

## Energy Sources for the World's Post-Petroleum Era

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America consumes petroleum products at the rate of 18 barrels per year per person. Predicted for the year 2025 is a world population of 9.1 trillion persons. If their standard of living has advanced to that enjoyed by Americans today, then their 18-barrel-a-day per person oil consumption will have exhausted the world's oil resources. Energy conservation and development of alternative energy sources will be needed. Farm-grown fuel, such as ethyl alcohol, and forest-grown pulp, would not be available because all arable land will be needed for food production. Heat energy rising from the Earth's core can be captured with water circulated through deep wells. Solar energy can be captured with high-efficiency solar cells, but a 50-story apartment building's roof can't intercept enough solar energy to power the residents' 24-hours-a-day, 365-days-a-year needs. Combined-cycle nuclear power plants can supply heat energy to nearby factories and buildings. Transportation is our big energy consumer. The Queen Mary burned 6 barrels of oil per mile traveled. A cruise ship towed by a nuclear-powered submarine requires no propulsion power. The ultimate water-travel efficiency would be based on the hydrodynamics of a dolphin that can swim 3000 miles on food that contains the energy in one gallon of gasoline. No petroleum is needed for land travel if the propulsion power is supplied by fuel cells consuming hydrogen, zinc, or aluminum. Their waste products can be electrolyzed into storable fuel with solar power. An ultimate vehicle for land travel is a streamlined electric bicycle that consumes only 100 watt-hours per mile. These and other options for achieving the coming need for reducing petroleum consumption are quantitatively evaluated.