

## 20 Things You Didn't Know About... Nuclear Power

**1** Nuclear power is the safest-ever way to make electricity, by a very wide margin. Only 43 deaths are attributed to nuclear power in its entire worldwide history – all at Chernobyl: 28 plant workers and emergency responders died from Acute Radiation Syndrome and, compared to the average of previous decades, fifteen excess fatal cases of thyroid cancer occurred between 1992 and 2003. **2** There is no scientific way to determine whether a particular cancer in an individual was caused by radioactive materials. WHO says there is no evidence of ongoing increase of cancer risk in Eastern Europe. **3** In 2002 alone, in Britain alone, 88 deaths were attributed to wind power. **4** If the residents of Fukushima were to return to their homes, their additional lifetime radiation exposure would be equivalent to one trans-Pacific airline flight, one CT scan, or living at 5,000 feet elevation. **5** There was no significant release of radioactive materials from Three Mile Island. **6** Used nuclear fuel consists of 5.2% fission products, and 94.8% unconsumed fuel in the form of actinides (uranium plus transuranic elements). **7** Converting one tonne of actinides to fission products can produce one gigawatt year (nine billion kilowatt hours) of electricity. **8** Fission products require special custody for 200-300 years – a trivial problem: Concrete dockworks poured 2,000 years ago by the Romans at Caesarea in Israel are still intact. **9** Actinides require special custody for 300,000 years. Today's light-water reactors cannot consume all actinides in their fuel. **10** A different type of reactor, a fast-neutron reactor, can consume all actinides in unused fuel, and nothing else can do it. If unconsumed fuel were separated from fission products, and completely used, Yucca Mountain would not be needed. If used fuel is not reprocessed and the actinides not consumed, eight Yucca Mountain-size facilities will be needed before the end of the century. **11** The system used in France and elsewhere to reprocess used fuel separates only plutonium and uranium from fission products, leaving other actinides mixed with

fission products. Such a facility occupies thousands of acres and has kilometers of pipes because concentrations of actinides must be kept very small to prevent criticality accidents. **12** Fission products and unconsumed actinides can be safely separated almost completely by an electrical process using a device the size of a washing machine, for each reactor. This does not separate actinides one from another, and in particular does not separate plutonium from the other actinides. A one GWe fast-neutron reactor facility would need to process about four liters (32 kg) of used fuel per day. **13** A fast-neutron reactor operated by Argonne National Laboratory at Arco, Idaho until 1994, called EBR-II, was proven to be inherently safe. Pete Planchon, the engineer who conducted the test for an invited international audience wrote “Back in 1986 we gave a prototype fast reactor two chances to melt down; it politely refused both times.” **14** After its cooling system was shut down, the core was below operating temperature within 700 seconds, without any moving parts or operator action. The reactor was not damaged. The operators were not harmed. There was no release of radioactive materials. **15** It is impossible for any kind of nuclear reactor to cause a nuclear explosion. **16** Used nuclear fuel is the most difficult substance from which to make weapons; nobody has done it (except maybe India). **17** The 80,000 tonnes of used nuclear fuel and 900,000 tonnes of depleted uranium in the United States today could provide all US electricity for 2,178 years, or all US energy for 575 years. **18** There is enough uranium in the world to provide all of humanity's energy needs for a million years. **19** Only nuclear and solar can supply all of humanity's energy needs without emitting CO<sub>2</sub>; everything else combined can only provide about 27% of today's needs. **20** In eight of ten countries surveyed, nuclear power provides the lowest-cost electricity (USA and South Korea excepted). Russia and China were not surveyed. The Diablo Canyon Nuclear Generating Station provides the lowest-cost electricity in California.

## More facts

21. All of the fuel necessary for the entire service life of a one GWe fast-neutron reactor, a cube about 6 feet on a side, could be delivered when it is built.
22. Once started, a fast-neutron reactor does not need enriched uranium fuel.
23. There is enough fissionable fuel in the United States in the form of 5.2%-used fuel and decommissioned weapons to start about 150 GWe of fast-neutron reactor capacity immediately.
24. Fast-neutron reactors can be operated in a mode that makes more fissionable fuel than they consume, without enriching uranium.
25. By using fast-neutron reactors, it would never again be necessary to enrich uranium to supply electricity. Anybody who has a fast-neutron reactor and claims to need to enrich uranium for civilian electric power is lying: The enrichment is for military purposes.
26. Liquid hydrocarbon fuels for ships and airplanes could be manufactured in a carbon-neutral way from CO<sub>2</sub> + water + energy.
27. It's safer to work in a nuclear power station than to be a stock clerk at Macy's.
28. Russia has had liquid-metal cooled fast-neutron reactors in civilian electric power generation service for decades. An 800 MWe facility is in service and a 1200 MWe facility is being designed. Russia has contracted to sell an 800 MWe facility to China.
29. American nuclear power engineers and scientists are retiring or dying faster than new ones are being prepared. America will soon be a third-world country in electric power production.
30. Every year, about 30,000 Americans die prematurely from the effects of burning coal.
31. America's coal-fired power plants produce 100 million tonnes of eternally-toxic solid waste per year.
32. A typical coal-fired power plant emits four tonnes of uranium and fifteen tonnes of thorium into the environment every year. There is 19 times more energy in the waste than was produced by burning the coal.
33. The level of radioactivity adjacent to a coal-fired power plant is several times more than the level of radioactivity adjacent to a nuclear power station.
34. The level of radioactivity outside a sea-level nuclear power station is lower than the level of radioactivity in a wheat field near Denver.
35. A GE/Hitachi consortium estimates they could build modular fast-neutron reactor systems, called S-PRISM, for less than \$2/watt.
36. Plutonium is not the most poisonous substance known. It is less chemotoxic than lead.