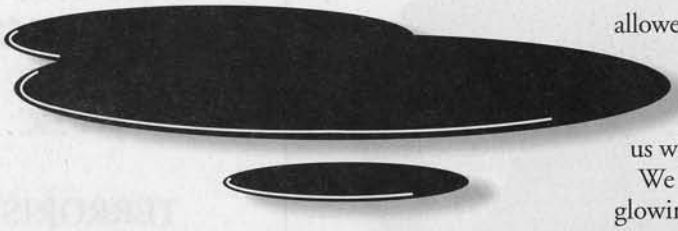
THE BIG CRUNCH

THE COMING END OF THE AGE OF OIL

BY WADE H. THOMSON



The author, has worked in and around the oil fields of California — The editors.

All the scientists, politicians, writers, business analysts who have been recently asked to reflect on what will happen in the next century are optimistic about the future and speculate that many great things will happen in the areas of space, medicine, and technology. Not one, it seems, anticipates that there is the remotest possibility that our great technological world society is facing a potential collapse because of a critical, dwindling natural resource. That resource is oil.

It is not just the fact that we are running out of oil that is the danger, but it is that we are ignoring the fact that we are running out of oil. We cannot solve a problem without first realizing that one exists. The word "problem" hardly defines what the consequences of using up our oil will mean.

It is uncertain when the beginning of the end will happen, an end that could be brought about by a second Great Depression, from which there will be no reprieve once it begins. This lack of reprieve is what is so dangerous to us. There will be no reprieve because oil is what has made our society great. It is the foundation on which our technological society is built. Remove that foundation and there is nothing else currently available that is able to energize our society.

Our dependency on oil developed quickly. From the first automobiles came trucks and then farm machinery, which allowed us to farm huge tracts of land and transport the produce all over the world. It has allowed us to fight wars on a global scale and ultimately to escape the gravity of earth and begin to explore the cosmos. Oil supplies us with the building blocks to make thousands of products.

We laud ourselves for our achievements and describe in glowing terms the future before us but in reality it is a tenuous position, which could come crashing down around our ears. It is unlikely to happen today, or tomorrow, but will happen someday soon.

To say we will be running out of oil and will suffer a depression during a time when we are experiencing one of the greatest economic booms in recent history seems fool hardy. But there are trends and statistics that indicate our economic boom, and our way of life, will not last.

Oil depletion is not a "might be" statistical possibility. It is an event that will happen. The big question is not "if" it will happen, but "when" it will happen. Some deny the possibility entirely by pushing its eventuality far into the future beyond our immediate concern. However, putting off the problem is irresponsible because of the 30- to 50- year lag time that is required to do research and implement an oil substitute.

The arbitrary raising of the price of oil causes several things to happen. It causes inflation and the higher prices cause people to buy less gasoline. This causes problems for the producers because inflation ends up increasing operation costs by raising the prices of equipment and salaries and the slower sales mean less revenue and profits. They end up worse off than before.

Oil depletion and its consequences is a difficult subject to sell, for in the past there have been "Chicken Littles" and cry "Wolf" warnings that have not come true, but in time things do fall from the sky and sheep get eaten by wolves.

The Y2K Bug is a good example of how our technology can go astray and how we can avoid dealing with an obvious problem through complacency and inaction, though in the case of the Y2K, or millennium computer bug, there were enough

resources and time to deal with the problem. We look for and prepare against catastrophes from natural forces and the cosmos but fail to see the ones that lurk under our very noses.

The world's oil supply is not as substantive as everyone believes and it is not a secure resource we can always depend on.

Economics Of Oil — When I refer to oil I mean not only crude oil but also all those things that are made from it, such as gasoline, kerosene, diesel oil, lubricants, solvents, medicines, fertilizers, perfumes, explosives, and thousands of other products we will find it impossible to live without.

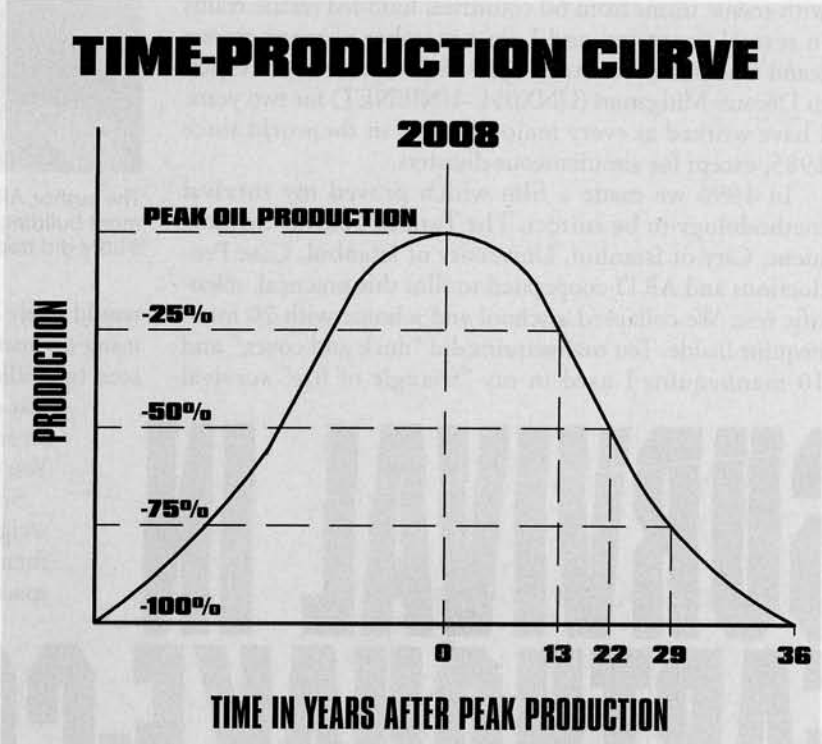
There are subtleties about oil that most of us are not aware of. Crude oil is not just a black liquid that comes out of the ground that we use to make gasoline out of. It comes in many forms, from a bituminous, thick, almost solid substance, to very light grades that need little refining. The thick heavy grades of oil are hard to pump out of the ground and require heavy refining to get them to a useable state. This heavy processing requires large complex refineries costing billions of dollars to design and build. To make more profit the oil producers will pump out the lighter grade oils first, if available, leaving the heavier grades for later. In time they end up with heavy grades of oil, higher costs, and lower production rates. To compensate for the higher production costs the real price of oil rises. The economics of oil plays an important part in the availability of oil. Oil companies produce oil to make money, not to supply the world with oil in an altruistic sense.

The arbitrary raising of the price of oil causes several things to happen. It causes inflation and the higher prices cause people to buy less gasoline. This causes problems for the producers because inflation ends up increasing operation costs by raising the prices of equipment and salaries and the slower sales mean less revenue and profits. They end up worse off than before. This is the reason that OPEC has been careful, since the 1970s and 1980s, not to raise oil prices too drastically and why the real price of oil is actually lower than in previous years. The oil producers make more money in the long run by selling the oil cheaply during non-inflationary cycles. The profits in oil are derived by the volume of oil sold rather than the high price of it. The next important part of the oil picture is who has the oil, and who doesn't.

The United States used to have lots of oil but after pumping out more than 176 billion barrels of oil it is now down to a mere 22 billion barrels in proven reserves. The only reason we have any oil left is because we are now importing nearly 60 percent of the crude oil we consume each year. We are still finding oil but it is a mopping up process of left over oil from old oil fields passed over during previous exploration. The US production rate is declining at over 2 percent each year and that rate is increasing each year. Oil refinery after oil refinery has closed down. The major oil companies have given up exploring for oil in the United States and are now hoping to find major oil discoveries in places like Russia and Azerbaijan, in the Caspian Sea area.

Unfortunately this has removed the more advanced technology that is needed to find the more elusive pockets of oil in the US, which costs us in the long run. An important part of the picture is who is supplying the oil we import into the US.

Mexico is one of these suppliers of oil and has 40 billion barrels in proven reserves and uses six out of every 10 barrels of oil it produces. This means the US can get, at the most, 16 billion barrels from that source. At the moment we are importing 511 million barrels from Mexico each year. Much of Mexico's oil is production-rated, meaning that the oil can only be pumped out of the ground at a certain rate. If the rate were increased, an influx of water would enter the reservoir and ruin it.



Based on the author's research, this graph indicates the time frame for a virtual total halt in world oil production following the peak production year of around 2008, with a 25 percent drop in production having very serious economic and lifestyle consequences to the world's population — particularly the US and other industrialized nations.

Venezuela is our major supplier of oil, exporting to us 620.5 million barrels a year. Venezuela has the largest oil reserves left in the Western Hemisphere with over 65 billion barrels. Only 28 percent of its reserves are light to medium density oil, the rest is 20 API or less. API is a density designator, the heavier the density the smaller the number. A light density oil would be in the 30 API range or higher.

Over half of Venezuela's revenues are spent keeping oil production at optimum. Venezuela's oil contains a high percentage of sulfur which requires processing to extract. As time goes on, more of Venezuela's revenues will be diverted to maintaining and upgrading its oil facilities and its oil production may become a burden to its already taxed economy. All of these things may spell trouble for Venezuela's oil industry and to our future oil supplies.

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Canada supplies us with a surprisingly large amount of oil considering that its proven reserves are only about 6.9 billion barrels. It exports to the US 547.5 million barrels a year. Canada has large unproven reserves of tar sands and bituminous oil locked away. Attempts are being made to unlock these reserves by steam assisted gravity methods using horizontal drilling.

Saudi Arabia supplies the US with about 511 million barrels per year. We'll discuss Saudi Arabia and its resources a little later.

The Western Hemisphere has combined proven reserves of over 132 billion barrels. A lot of oil but not all of it will be available on demand —when we want it or need it — because as oil fields mature more effort and money is needed to get the oil out of the ground.

How Oil Is Produced — To better understand what the numbers relating to oil mean, I will describe briefly how oil is produced. I've used the word "produced" a number of times and the word means generally the combined processes of exploration, drilling, pumping, refining, and delivering the oil to consumers.

Oil is found only in sedimentary rock and requires certain conditions in the rock formation for it to exist. When a well is first opened the oil is under pressure, caused by gas build up and layers of rock pressing down on the oil reservoir rock, and the oil comes out, mixed with natural gas, like water out of a seltzer bottle. I might add here too that "reservoir rock" is any layer of porous rock that will hold oil and has pathways for the oil to flow to a well. In time the gas and pressure is exhausted and from then on pumps are needed to produce the oil. Most everyone has seen pictures of those huge "grasshoppers" pumping away. In time other physical forces begin to work against the pumping action and the oil slows to a trickle — especially in fields where the oil is thick and normally flows slowly. Adhesion and capillary forces capture the oil in reservoir rock and this is the reason why only about one-third of the oil can be taken out of the ground. Think of the oil as being contained in a concrete block 5,000 feet in the ground.

Secondary methods can produce more oil. Secondary methods are water flooding, steam injection, acid treatment, microfoam, horizontal drilling, chemicals, and even someday, bacteria specifically designed to generate gas and thus pressure. All of these treatments add to the expense and the time that it takes to produce oil. When it costs as much to produce a barrel of oil as what you can sell it for you have reached what is known as economic oil depletion. Much of the oil statistics being thrown out for public consumption today incorporate much of this oil that is not economical to produce as well as oil that is beyond our present abilities to produce but oil that some optimistically consider to be producible in the future. It is a hard concept for some people to understand: that there can be billions of barrels of oil in the ground and yet we can be "out" of oil.

Raising prices on oil does not help to produce more oil. In fact, as was previously shown, raising prices acts to inhibit oil production in the long run by decreasing consumption. This takes away the profits that could be used to explore for more oil and for developing better methods of producing oil.

People have heard that the oil companies over the years have been shutting down wells because of low oil prices and will open them again when the oil prices go back up. This is partly true, as some marginal wells may be opened back up, but the majority of them will be shut down forever because there is no profit to be made by reopening them. Now to who has the oil and who doesn't.

Again, in our hemisphere the major players in oil production are the US with 22 billion barrels, Mexico 40 billion, Venezuela 65 billion, and Canada 6.9 billion.

Western Europe has very little oil, with the UK reserves at about 4.5 billion and Norway's at 11.2 billion.

The former USSR region has from 57 to 189 billion barrels. The larger number probably reflecting optimism rather than reality.

China is reported to have from 24 to 31 billion barrels. Africa has three major producers: Algeria with 9.2 billion, Libya 29.5, and Nigeria 15.5 billion barrels.

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The Middle East region holds the greatest reserves of oil in the world; with Iran's reserve at 57 to 88 billion barrels, Iraq 100, Kuwait 96, United Emirates from 63 to 98 billion barrels, and lastly Saudi Arabia with a whopping 261 billion barrels.

Oil Availability Threats — The numbers in the case of the OPEC countries are suspect, however, because their production quotas are based on how much oil they report for their reserves. The larger the reserve of oil they have the more oil they are allowed to sell. These quota requirements may be the reason that in 1985 Kuwait increased their reserve numbers by 41 percent and in 1988 Abu Dhabi and Dhabi tripled their reserve numbers and Iran, Iraq, and Venezuela doubled their oil reserve estimates. In 1990 Saudi Arabia increased their reserve estimates by 50 percent.

You can see by the numbers that most of the world's oil is in the Middle East and after the Western Hemisphere's oil is depleted the Middle East will be a position to dictate to the rest of the world.

It is ironic that the most important commodity in the

world is produced in the most unstable region in the world. Political and religious instability in the area is likely to cause an upheaval that will cause a premature and artificial depletion of oil. The most serious and growing danger is Moslem fundamentalism.

The Saudi ruling class is Sunni Moslem and the bulk of the Arabs in the region are Shiite. Ninety-five percent of Iran's population is Shiite and 63 percent of Iraq's are Shiite. Conversely, only 15 percent of the Saudis are of the Shiite sect.

Moslem fundamentalism, mostly based in the Shiite sect, is growing and becoming more militant as it fights against the advance of Western culture.

At this point, it appears unlikely that anything will be done soon enough to prevent The Big Crunch. Politicians are notorious for being shortsighted in dealing with problems. It would be political suicide to advocate spending billions and even trillions of dollars on a problem no one at the moment is even recognizing as a problem.

As the oil production becomes more centralized and focused in the Middle East, Arab confidence in their omnipotence will grow and a take over of the oil from the Saudis is almost a certainty — for what better weapon against the West is there than oil? There would be little the West could do if the fundamentalists gained control of the region. Using force against them would be very risky, as illustrated by the fact that it took months to shuttle in troops and equipment to deal with Saddam Hussein and that was when we had the advantage of Arab backing and their land to muster troops and equipment on. In the length of time that it took for us to build up our forces during "Desert Storm," trillions of dollars worth of infrastructure could be plastered with explosives and held hostage as a means of preventing an attack. The West would have to capitulate to whatever demands were made because the result of blowing up the infrastructure — refineries, pipelines, storage facilities, loading facilities, gas-oil separators — would leave the world without oil for a very long time, maybe permanently.

Even without a hostile takeover of the oil,the world is faced with an oil monopoly from an area and people not sympathetic to the West.

As the Middle East begins to deplete its oil there will be nowhere and no one else to supply oil. Without alternative energy to replace oil, an energy vacuum will exist. What will happen then is hard to predict.

A super depression, what I call "The Big Crunch," could result in the destruction of our way of life. A hunting and gathering way of life is not the best way to survive — that is why humans took up farming. Without lots of food set aside very few people could survive The Big Crunch.

A year's supply of food may not get you by either, because of the many thousands of desperate people wandering about trying to find food, water, and shelter. By the time the next growing season rolled around, most of those unprepared and unlucky, possibly 80 to 90 percent or more of the population, might have died from starvation, exposure, disease, and human interaction. The land would have to be mostly barren of people before it could be safe enough to begin any type of agriculture. It takes 100 to 120 days for most crops to mature and gardening is a full time occupation. You must have food to live on until a harvest.

Agriculture is also risky because there is always the chance of blight or drought happening that could wipe out a crop and that would mean no food for that year.

Besides the hardships mentioned there are those diseases that we have been incubating over the years, such as AIDS, incurable tuberculosis, flesh-eating bacteria, as well as the usual plagues and horrors that have always been with us. The diseases would have an opportunity to spread throughout a surviving population because malnutrition and the elements had weakened it.

How Long Before The Crisis? — The big question the reader may be asking by now is, "When is all this going to take place?" To answer that question I have to first tell how I came to the conclusion that I did.

For the last three years I have been gathering data — mostly from the Energy Information Agency of the Department of Energy and supplemented by my own textbooks on civil and oil engineering.

New oil discoveries are taking place at about a 1:4 ratio, relative to consumption. We are discovering one barrel for every four consumed. That ratio is increasing at some rate each year — I place it at 1.5 percent. In other words, we are finding 1.5 percent less oil each year.

Our consumption rate increases from 1 to 2 percent each year — 1.5 percent being the most quoted figure — and the world now consumes a little over 24 billion barrels each year and has about 980 to 1,000 billion barrels in proven reserves.

To help me analyze the data, I wrote a computer program in BASIC. Its output would be based on time (x ordinate) and oil production (y ordinate) and referenced from a point of zero corresponding to the world's peak production. The time-production curve is similar in shape to a standard bell curve. The peak oil production would be at a point where the slope of the curve changes from positive to negative, i.e., on the top of the curve.

The program calculated a timetable referenced from peak production to give a time for minus 25 percent oil production, minus 50, minus 75, and minus 100 percent. The minus 100 percent would correspond to zero production, or total oil depletion, which is a point that is only theoretical, for it will never be reached (see the figure at the beginning of this article).

The significance of these percentages becomes clear when you consider that oil shortages cause inflation, recessions, and even depressions. We have some historical examples of economic hard times that are based on reductions in employment and the Gross National Product (GNP). We can relate the reduction in oil to unemployment and shrinking GNP. A 25 percent reduction in oil would have a serious effect on our economy. We know that recessions are brought on by an increase in unemployment from a normal 5 percent unemployment rate to a 6 to 7 percent one, and a reduction of GNP of 5 to 10 percent.

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A serious depression such as the Crash of 1929 represented an unemployment rate of 14 to 25 percent and a shrinking GNP of 40 percent.

In 1973 the panic and subsequent recession was caused by a 5 to 10 percent reduction in oil. A reduction in oil of 2.5 times greater, as represented by a minus 25 percent reduction in oil production, could mean that our economy would suffer catastrophic consequences.

The results of my computer analysis gave 13 years from peak oil production for the minus 25 percent point, 22 years for minus 50 percent, 29 years for minus 75 percent, and 36 years to theoretical total depletion. The big question is then when will world oil production peak occur? A Scientific American magazine article in the March 1998 issue stated that the peak production would occur around the year 2008. No one can say for sure, however. It could happen before that time or a few years later.

Based on the behavior of past oil fields, the reported oil reserves, and particularly the lack of major new oil discoveries, world oil production will soon reach its maximum peak production.

Adverse effects will soon begin to be felt after the production peak occurs. The reduction in oil will increasingly stifle the production of goods, cause increases in unemployment, and reduce the mobility of goods and of people. Mobility is our greatest need. We can derive energy from many sources for utilities but for transport vehicles we have only one source of energy and that is oil.

Readers may desire to verify my data and wish to do some investigating on their own. The primary sources for information about oil resources are World Oil and Oil and Gas Journal. These two organizations query the oil producing countries and compile the returned data, which they publish. The Energy Information Agency of the Department of Energy uses this information in their reports. I have been accessing the government data by means of the Internet by typing in "Energy Information Agency" to get to their home page. To gain up-to-date information anyone having access to the Internet can do the same.

The methods used by the oil industry to "prove" their reserves are by the drilling of holes to find the oil, core samples taken from test holes, seismic studies, and experience based on the behavior of adjacent oil formations.

After the information is gathered the oil reservoir is mapped and the oil quantities are determined from the thickness of the reservoir rock, the oil content of the rock, and the boundaries of the reservoir. Even though much information is collected and analyzed, estimates are still part gut instinct. There are very few absolutes about oil.

Alternatives To Oil? — Myths about oil abound. The most common myth is the "super carburetor" that was supposedly bought up years ago by the oil companies because it saved too much gasoline. Physics is physics and we are squeezing about as much energy as we can out of gasoline. In other words, there are no super carburetors.

Another energy myth is the one about running everything on solar power. Imagine running an 80,000-pound 18-wheeler on batteries and solar panels or running a farm tractor on solar power. Most of the alternatives you have heard about are costly, bulky, and totally inappropriate for heavy transport use.

Hydrogen is another of those utopian dreams that without analysis seems to be the answer to everything. The problem with hydrogen is that it takes a lot of energy to break the bond between hydrogen and oxygen molecules. Hydrogen also requires special handling. It has to be kept pressurized and at very low temperatures in order to keep it liquefied.

Coal is the only option we have at the moment as an alternative for oil, but coal has many drawbacks. It is extremely dirty and is contaminated with heavy metals, such as uranium, arsenic, sulfur, iron, and more. It has rock and other materials that need to be removed.

To make synthetic oil out of coal, hydrogen must be added. Coal on average contains about 5 percent hydrogen, compared to about 12 percent for petroleum. The process of adding hydrogen is referred to as hydrogenation or liquefaction. The coal is pulverized and hydrogen gas is added to it under high temperatures and pressures. The hydrogen gas gradually combines with the carbon in the coal to produce a liquid. At the moment the process costs $35 to $40 a barrel. About 4 to 5 barrels of synthetic oil can be produced from one ton of coal. A process efficient enough to produce oil in the quantities we need is a long way off and research and implementation of a synthetic oil program will take many years and cost trillions of dollars.

At this point, it appears unlikely that anything will be done soon enough to prevent The Big Crunch. Politicians are notorious for being shortsighted in dealing with problems. It would be political suicide to advocate spending billions and even trillions of dollars on a problem no one at the moment is even recognizing as a problem. The oil companies too are not about to promote a program that would take money out of their pockets and scientists and technologists are conservative and are generally involved only in their own areas of expertise.

Coal is the only option we have at the moment as an alternative for oil, but coal has many drawbacks. It is extremely dirty and is contaminated with heavy metals, such as uranium, arsenic, sulfur, iron, and more. It has rock and other materials that need to be removed.

The best means of surviving The Big Crunch is by preventing it from happening and the only way of doing that is by becoming aware that it can happen. Even if it were to happen beyond our immediate time, we could be passing on a death sentence to our children and our grandchildren. ASG