Book Review

Beyond Fossil Fools: A Roadmap to Energy Independence

Fred Zimmerman

With gas prices hovering at $4 per gallon, airlines operating at record losses, and myriads of companies, families, and communities buffeted by high energy costs, political candidates of all parties are striving to coin the repeatable sound bite on the energy situation. But, there isn't one. The current energy crisis has been building for a hundred years and groundless platitudes are not needed. Applied science is needed.

Applied science is now available in a fascinating new book on energy, written by a fellow manufacturer. *Beyond Fossil Fools: The Roadmap to Energy Independence by 2040* is the most factual and authoritative treatment of the energy situation that I have ever read or heard about. It does not crusade, but it does encourage us to respond to our pressing imperatives. The book is scientific, written from the perspective of a successful engineer, entrepreneur, businessman, and corporate director. But the book contains heart; written on behalf of our grandchildren. Above all, it is neither simplistic nor gloomy. Thankfully, it is practical and hopeful.

Joseph M. Shuster is the founder or cofounder several successful companies including Minnesota Valley Engineering, Cryo-Diffusion, Cryo-Diffusion (a French manufacturer of cryogenic equipment); Agro-K Corporation (a developer of biological farming systems); International Cryobiological Services; Cool Clean and several other companies. He has also served as the President of the Minnesota High Tech Association and on the boards of directors of several companies. Joe received his Bachelor of Chemical Engineering degree from the University of Minnesota in 1955.

His book is a hopeful and believable scholarly treatment of the options before us; which ones will work, which ones are hype, and what practical steps we need to take to improve our chances of achieving a more stable energy situation in the future.

It is hard to describe the tone of Joe's book. He does not pander, as so many of the politicians do. He resists laying all of the blame on evil parties distant from ourselves. The tone is much like a mid-twentieth century nun who lovingly stands over her class with a ruler. The book is written in behalf of younger citizens so they may escape the rampart turmoil likely to emerge in a world chronically short of energy. The book displays caring of the highest order.

But it is also written with the practicality and objectivity of a successful engineer. One by one, Shuster goes through the various energy alternatives available to us – both now and with reasonable technological development in the years ahead. He provides a rich assortment of factual data along with a thorough explanation of recent research to conclude how much we can expect from each of these alternatives and what operational steps we would need to make to achieve them. Importantly, the author is eminently fair in considering the environmental aspects of each alternative to be considered. Skillfully, he critiques our present systems against the same criteria.

The author gently, but firmly, debunks the idea that platitudes and slogans will get us anywhere in view of the limited time available to put in place the essential remedial steps that could stave off the

Figure 1.1. Countdown to Total Depletion (2008 World Fossil Fuel

OIL								
Country	Population in Millions		Oil Reserves in Billions of Barrels		Billions of Barrels Consumed Per Year		Consumption Per Capita in Barrels per Year	Years Left Until Reserve All Gone*
	Amount	% of Global	Amount	% of Global	Amount	% of Global		
United States	300	5	22	2	7.5	25	25	3
European Union	460	7	7.3	0.7	5.5	18	12	1.3
China	1,300	20	18.3	1.7	2.3	8	1.8	8
India	1,100	17	5.7	0.5	0.9	3	0.8	6
Russia	145	2	69	6.3	1	3	7	69
Rest Of World[1]	3,200	49	975	89	12.9	43	4	76
World	6,500	100	1,100	100	30	100	46	37
			+1,100[2]					74
NATURAL GAS								
Country	Population in Millions		Natural Gas Reserves in Trillions of Cubic Feet		Trillions of Cubic Feet Consumed Per Year		Consumption Per Capita in Thousands of Cubic Feet per Year	Years Left Until Reserve All Gone*
	Amount	% of Global	Amount	% of Global	Amount	% of Global		
United States	300	5	190	3	22.0	23	73	9
European Union	460	7	115	2	17.0	18	37	7
China	1,300	20	90	1.5	1.2	1.3	0.9	75
India	1,100	17	30	0.5	1.0	1	0.9	30
Russia	145	2	1,700	27	14.0	15	97	121
Rest Of World[1]	3,200	49	4,075	66	43	44	13	95
World	6,500	100	6,200	100	98	100	15	63
COAL								
Country	Population in Millions		Reserves of Hard Coal in Billions of Tons		Billions of Tons Consumed Per Year		Consumption Per Capita in Tons per Year	Years Left Until Reserve All Gone*
	Amount	% of Global	Amount	% of Global	Amount	% of Global		
United States	300	5	270	27	1.2	20	4	225
European Union	460	7	40	4	0.9	15	2	45
China	1,300	20	126	13	2.1	34	1.6	60
India	1,100	17	102	10	0.5	8	0.5	204
Russia	145	2	173	17	0.3	4	1.8	575
Rest Of World[1]	3,200	49	289	29	1.1	18	0.3	263
World	6,500	100	1,000	100	6.1	100	0.9	164

1 Of these, 2 billion people use essentially no fossil fuels except wood.

2 Let's speculate that the world discovers and extracts an additional 1,100 billion barrels of oil from unconventional oil sources (oil shale and oil sands)

* As population grows, these reserves will be depleted in less time. Consequently, world conventional oil reserves will last only 28 years until it's all gone. Natural gas will last 47 years. Coal will last 125 years. (Even assuming the addition of a speculative 1,100 billion barrels, oil reserves would last fewer than 60 years.)

turmoil that can be so easily predicted when an expanding world population is faced with energy deprivation.

Shuster begins with a realistic assessment of what is our remaining supply of conventional fossil fuels. Figure 1.1 shows his "Countdown to Total Depletion." With respectable evidence he verifies that current reserves and current usage rates the world has about 28 years of remaining oil reserves, 63 years of natural gas reserves, and 164 years of known coal reserves. More could be found, of course, but the author is quick to point out that additional large fossil fuel reserves are becoming increasingly difficult and expensive to find. He also reminds us of the reality that major environmental compromises will have to be made in order to tap even some of the reserves that are known to exist.

Beyond Fossil Fools also deals effectively with the severe environmental aspects of our present practices. He points out that researchers at Carnegie Mellon University in Pittsburgh have estimated that more people are killed by air pollution than by auto accidents. Global warming, ocean acidification, acid rain, smog, ground-level ozone, mercury proliferation, and other attributes of our huge use of fossil fuels all require us to seriously critique our present energy systems.

Shuster's next step is to weigh the pluses, costs, and practical difficulties of potential solutions. His skillful analysis deals with each technology fairly. In many cases, he favors alternative energy initiatives. In other cases, he expresses concern about cost and ramifications. Importantly, he sagely identifies instances where the most talked-about technologies have application and where they are "hype."

Some quotes from *Beyond Fossil Fools* on Solutions

Oil Sands and Oil Shale

"While the United States is doing very little to develop U.S. oil shale resources, in spite of having the largest deposits in the world, others are aggressively exploiting oil from oil sands and oil shale. Wake up, America. The resources for a transitional bridge are right here in the USA. We only have to dig. Also, if we are to help other nations become energy independent, we should plan on providing them oil from oil shale at a reasonable cost because all nations will have the same problem of not having a sufficient bridge to energy independence. U.S. deposits contain the most extensive and economically recoverable oil from oil shale on earth."

Solar Energy

"In the past decade firms in Japan installed more than 750 megawatts of grid-connected systems on homes and businesses. In Germany firms installed more than 400 megawatts. In the United States the solar-energy industry installed about 340 megawatts of off-grid and grid-connected systems. contributing far less than 0.1 percent of total U.S. electrical energy needs."

Wind Turbines

"Don't get blown away. You and I should vigorously support wind power, particularly if the alternative is the continued use of fossil fuels. The more energy derived from wind, the less pollution and the less reliance on foreign sources. At the same time, we must be realistic and not be led down impractical paths that cause us to disregard other solutions. Wind has advantages and huge potential, but it also has some significant limitations. Our industrial and political leaders should have a broad understanding of the facts before formulating policy."

Ethanol

"Since 1980, processors have reduced the energy needed to produce ethanol by over 40 percent. Significant opportunities remain to further cut costs. First, an oil can be extracted from the high-protein residue (DDGs) to produce 5-10 percent more fuel in the form of biodiesel. In the process, according to the Center for Energy and

Environment, the quality and selling price of the high-protein residue (DDG) would also improve. Second, clean electricity could be produced from currently wasted heat, thereby reducing total costs. Third, experts anticipate that costs will be cut through better recycling and management of water. The amount of water used to produce ethanol is very high, but will likely be cut in half, from 3 gallons to 1.5 gallons for every gallon of ethanol produced. Still, the amount of water required to produce ethanol is dramatically less than the water required to refine oil—about 44 gallons of water per gallon of crude oil, according to the EPA."

"Corn and sugar crops represent only a small fraction of biomass that can produce ethanol. Several technologies can produce ethanol from other forms of biomass, such as grasses, trees, forestry residue, and plant stalks, as well as industrial and domestic waste, and even municipal solid waste."

"Cellulosic ethanol also has a more favorable energy in/energy out ratio than corn ethanol."

Other Bio-Fuels

"Biodiesel is better for the environment than petroleum-based diesel and other fossil fuels. Compared to petroleum-based biodiesel, pure biodiesel spews about half the particulate matter and carbon monoxide, and it emits even lesser amounts of other toxic pollutants. Sulfur emissions, a major source of acid rain, is essentially eliminated."

The Hydrogen Economy

"The world cannot afford such false and poorly informed statements [about the hydrogen economy]. Such declarations are dangerous, and they mislead just about everyone, including world leaders, to believe that the solution to the world's energy problems is close at hand. Without a disciplined plan and a quantified time table to get us there, these kinds of statements are just hot air. Don't believe vague, generic claims. No hydrogen economy is going to happen any time soon."

Nuclear

"The uranium in the leftover "tailings" from the enrichment process is called "depleted uranium." While no longer useful for thermal-reactor fuel, the depleted uranium tailings still contain more than 80 percent of the energy that was in the original ore. Since that energy can be accessed with fast neutron reactors, the depleted uranium constitutes a very large energy resource. In fact, the energy in the depleted uranium waste already on hand in the United States far exceeds the energy in the coal reserves still in the ground."

Summary

Joe Shuster is not a pessimist. Instead, as an accredited entrepreneur, he is a hopeful optimist. But, in view of the horrific consequences of mishandling the energy problems, he is worried about what life will be like for our grandchildren. He questions why we, the citizens, put up with some of the public office holders, in both major parties, who seem so unable to marshal the resources necessary to make minimal progress on the most pressing economic, national security, and societal problem we have before us.

All-in-all, *Beyond Fossil Fools* is a great book.
Fred Zimmerman