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A Conspectus on US Energy

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Until about 1850, the energy used in the US came almost exclusively from firewood. Now we use petroleum, coal, natural gas, nuclear fission, indirect solar energy (biomass, hydro, and wind), geothermal energy, and direct solar energy (solar/thermal, solar/thermal/electric, and photovoltaics). Compared to our ancestors in 1850, we use over 40 times as much energy, of which only about 6 percent is from solar sources, versus 100% in 1850. On a per-capita basis we use about 3.1 times as much energy, in spite of the modern conveniences that to Abraham Lincoln would seem unthinkably lavish. The US uses about 107 EJ of primary energy annually, equivalent to 3.4 TW around-the-clock average power. About 40 percent of that energy goes toward production of electricity. Approximately 2 EJ of heat is obtained from combined heat-and-power plants that produce about 10^9 kWh (3.6 PJ) of electricity. (N.B.: hydro and wind do not involve heat-to-work conversion. By custom, the electrical energy produced by wind and hydro is multiplied by about 3 to generate an as-if quantity of primary energy.) When account is taken of how the electricity is distributed, industry uses 33 percent of the primary energy, followed by transportation (28%), residences (21%), and commercial establishments (18%). “Fossil fuels” (coal, oil, and natural gas) account for about 85 percent of our primary energy. Nuclear energy accounts for about 8%. Biomass and hydro, the venerable solar-derived sources, account for about 7%. Geothermal, wind, and direct solar energy account for about 0.4%. This talk will discuss prospects for various alternative sources, including nuclear fission and T. Boone Pickens’ plan to displace imported petroleum indirectly by substituting wind for natural gas.