

## ALTERNATIVE ENERGY

*Elena Karaganova, Ekaterina Konchenko*  
*Donetsk National Technical University, Ukraine*

The people of the world will need to use every conceivable source of energy to sustain a burgeoning population living on a planet of limited space and resources. Fossil fuels are clearly limited resources, and serious environmental and ecological effects are associated with the use. Nuclear energy, thought by some people to be the salvation of the world's energy needs, is inhibited in development by public apprehension concerning its safety. However, there are several renewable energy sources in addition to direct solar and biomass that may, in the future, contribute a very important mix to the world's energy supply. These alternative energy sources include ocean temperature differences, ocean currents, tides and waves, wind, geothermal, and hydro. These energy sources are generally dispersed, with the exception of geothermal, and have fewer associated environmental, ecological, health, and safety problems than do fossil or nuclear fuels. They are best utilized for generating electric power or for manufacturing energy – intensive products such as hydrogen gas or ammonia. Hydrogen gas may be conveniently transmitted through pipelines and burned without any carbon dioxide, carbon monoxide, or sulfur dioxide emissions. Hydrogen may also be used to energize fuel cells. Ammonia is in great demand for fertilizer and its production by alternative means to use as natural gas could save enormous quantities of petroleum.

Ocean thermal, ocean currents, tides and waves, wind, hydro, and geothermal power are self – renewing energy resources that may be tapped to various degrees for the extraction of power. In each case, nature provides a higher concentration of these resources at certain sites than at others. It is at these sites that extraction of some of the energy is most practical. Only certain estuaries possess the highest tides; certain coasts, islands, or mountain passes the highest winds; steep mountain valleys the greatest hydro potential; and hot magma areas near the surface the greatest geothermal possibilities. The equatorial and subequatorial oceans have the greatest temperature difference between surface and deep water. Great ocean currents sweep the coastlines of the world. Even the swiftest of these – those currents in equatorial regions along the western boundaries of the oceans – are of very low energy densities. It is unlikely that ocean currents will be used to generate much power. Tidal power is the most widely distributed of these, but it is not generally located at useful sites.

Alternative energy sources – solar, wind, geothermal, ocean thermal, tides, ocean waves, hydro – can only provide a fraction of the total power required by a burgeoning world population living in an industrialized society. There are all dispersed energy sources and they cannot provide the concentration of power needed except at very low efficiencies. On the other hand, oil, gas, coal and uranium are highly concentrated energy forms but each has a finite supply.

The people of the world are in an environmental vise between carbon dioxide and acid rain on the one hand and radioactivity on the other. Populations overrunning food production are dying and millions of people are suffering from impoverished ecosystems today. Soil erosion is occurring at an alarming rate and no less so within the developed than among the developing nations. As soil deterioration occurs, more and more nutrients must be supplied to maintain crop productivity. However, nutrients, particularly nitrogen, require petroleum for the production, and petroleum shortages will eventually be commonplace.

Estimated quantities of oil, gas, coal and uranium resources will continue to change as new discoveries are made – or fail to be made. Even estimates concerning the amount of power derivable energy sources will change considerably as technology improves and our understanding of each source increases.

We can choose to live in a fool's paradise for a while longer, but the day of energy reckoning will come and our children and grandchildren will pay for our profligate waste.