



Some Predictions from the Time when Today Was the Future of Oil

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After my post about the “The Prize” video there was a short discussion in comments about earlier predictions made by Dr Yergin, and the book “Energy Future - Report of the Energy Project at the Harvard Business School, ” which he co-authored with Robert Stobaugh. Now back when those studies came out I was also trying to read the tea leaves to see what sort of a future our own students would have. At the time coal seemed to get more attention and favor than it now holds, so there is a little more emphasis there. Let me begin with “Energy Future” which begins with an interesting paragraph (given it was written in 1979).

In 1968, the State Department sent the word to foreign governments-American oil production would soon reach the limits of its capacity. Friendly governments needed to know that the cushion of the U.S.’s extra capacity, which could be called into production during an emergency, was about to disappear. The end of an era was at hand.

There were two dramatic oil prices increases in the 1970’s, the first which multiplied the price of oil eight-fold by the end of 1974 over that when the State Department sent out the memo, and the second, which came with the fall of the Shah of Iran some five years later, when the price of oil went up another two-and-a-half times. As a result not only Dr Yergin's collaborative effort editing a second book “Global Insecurity – A Strategy for Energy and Economic Renewal”, (from which the last sentence came) but a significant number of other august bodies also began to produce their own projections. For your amusement I thought you might like to see some of them.

To begin by putting things in perspective, back in 1977 the United States was consuming the following quantities of energy.

Source		mbdoe	Percentage	Quantity
Petroleum	Domestic	9.7	26.4%	10.7 mbd
Petroleum	Imported	8.7	23.7%	8.7 mbd
Natural Gas	Domestic	8.7	23.7%	18.2 trillion cfm
Natural Gas	Imported	0.5	1.4%	1.0 trillion cfm
Coal		6.7	18.3%	625 million tons
Nuclear		1.3	3.5%	251 billion kwh
Hydro		1.1	3.0%	230 billion kwh
TOTAL		36.7		

You can see, already, in the years since 1970, that imports had become almost half of American supply, and even back in 1970 they provided 24% of consumption. The book “Energy Future” was written to suggest a transition from imported oil, to a more balanced, and more domestic, energy supply. Thus the various chapters examined ways to increase production, or at least

maintain existing levels, for the different fuel sources. Since we are mainly about oil and natural gas (and because I want to include other references) let me just very crudely condense the two relevant chapters. But to give some cover to the authors, it should be remembered that the book was written just after the Three Mile Island incident. The authors look at two possible solutions, removing price controls and easing drilling restrictions to increase conventional recovery, and unconventional recovery through the processing of oil shale. They conclude that even by the year 2000 the latter would be unlikely to make any significant contribution, and thus they anticipate that oil production levels would be maintained at 1977 levels, through increased production from conventional wells. However they go on to state (page 44)

Thus, the total oil output in the late 1980's from both known and newly found oil fields and from enhanced recovery will likely approximate 10 million barrels daily, about the same as current production. Even this level is quite speculative and perhaps on the optimistic side. To maintain that production level would require the finding of almost four billion barrels annually, but there has been only one year in the last thirty in which more than three billion barrels of reserves have been found.

However their optimism is mild relative to the experts from 1974 that they quote

Administration experts, with the aid of large computer models, argued that domestic production could reach 15 million or even 20 million barrels daily, and that U.S. imports thus could be reduced to zero. They said this would require an eleven-dollar a barrel oil price (in 1973 terms) which, in fact, was not much higher than the 1975-78 prices for newly found oil.

(Hmm! Parts of that sound a bit familiar). The chapter concludes that it would not be realistic to anticipate that domestic production could (for the reasons cited above) exceed 1977 values, and thus in order to reduce the reliance on foreign oil, the United States should look to fuel sources other than oil. Natural Gas had been a regulated fuel in the United States until 1978, and in a great debate about deregulation of price it was agreed that the nation would be unlikely to see any increase in production beyond the 20 tcf then being provided, but the USGS predicted that at that rate the US would have enough reserves for between 44 and 100 years, while the CIA suggested the reserve would last 50 to 60 years. It was then in process of deregulation and the authors conclude the chapter with the paragraphs

First, higher prices might stimulate exploration to such an extent that the discovery of new reservoirs would support consumption in excess of the current 20 tcf per year, say 25 tcf per year or more. In that case, new electric generating plants might even be permitted to use natural gas. This seems, on the available evidence, to be the least likely outcome, but it is possible. Second, and only slightly more likely, is that higher prices could fail to stimulate more than the current 10 tcf of new discoveries per year. The third and most likely outcome is that annual discoveries will range between 10 tcf and 25 tcf per year. Within that range, a figure closer to 10 tcf means further restrictions on the industrial use of gas as boiler fuel and as feedstock, plus stern enforcement of mandates to convert existing gas-fired industrial and electric utility boilers to coal.

Based on these assumptions, and some discussion of alternative fuels, the authors ended with a prediction that gave, by the end of the 1980's, the following anticipated progress in fuel supply.

Two Futures for Energy					
		Late 1980's scenarios			
Source		1977	As normal	Recommended	Actual 1990
Petroleum	Domestic	9.7	10.00	10.00	19.2*
Petroleum	Imported	8.7	14.00	9.00	
Natural Gas	Domestic	8.7	9.00	9.00	10.9*
Natural Gas	Imported	0.5	1.00	1.00	
Coal		6.7	12.00	11.00	9.80
Nuclear		1.3	3.00	2.00	3.30
Hydro & Solar		1.1	2.00	4.00	4.50
TOTAL		36.7	51	46	47.60
Conservation			3.00	8	

* domestic and imports have been totalled

I have added the actual data (taken from the EIA International Energy Outlook 2005. Not having looked at the accuracy of their prediction, I must confess to being a little more impressed than I expected to be (since my estimates were somewhat different). In the following book, Global Insecurity, the topic became rather the world supply with the prevailing supplies being given as:

World Consumption of Energy up until 1980 (Global Insecurity)				
		1950	1973	1980
Oil		29%	52%	47%
Natural Gas		12%	23%	24%
Coal		57%	22%	25%
Primary Electricity	(hydro, geothermal and nuclear)	2%	3%	4%

World Projected Supply of Energy (Global Insecurity)				
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Most of the book deals with a nation by nation analysis, and so I will just extract one table, and give the tables for world energy consumption in 1978 and their projected use in 2000, under two scenarios.

World Projected Supply of Energy (Global Insecurity)				
	1978	2000 upper	2000 lower	2001 Actual
Oil	51.4	56	42.8	64.2
Natural Gas	17.2	29.2	20	35.4
Synthetic fuel	-	8	3.2	
Coal	16.6	42	28	42.7
Nuclear	2.6	18.8	8	9.6
Hydro & Solar	6.8	14	10	12.5
TOTAL	94.6	168	112	164.2

And by now there is some clearer difference appearing in the energy levels coming from different sources. Unfortunately for their original proposition much more of it is coming from imported oil than they had anticipated. Next to come out of that dark corner of my bookshelf is a small book "Coal and Energy" by the then ex-Chair of the British National Coal Board, Sir Derek Ezra, who made the following predictions in 1978, for world energy demand comparing 1974 with projections for 1985 and 2000. He focused purely on the world outside the then Communist regions.

Non-Communist World Energy Use (Derek Ezra)				
	1974	1985	2000	mbdoe
Oil	33.5	44.7	59.6	
Natural Gas	13.2	18.6	25.5	
Coal	13.0	19.1	26.6	
Nuclear	0.9	6.9	27.7	
Hydro and solar	4.8	6.4	9.6	
TOTAL	65.4	95.7	148.9	

However, while of limited interest, he did also include projections of oil imports for various nations within those time frames:

Oil Imports for Various Nations (Derek Era)				
	1974	1985	2000	
Western Europe	10.9	10.6	12.8	
United States	4.7	8.0	12.2	
Japan	4.0	6.9	9.0	
Other	2.9	2.7	6.9	
TOTALS	22.5	28.2	41.0	

In regard to which a book on Coal – Bridge to the Future by the World Coal Study Group in 1980 looked at three possible scenarios for oil production from around the world and came up with:

Coal Bridge to the Future - Oil production to 2000					
	1978	2000 - 1	2000 - 2	2000 - 3	ACTUAL
OPEC Production	30.4	35	30	35	27.7
OPEC Consumption	2.2	5	5	9	4.98
OPEC Exports	28.2	30	25	26	22.72
Imports elsewhere	2.2	3	3	9	
Imports OECD	26	27	22	17	

It is interesting that none of these is considering demand growth from China. In regard to the increase in prices over the years, the United Nations Economic Commission for Europe wrote a report on Coal:1985 and Beyond, where they anticipated that Oil prices would rise 3.25 times between 1970 and 2000, Natural gas prices would rise 7.56 times and coal prices would drop to 86% of the price. The National Research Council who in 1978 came out with a report on Energy Modelling for an Uncertain Future, projected the introduction of the Fast Breeder Reactor in 2000, and thus came up with:

NRC				
	1985	2000	2010	2000 ACTUAL
Oil and Natural gas	19.8	18.0	13.6	18.1
Natural gas	*combined with oil			11.3
Imports	9.9	9.0	6.8	combined
Coal	8.4	18.9	21.2	10.7
Nuclear	3.3	10.9	14.5	3.7
Shale Oil	0.0	0.9	2.8	
Hydro etc	1.9	2.8	3.5	2.9

This was part of a much larger study that covered more than 6 scenarios with overall demand varying from around 28 mbdoe to about 75 mbdoe. If there is interest I could reproduce them, but otherwise I will let these examples speak for themselves. It does appear that the predictions for nuclear energy were the most optimistic, relative to the actual result.



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