. Also if biomass crops are grown for fuel, CO_2 is absorbed from the atmosphere. At this point it is far from proven that this makes economic sense, but millions of dollars are being spent on it.

Other sources of fuel include animal waste from food processing, solid waste that otherwise would go to a landfill, wood scraps, and gas from digestion of sewage. Incineration not only produces considerable energy but keeps waste out of landfills. It is amazing to me that they are so strongly resisted in most areas. Part of this resistance is fear, mostly unjustified, of air pollution and the other issue seems to be capital cost. Municipalities have little incentive to take the long view. This would change when fuel prices increase.

The world is heading into an era of very significant change, but it does not have to be a crisis. There are many ways to both cut fuel consumption and introduce new supplies, and we have the time to do it. There have been endless predictions of the end of the world and major crises. In the late 1800s it was thought that Manhattan had reached the limits of its growth because of the problems caused by huge quantities of horse manure. Boston, New York, London, Paris, and other cities almost choked on sewage for years before building pipelines and treatment plants. The construction of these plants was expensive and at the time considered risky, but it was done. Thousands of lives were saved and improved and these cities grew way beyond what was conceivable at the time. Many billions of dollars are available and thousands of people are ready, willing, and able to find solutions to our fuel problems. These solutions will be extensions of what we now know and understand, but they will be sufficient to get us to the next era of energy, which is in its early stages of exploration. This next era is at this point being pursued by a few pioneers who are knowledgeable about the current paradigms but skeptical enough and with enough imagination and ambition to make the first bold steps. Margaret Mead once said, "Never doubt that a small group of thoughtful, committed people can change the world. Indeed it is the only thing that ever has." I have no doubt that solutions will be found.

There are plenty of smart, hard-working people out there who will lead the way. As usual, the masses, and finally governments, will follow and life will go on. It may be a very different life, however, depending on the innovators who will lead the way. There may be a great need for conservation and a Spartan lifestyle at least for awhile. This is not necessarily a bad thing. There is a lot more to life than wanton consumptionism. The period of scarcity would be followed by a period of abundance based on other energy sources probably combined with a healthy sense of conservation. Even if energy is "free" and "clean," the use of it has consequences.

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Recent Grants Awarded: The New Energy Foundation is pleased to announce the following recent grant award: The e-newsletter *New Energy Times* has been awarded a grant in the amount of $2,500 to aide in future publication of this valuable resource to cold fusion/LENR researchers and advocates. The newsletter is produced and edited by Steve Krivit; request a free e-subscription online at www.newenergytimes.com. The newsletter, which began publication in May 2004, is emailed to nearly 1,000 subscribers approximately every two months. Krivit has done a tremendous job in information gathering and sharing, and the New Energy Foundation is hopeful that this grant will enable him to continue to move onward with publication of *New Energy Times*.

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William Zebuhr, Chairman
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