Entering the Energy Superhighway

Just how much information is out there, anyway?

by K. Kinoshita

As its very name indicates, energy is the main focus of the ECS Energy Technology Division. Any discussion of energy-related topics usually revolves around statistical data, often presented in different energy units. Take for example the unit of energy referred to as "quad" or "quadrillion." It is equal to 1 x 10^{15} BTU or 1.825 x 10^{8} barrels of oil equivalent. These are large numbers and not easy for the layman to comprehend. For ECS members, the unit of energy which is probably more familiar is the kilowatt hour (kWh), which is equal to only 3.412 x 10^{3} BTU or 3.412 x 10^{-12} quad. Thus, our unit of energy is like a small fish in a large ocean of quad energy. No problem; we can strive for parity by introducing the megawatt and gigawatt. These large numbers are needed when we think of the consumption or availability of energy on the global scale.

The 5th anniversary of ***Interface*** is a good time to look back to the time of its origin and to the future. One might ask, with respect to energy, what has changed in the past five years and what does the future hold? With the use of the World Wide Web, it is relatively easy to find some interesting statistics to answer these questions. Entering the Internet superhighway does not require the brains of a rocket scientist or the skill of a computer nerd, just the patience of an electrochemist will do. Once you get over the cyberspace jargon, the drive on the Internet superhighway can be very pleasant. This article illustrates one journey on the information superhighway to seek historical data and predictions on world oil consumption and sources of energy.

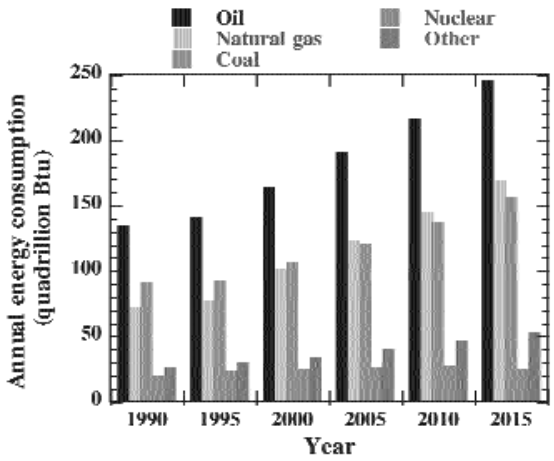
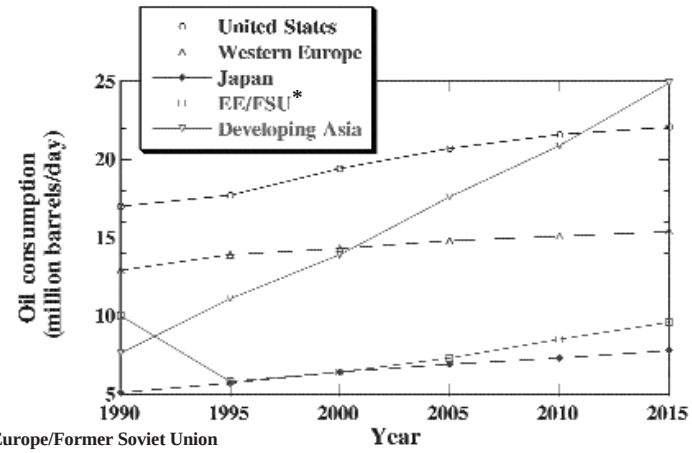


FIG. 1. Global energy consumption (1990 and 1995) and predictions from 2000 to 2015.



*** Eastern Europe/Former Soviet Union**

FIG. 2. Daily oil consumption in different geographical regions (1990 and 1995) and predictions to 2015.

Before the Internet became so pervasive, gathering statistics on energy required a trek to a library and countless hours searching through books and journals. Now there is a wide range of Internet sites which provide information at your fingertips with the click of the mouse. This is illustrated by the different Internet web sites (listed in TABLE 1) which are relevant to energy-related topics. A casual check (on September 12, 1997) using a search engine and the categories Science, Energy, and Electrochemical, with the key words "electrochemical energy analysis" resulted in 70,900 "hits." ECS (http://www.electrochem.org) was well represented with many references to its meetings and publications (the **Journal**, Proceedings Volumes, ***Interface***, Abstracts, etc.). Another search attempt using the key words "electric vehicles" produced over 800,000 hits. It would be a very time consuming process to search all of these web sites to find useful information on the subjects of electrochemical energy analysis or electric vehicles. One approach is to narrow the search by using more specific key words. The bottom line is that there is a wealth of energy-related information on the Internet superhighway, but finding relevant material requires more effort.

For this article, the search was narrowed considerably by searching the

statistical data available on the Internet sites from the U.S. Department of Energy. Starting from the home page for the Energy Information Agency (EIA), one can quickly arrive at the web site for information on the 1997 "World Energy Outlook," at the Internet address given in TABLE 1. The following discussion is based on information derived from the EIA Web site.

The amount of energy from various sources that is consumed annually in the world is illustrated in FIG. 1 for the periods 1990 and 1995, and the predictions from 2000 to 2015 are also noted. The prominent role that oil plays as an energy source is clearly evident, and its consumption is projected to remain high to the year 2015. Consumption of natural gas and coal, while less than that of oil, is expected to increase, with natural gas showing a greater annualized increase (4.0% versus 2.6%). The increase in consumption of coal is projected to be comparable to that for oil (2.8%) and other sources (2.9%). On the other hand, nuclear power is projected to grow very slowly (0.4%) to the year 2015.

Oil plays a major role in our everyday lives, and nowhere is that more evident than in the United States, and particularly in California. FIGURE 2 is a graph showing the daily oil consumption in different geographic regions of the world in 1990 and 1995, and the corresponding projections to the year 2015. Not too surprising is the fact that the United States (50 states and Washington, DC) consumes more oil than any of the other regions shown in the figure, and this is expected to continue far beyond the next decade. Oil consumption in Western Europe is not projected to change significantly over the period from 1990 to 2015, annualized at 0.5%. The disruption in the economies of the former Soviet Union (FSU) and Eastern Europe (EE) produced the large decrease in consumption between 1990 and 1995. However, positive growth in their economies and increased oil consumption is expected beyond 1997. In Asia, Japan is expected to increase oil consumption by about 1.4% annually, slightly higher than that for the U.S. at 1.1%. The most dramatic changes in oil consumption are expected from the developing countries in Asia, namely China, India, and the southeast Asian countries. Here, the oil consumption is projected to increase by an annual rate of 4.1%. This large increase in oil consumption will occur through the increase in demands of the transportation sector, particularly in China. This should also be an expanding market for battery- and fuel-cell-powered vehicles (cars, buses, bicycles).

Compared to 1995 when the world oil production rate was 70 million barrels/day, it is expected to reach nearly 105 million barrels/day in 2015, an increase of about 50%. This production rate is expected to keep up with world demand, totaling 104.6 million barrels/day in 2015. Looking at the world's leading oil consumer, the United States, the numbers are still daunting. In 1995, the U.S. was responsible for 25.5% of world oil consumption, and it is still projected to be 21.1% in the year 2015.

What have we learned from this simple exercise and the information that was presented? One, useful information is available on the Internet. Two, an overflow of information can be found. Of particular significance to those of us who have spent the better part of our careers on energy-related R&D is the underlying environmental issues that must be addressed with the increase in energy consumption. These concerns are considered in numerous reports and meetings of ECS. As might be expected, such information is also found on the Internet. Your assignment is to find it before the next five years pass. ■

About the Author

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Table 1. Internet sites for energy-related topics.

Energy efficiency and renewable energy network (sponsored by the Department of Energy)	Energy database (sponsored by the U.S. Environmental Protection Agency)
www.eren.doe.gov	gem.crest.org
www.eren.doe.gov/AB	Geothermal
International information on renewable energy technologies (sponsored by the International U.S. Department of Energy)	www.demon.co.uk/geosci/igahome.html
www.caddet.co.uk	Nuclear
World energy outlook (sponsored by the Energy Information Agency, U.S. Department of Energy)	www.nirs.org
www.eia.doe.gov/oiaf/ieo97/world.html	Photovoltaics/solar
Alternative fuels	www.ases.org/solar www.ises.org
www.biofuels.doe.gov	www.psic.org www.seia.org
www.ethanolRFA.org	Wind
Biomass	www.igc.apc.org/awea
www.biomass.org	Wood
www.crest.org	burningissues.org/bi
Electrochemical Science and Technology Information Resource	Environment
electrochem.cwru.edu/estir	www.ilsr.org
	www.ucsusa.org