

## Hydrocarbons in General

In the developed world, hydrocarbons have been the primary energy source for decades. Hydrocarbon sources of energy include oil (yielding gasoline, liquid petroleum gas [LPG], fuel oil, and feedstock for the petrochemical industry), natural gas, and coal.<sup>i</sup> Together, these three account for more than 85% of the energy consumed in the U.S.<sup>ii</sup> All three contain hydrogen and carbon atoms, hence the name hydrocarbon. The exact composition of each is a mixture of hydrocarbon compounds and of contaminants (like sulfur) that change from field-to-field, mine-to-mine. Not all oil is refinable, not all coal is burnable. The carbon in hydrocarbons is the primary source of carbon dioxide (CO<sub>2</sub>) implicated in global warming. Hydrocarbons are also a primary source of other pollutants, such as sulfur dioxide, nitrous oxides, ozone, and particulates. Industrial processes can convert forms of hydrocarbon into each other, although the processes have significant energy, pollution, and economic costs.<sup>i</sup>

Hydrocarbons come from wells or mines. Although exploration and recovery methods have improved over time, the geological conditions required for hydrocarbon formation are uncommon. Humans have exploited hydrocarbons for so long that the “low hanging fruit” was picked long ago. Recovery of hydrocarbons now involves significant technical challenges, working in difficult environments, and dealing with politically unstable countries. Estimates of the amount of remaining hydrocarbon reserves vary, but all agree that they will eventually get used up. The amount of total reserves is different from the amount of recoverable reserves, which is entirely different from the rate of production. Rate of production of a known hydrocarbon resource is limited by geological conditions and other factors, not just by total reserves. Thus, it can’t always be ramped up as demand increases.

Hydrocarbons must be transported in huge volume from recovery site to user, a significant challenge, and historically some hydrocarbon fields have been “stranded” because they could not be practically or economically transported.<sup>i</sup>

Of the hydrocarbons, oil is the most energy dense and easiest to transport, but it is also the most depleted and the second most polluting. Coal is the second most energy dense, the most plentiful (especially in the U.S.), and second easiest to transport, but it is the most polluting. Natural gas is purest and contains the least carbon, hence it is the least polluting. However, it is the least energy dense, and if there is no pipeline nearby, the most difficult to transport. It is the second most depleted.<sup>i</sup>

Many large industrial uses can consume either oil or natural gas, and electrical generation can use coal as well. Transportation, however, requires a dense energy source that is safe and easy to transport and which can be burned in a compact engine. Under current technology, only oil distillates and ethanol meet those requirements. Thus, until technological challenges are met, oil is our only really viable energy source for transportation. That is why the possibility that oil may be coming into short supply presents us with a challenge that is so important to meet.<sup>i</sup>

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- <sup>i</sup> Nersesian, Roy. (2007). *Energy for the 21<sup>st</sup> Century*. Armonk, NY: M.E. Sharpe.
- <sup>ii</sup> *Annual energy review, 2006*. U.S. Energy Information Administration.