16.11: Green Chemistry for Sustainable Prosperity and and a Safer World

Poverty, human misery, and hopelessness are conditions that feed terrorism. Although eliminating these conditions would not guarantee a safe world, reducing them would go far toward ensuring safe societies. People with satisfied material needs able to lead comfortable and fulfilling lives are relatively less likely to commit violent acts. To the extent that the practice of green chemistry fulfills human needs and makes life more comfortable, it can play a significant role in reducing terrorism.

Prosperity, narrowly defined, has resulted in consumption of increasingly scarce resources and environmental degradation. But, as stated by Elsa Reichmanis, a former President of the American Chemical Society, “We are past the days when we can trade environmental contamination for economic prosperity; that is only a temporary bargain, and the cost of pollution both economically and on human health is too high.”[6] Green chemistry and the practice of industrial ecology can go far in providing high living standards without ruining the environment or recklessly exploiting resources.

The key to material prosperity consists of sources of abundant, inexpensive energy that can be tapped sustainably without major environmental harm; with such energy sources, all else is possible. Energy sources tend to be contentious and competition for them has precipitated past wars. Some of the most abundant producers of petroleum, currently the key energy source for industrialized nations, are regions that are breeding grounds for terrorists. The provision of adequate energy independent of such sources would substantially reduce terrorist threats.

Figure 16.5 shows how abundant, sustainable energy is the foundation of the kind of prosperity that can lead to less terror-prone societies. Abundant energy can be used to produce food through synthesis of fertilizers (particularly by synthetic fixation of atmospheric nitrogen)and for irrigation, cultivation, and reclamation of farmland. Energy can be used to fabricate materials for housing and to provide the heating, cooling, and lighting required to make dwellings comfortable. Energy is required to pump water, in some cases over great distances from abundant sources to more arid regions. Energy can be used to purify water of marginal quality and to reclaim water after use. With an abundant source of energy, seawater can be desalinated for domestic, industrial, and agricultural use. Safe, comfortable, non-polluting transportation systems require an abundance of energy. These and other amenities based upon abundant, sustainable energy can go far toward building peaceful, productive societies with high living standards. They do not guarantee tranquility and prosperity because reasonable social systems, functional democratic governments, and sensible religions are needed as well, but material well being based upon a foundation of abundant, sustainable energy can go far in eliminating conditions that breed terrorism.

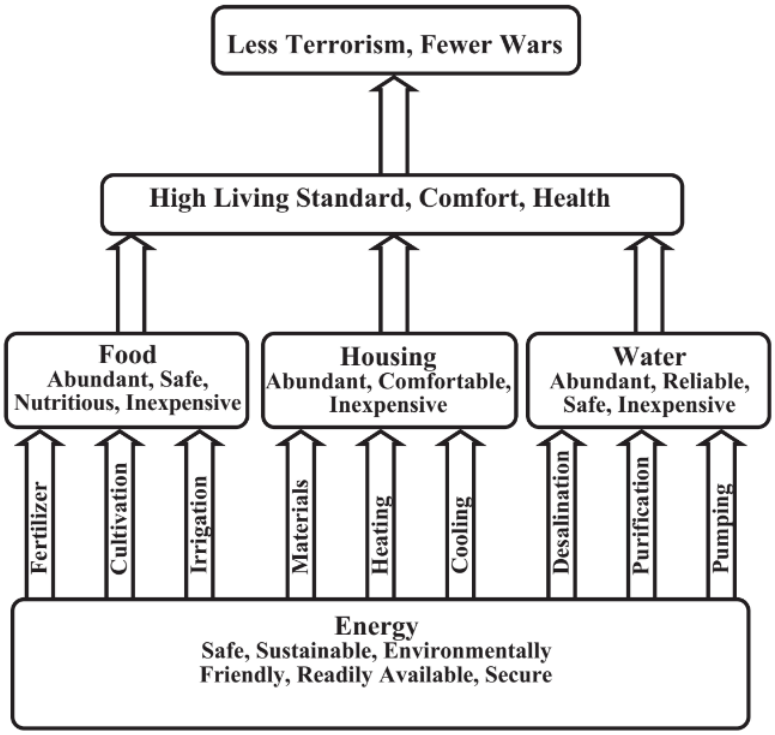

Figure 16.5. Abundant, sustainable energy is the base of a pyramid through which greater human well-being combined with suitable political and social systems leads to less conflict and terrorism

The provision of abundant, sustainable energy in the future requires the best practice of green chemistry, green engineering, and industrial ecology. Increased efficiency of energy utilization is a key aspect of providing more usable energy. Solar, wind, and biomass energy are leading contenders for renewable energy sources. Another essentially inexhaustible energy source is thermonuclear fusion, the stuff of hydrogen bombs and the sun's energy, but despite significant investments, a practical controlled system of energy production from this source has proven elusive. Fossil fuels will play an interim role, especially if sequestration of greenhouse gas carbon dioxide byproduct can be achieved. Despite its bad reputation in some quarters, nuclear fission with uranium and perhaps thorium fuel can provide abundant energy safely with new-generation nuclear reactors and with reprocessing of nuclear fuel.

A key challenge in providing abundant renewable energy is its storage and transport. Wind and solar sources are by nature intermittent and dispersed, and they often produce electricity in locations far from where it is used, so the energy that they generate must be moved over long distances and stored for later use. For example, solar collectors function only in daytime and, aside from rooftop installations, are often located in remote desert locations. Wind-powered electrical generators, which require at least some wind, are not usually welcome in urban areas where the energy is required, and some of the prime locations for them are the remote plains of Kansas orTexas or offshore. Superconductor or quantum conductor power cables are candidates for transport of electrical energy from source to use. Various means are available for energy storage, such as pumped water hydroelectric storage or high-speed flywheels coupled with electric motor/generators. In the future, elemental hydrogen, H2, will be widely used for energy storage and transport as well as for fuel. Hydrogen can be produced by electrolysis of water and direct photoconversion of water to hydrogen and oxygen may eventually become practical. Hydrogen can be moved by pipeline and used to produce electricity directly in fuel cells.
