Conventional Energy Resources and Reserves

1. THE RESOURCE/RESERVE SPECTRUM

To understand what is meant by energy availability in Canada requires an appreciation of the terms *reserves* and *resources*. Consider the following quote from the 1926 *Book of Popular Science* which reflected a widely held view of the time:

> ...it is apparent that the supply of petroleum will soon be exhausted, and even now gasoline is becoming expensive. New and advanced methods of production may add to our supply somewhat, but unless new oil fields are discovered, the end of this commodity is not far off. We must look elsewhere for fuel for automobiles. Distillates from vegetable products can be made that will work well in gas engines and the hope of the future appears to lie in this direction. *(The Book of Popular Science,* Grolier, N.Y., 1926, p. 570)

The authors further predicted that the automobile was destined to play a diminishing role in American life, with the horse returning to a well-deserved position of prominence. The statement contains elements of fact as true in 1981 as they were in 1926, but the erroneous conclusion was based on a misinterpretation (or ignorance) of the distinction between reserves in the ground and ultimately recoverable resources.

Any estimate of a country's natural energy resources — be they petroleum, forests, or wind energy — must specify cost criteria and a time frame for exploitation unless we are speaking of an ultimate "resource base", a concept which has little application in any practical sense. It is apparent, then, that meaningful long-term forecasts of resource availability cannot be made because the course of technological advance, politics and economic policy is unpredictable.

Figure 3-6 provides a framework within which any natural resource can be categorized. Although its usefulness is biased towards "nonrenewables" such as petroleum, natural gas, coal and uranium, one can see how the spectrum of potential hydro-electric generation sites or biomass energy production schemes, to give two examples, could be assigned places on an adaptation of the diagram. Looking at natural gas for instance, it is apparent that all such deposits can be assigned to one or another quadrant of the figure, with currently-producing fields belonging to the "reserves" quadrant. Other gas resources are either known and uneconomic, or undiscovered, whether economic or not.

The missing dimension in the diagram is that of time. As time progresses, the positions of all deposits plotted on the graph tend to move towards the "extraction and processing" arrow: subeconomic resources become economic; undiscovered resources are discovered and eventually become economic. Nevertheless, the path taken by a specific deposit over time may be a tortuous one. What factors cause resources to become reserves or, conversely, cause former reserves to become subeconomic? The principal reasons are shifting consumption patterns, the release or formation of stockpiles, and changing government policies — all three factors tend to be interrelated.

It is important to bear in mind two constraints upon the reserve and resource estimates presented here. First, reserve estimates apply only to present economic conditions. Second, supply and demand projections, while useful, are highly speculative beyond the short term. A third consideration relates to physical limitations upon the rate of delivery of a resource — the fact that a reserve is present in large quantity by no means guarantees that it is or will be producible at a rate sufficient to meet demand. The creation of a new oil sands plant, for example, can easily require a decade from conception of the project to the first production of synthetic crude oil, and limitations on capital and manpower availability could force a slower rate of development than might otherwise be desired. Even a producing deposit is subject to rate-related constraints — crude oil is extractable from a reservoir at a rate determined by the viscosity of the oil, the characteristics of the reservoir rocks and well spacing.

2. HYDROCARBON RESOURCES

Hydrocarbons are organic compounds consisting of carbon and hydrogen, and these compounds may exist as gases, liquids or solids. Crude oil, natural gas and coal are essentially mixtures of hydrocarbons of varying degrees of complexity and containing varying amounts of impurities such as sulphur.