

SOME FACTS ABOUT NUCLEAR, SOLAR AND WIND POWER

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Today there are 104 commercial nuclear power plants in the U.S. These produce about 20 percent of our electricity. About 440 nuclear power plants supply about 16% of the world's electricity. All these plants use uranium 235, which makes up only 0.7% of natural uranium. In a U-235 power plant, only 1% of the energy is recovered; the rest is nuclear (radioactive) waste. If the number of this kind of nuclear plant were increased to provide about 40% of the present use of fossil fuels, all known uranium deposits would be mined and used in about 30 years. Nuclear power plants require a long time to build. So conventional power plants are neither a long-term nor a short-term solution to the world's energy needs.

Three types of uranium occur in nature: uranium-238, which accounts for approximately 99.3% of all natural uranium; uranium-235, which makes up about 0.7%; and uranium-234, which makes up about 0.005%. Uranium-235 and uranium-238 are two naturally radioactive isotopes of uranium. Uranium-235 is the only naturally occurring fissionable material and therefore is essential to the production of nuclear energy. Uranium is processed (called enrichment) to increase the concentration of uranium-235 from 0.7% to about 3% produces enriched uranium, which is used as fuel for the fission reaction.

Standard (non-breeder) reactors have a lifetime of about 30 years after which they have to be decommissioned. Since so much of the power plant is radioactive by this time, decommissioning is a serious problem. Decommissioning or modernization of a nuclear power plant is a controversial part of the uranium cycle with which we have little experience. Contaminated machinery must be disposed of or stored so that environmental damage will not occur. Decommissioning or refitting will be very expensive (perhaps \$200 million to \$500 million) and is an important aspect of planning for the use of nuclear power. It is possible that dismantling of old decommissioned reactors may become one of the highest costs for the nuclear industry. The resulting radioactive wastes await a place to store them for 10,000 plus years.

Uranium mining also creates radioactive wastes. Mine tailings (materials that are removed by mining activity but are not processed and remain at the site) from uranium mines and mills must also be considered hazardous. In the western United States more than 20 million metric tons of abandoned tailings will continue to

produce radiation for at least 100,000 years.

ALTERNATIVE ENERGY

The estimated recoverable energy from solar energy is about 1,000 times the present human global energy consumption of 10 TW (~320 exajoules) per year. Ten weeks of solar energy is roughly equivalent to the energy stored in all known reserves of coal, oil, and natural gas on Earth. Solar energy is absorbed at Earth's surface at an average rate of 120,000 TW (one TW is 10^{12} W), which is 10,000 times the total global demand for energy.

We only need to be 0.1% efficient in converting solar energy to usable energy for sunlight to provide the present world consumption of fuels. Present photovoltaic devices (that convert sunlight to electricity) are 10% efficient. If we would only be able to put solar energy devices on 1% of the area where there is recoverable solar energy, all the world's energy needs could be met with solar energy alone. The technology to do this exists now.

If we were able to put photovoltaic devices on 10% of the area where there is recoverable sunlight, in two years enough electricity would be produced to equal all known reserves of coal, oil and natural gas. If we only used 1% of the recoverable at 10 % efficiency, it might take 20 years to produce electricity equal to all known reserves of coal, oil and natural gas.

Wind energy provides similar potentials. It's believed that there is sufficient wind energy in Texas, South Dakota, and North Dakota, to satisfy the electricity needs of the entire country.

The world's largest wind farm is being built on the Oregon-Washington border. The facility will include over 450 windmills sited on ridges above the Columbia River. Total power output, W300 MW, is about one-third of that produced from a large fossil fuel of nuclear power plant. The cost of producing the electric energy will be about \$0.04 (4 cents) per kilowatt hour, compared to as much as \$0.20 (20 cents) per kilowatt hour for electricity from burning natural gas.