

The Gibberish That Bad Measurement Bequeathed

“With the exception of preventing war, this is the greatest challenge that our country will face during our lifetimes. The energy crisis has not yet overwhelmed us, but it will if we do not act quickly....The oil and natural gas we rely on for 75% of our energy are simply running out...we now believe that early in the 1980s the world will be demanding more oil than it can produce.”

—President Jimmy Carter, *Address to the Nation*, April 18, 1977

“It is only in recent years that we have come to recognize that we [the world] are just running out of oil and that we will peak in the last quarter of the century. We face in the energy area a standard Malthusian case of exponential growth against a finite resource...”

—James R. Schlesinger, *Carter Administration Energy Advisor*, *Business Week* April 25, 1977

“...the increase is likely to be so steep that as early as 1981 the West may be faced with an annual oil shortage, and by the end of the century the shortfall could be 20 million barrels a day—as much as all of Western Europe now uses.”

—Allan Mayer, *citing from the Energy: Global Prospects report*, *Newsweek*, May 23, 1977

“All our work can be boiled down to a single message...The free world must drastically curtail the growth of energy use and move massively out of oil into other fuels with wartime urgency. Otherwise, we face foreseeable catastrophe.”

—Carroll L. Wilson, *director of the Workshop on Alternative Energy Strategies*, *Massachusetts Institute of Technology*, *Newsweek*, May 23, 1977

What Oil Shortage?

By Joseph W. Duncan and Andrew C. Gross

Throughout much of the 20th century, the world supply of energy exceeded demand. Defining surplus as the amount of energy allocated for inventories and for fueling ships on a worldwide basis, surplus was at about 4 percent total demand in both 1961 and 1972. Then came the energy crisis of 1973-4 when the OPEC nations asserted themselves vis-à-vis the multinational oil companies. In retrospect, the crisis can be viewed as an opportunity long over-

due for energy conservation by nations, firms, and households. Users in the past 20 years did not gain a dominant upper hand, but did force producers to alter their production and pricing strategies.²

How this happened is seen in the data of Figures 24 and 25 which show the global world energy supply and demand situation during the 1972-85 period. To put it bluntly, the forecasters and doomsayers were wrong and thus humbled. In retrospect, we now know that citizens and organizations were resilient as they made the adjustments. The response to higher prices was low-

ered demand. The annual growth rate of 5.2 percent for all fuel production turned out to be 1.6 percent. As might be expected, natural gas and nonhydrocarbons showed far better growth than did crude oil or sulfur-laden coal.

In the mid-1970s, OPEC oil production as a percentage of world oil

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Figure 24
World Energy in Historical Perspective:
Supply (Production) by Major Fuel

Type of Fuel	Absolute Numbers (quadrillion BTU)			Annual Growth (percent)	
	1972 Actual	1985 Forecast made in 1973	1985 Actual	1985/1972 Forecast	1985/1972 Actual
Coal	76.3	111.6	84.2	3.0	0.8
Crude Oil	105.3	200.1	112.2	5.1	0.5
Natural Gas (dry & liquid)	50.8	105.1	79.7	5.7	3.5
Nonhydrocarbons	14.9	62.7	34.2	11.7	6.6
Total	247.3	479.5	302.1	5.2	1.6

Figure 25
World Energy in Historical Perspective:
Demand (Consumption) by Major End Use

End Use	Absolute Numbers (quadrillion BTU)			Annual Growth (percent)	
	1972 Actual	1985 Forecast made in 1973	1985 Actual	1985/1972 Forecast	1985/1972 Actual
Transportation	25.7	44.3	42.0 ^e	4.3	3.8
Residential and commercial	33.2	41.2	40.0 ^e	1.7	1.4
Electric power	57.7	145.1	80.0 ^e	7.4	2.6
Industry	121.1	221.6	143.0 ^e	4.8	1.3
Total	237.7	452.2	304.7	5.1	1.9

e = estimated

Source: W. Ware and A. Gross, "World Energy: Demand and Supply," *Columbia Journal of World Business*, Fall 1974, p. 11 & 13; and Energy Information Administration, *International Energy Annual 1992*. (Washington, DC: USDOE/EIA, 1994), pp. 110 & 118 ff.

Proved Reserves

Reserves are estimates of fossil fuels that are left untapped in the ground and under the sea; some of it can be obtained, other portions are difficult to extract. According to the EIA [Energy Information Administration], (1) there is no international standard for defining or estimating reserves, (2) each country and company has its own definitions, and (3) most countries have several categories of reserve estimates, reflecting the likelihood of actual extraction and circumstances in the field. The most important reserve category is "proved reserves," which reflect a high or reasonable certainty of actual production. Proved reserves are economically and technically feasible to produce, given the current infrastructure. But what is high or reasonable certainty, or economic feasibility? Again, countries differ on their definition of the term; some do not even report their proved reserves.

In addition to problems of inconsistent definitions and standards, analysts work with data that are incomplete, imprecise, and often of questionable quality. They must decide what information will be used and how and what data will be discounted based on their own experience and judgment. They may also call on their own expertise when estimating some parameters and in choosing an estimation procedure. Therefore, equally competent engineers may arrive at significantly different reserve estimates for a given field. In addition, there is always the potential of a country or individual company reporting misleading or conflicting data for a particular field to gain financial or political advantages. In many instances, gas reserves data are held in strict confidence by countries

consumption hovered around the 50 percent mark. By 1985, this figure plummeted to about 30 percent. The price of crude oil rose from around \$10 per barrel in 1970 to \$30 in the mid-1970s, to over \$50 in 1980, only to decline to the \$20 mark by the mid- to late 1980s. The OPEC cartel did not fade away, but it had to make some drastic adjustments.

On the demand or consumption side, all of the major end-use sectors under-

took an effective program of conservation and redesign. The original forecast of 5.1 percent growth turned out to be much too high. The actual annual growth during 1972-85 came in at 1.9 percent. Industry and the electric power sectors made the biggest adjustments, with actual growth rates turning out to be one-third of the forecasted ones. Transportation was the least resilient sector, as cars and trucks were wedded to running on refined petroleum....

and independent verification is not possible.²¹

The above quote, from the EIA *International Energy Annual 1992*, is itself subject to controversy at least on one count. The 1993 *BP Statistical Review of World Energy* claims that the increase in proved reserves of natural gas continues unabated, with the growth in 1992 coming mainly from the former Soviet Union and the Middle East.

The two key sources for proved reserve estimates of crude oil and natural gas are two US-based publications, *Oil & Gas Journal* and *World Oil*. Both are highly respected by government and private sectors alike; both produce authoritative issues. *Oil & Gas Journal* publishes year-end issues on proved reserves and on production. Yet they do differ on their estimates. For example, between 1991 and 1992, *Oil & Gas Journal* reported an increase of less than 1 percent in world crude oil reserves to 996 billion barrels, while *World Oil* reported an increase of 13 percent to 1,092 billion barrels. For natural gas, the higher estimate is by *Oil & Gas Journal*, which showed an increase of 12 percent to 4,883 trillion cubic feet versus *World Oil* with only a 3 percent rise to 4,817 trillion cubic feet. Differences can be attributed to varying definitions of reserves data. The variances come from

both developed and developing nations: Australia, China, Egypt, Germany, Indonesia, Norway, Pakistan, Yemen, et al.²²

The EIA relies on two other organizations for estimates of world coal reserves: British Petroleum (BP) and the World Energy Council. There are no significant differences, as both put global coal reserves at about 1,145 billion

“*There is no question, however, that reserve estimates constitute one of the “soft spots” in our energy knowledge.*”

short tons. This makes coal the most plentiful of the fossil fuel reserves, with over 200 years at 1992 consumption levels....

Conclusion

...there is no real danger of an energy crisis and no immediate major problems are seen in regard to supplies of primary fuels. Global and national economic growth will proceed, while energy conservation and other fuel-saving measures continue. As for energy statis-

tics, there is no major problem on that front either. Gaps in the data are relatively few, and disagreement on “proved reserves” still allows a relatively narrow range of useful estimates. There is no question, however, that reserve estimates constitute one of the “soft spots” in our energy knowledge.

Endnotes:

²The treatment of electric power has changed; it is no longer seen as an energy end-use sector. Nuclear, hydro, and other renewable sources of electric power appear on the supply side along with fossil fuels. Electricity generation is viewed as converting the primary energy sources for use by the consuming (demand) sectors. For further details, see Electric Edison Institute reports and journals, such as *Electric World* and *Public Utilities Fortnightly*.

²¹AEO [Annual Energy Outlook] 94, p. 22; see also sources mentioned in endnote 2 above; see also AER [Annual Energy Review] 92, Chapter 8.

²²See IEA [International Energy Annual] 92, p. 102 and AER92, p. 310. The World Energy Council defines proved recoverable reserves as the tonnage of proved amount in place that can be recovered (extracted from the earth in raw form) under present and expected local economic conditions with existing technology. British Petroleum in BP93 defines proved reserves as those quantities that geological and engineering information indicate with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

A Better Chance You'll Shoot Yourself Than Be Shot By Another

By John Allen Paulos

A recent spate of stories announces that guns will soon kill more people than do cars, the present number-one cause of injury-related deaths. The two graphs are projected to cross each other in the mid-1990s when, it's to be imagined, some safety-engineered car will function just long enough to participate in a drive-by shooting.

Although in favor of stricter gun control, I find these headlines a bit misleading. The Centers for Disease Control reports approximately 43,500 deaths in motor vehicle accidents and 38,300 deaths from firearms in 1991, the former number slowly decreasing, the latter increasing. But firearm deaths are almost always intentional. Only 4 percent of the 38,300 deaths from firearms were accidents, while 47 percent were homicides, 48 percent suicides, and the remaining 1 percent undetermined.*

*If a randomly chosen person adds up the probabilities that each of the 5 1/2 billion other people in the world will kill her, the sum, even in this violence-prone society, is still less than the probability that she'll kill herself.

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