Argonne NATIONAL LABORATORY

Nuclear Energy FAQs

What is nuclear energy?

Nuclear power plants split uranium atoms inside a reactor in a process called fission. At a nuclear energy facility, the heat from fission is used to produce steam, which spins a turbine to generate electricity. At this point a nuclear plant is similar to a coal or gas or solar thermal plant; those energy sources also generate steam through heat to spin a turbine. The main difference is therefore how the heat is generated.

What is the difference between natural radiation and radiation from nuclear energy?

Radiation is present at all locations where people live and comes from various sources (solar radiation, terrestrial radiation from the ground), and this level of background radiation changes with people's everyday activities (eating certain foods, flying on a plane, getting an x-ray, where they live on the Earth). However, human bodies are designed to live in an environment with ever-constant radiation at the levels we experience here on Earth. The tiny amount of radiation that comes from a nuclear reactor is the same type of radiation that can be found through these natural sources, and because the radiation from nuclear energy is far below natural levels, there is no threat to a person who comes into contact with it.

Does nuclear energy produce greenhouse gases?

There are no emissions of greenhouse gases such as carbon dioxide, nitrogen oxides and sulfur dioxide during the production of electricity at nuclear energy facilities. It also doesn't create any particulate pollution. Nuclear energy is the only clean-air source of energy that produces electricity 24 hours a day, every day.

Isn't Fukushima a good reason not to build nuclear plants? Isn't that area now uninhabitable?

No on both counts. The radiation levels near the Fukushima plants have been low enough for human habitation and for growing crops for many months, and people have started returning to their homes. The Fukushima reactors were among the oldest in the world and could have been updated to higher safety standards, had the utility that owns them been willing to spend money to do so (the few commercial reactors in the U.S. of this same design have had these updates made). The newest commercial reactor designs differ considerably from the Fukushima reactors and have features that would have prevented the failures that occurred following the tsunami at Fukushima.

Will radiation from Fukushima be of concern along U.S. and Canadian coasts?

Even near the Fukushima plants, the contamination in the sea is so low that it is not a health hazard, as the radiation levels are significantly less than background radiation. From that low level, it is diluted as it crosses the ocean. Levels of any Fukushima contaminants in the ocean will be many thousands of times lower after they mix across the Pacific and arrive on the West Coast of North America in 2014. At the levels expected even short distances from Japan, the Pacific is safe for boating, swimming, etc.

Don't nuclear power plants spew out a lot of radiation?

No, they give off almost no radiation. Coal-fired power plants emit about 3 times as much radiation as a nuclear power plant, all from naturally occurring radioactive materials. Radiation exposure from a nuclear power plant is 1/300 as much as natural background levels of radiation.

Won't a lot of radiation be released if a nuclear plant loses power because of an earthquake, or a hurricane, or a terrorist attack?

No. U.S. reactors have many more additional ways of cooling the reactors in a blackout than did the Fukushima reactors, which had not been updated to handle heat removal following a loss of electricity to the plant. If a blackout occurs, a reactor immediately shuts down (as did the Fukushima reactors); the difference with newer reactor designs is that the remaining heat from radioactive decay is continuously removed whether there is available electricity or not, thus preventing fuel melting and keeping the radioactive material secured within the reactor.

Can't a nuclear power plant explode like a nuclear weapon?

It is impossible for a reactor to explode like a nuclear weapon. Nuclear weapons contain very special materials in very particular

arrangements, neither of which is present in a nuclear reactor. Explosions that occurred at Fukushima were driven by a build-up of high-pressure gases (hydrogen and steam), and the resulting explosion is similar to a can of soda exploding upon impact. In the U.S., these explosions would not have occurred – the gases would not have been allowed to build up.

What about the huge amounts of nuclear waste from nuclear power plants? There's no way to get rid of it, is there?

Used fuel isn't "waste"—96 % of this "waste" can be recycled to make new nuclear fuel rods. And it isn't a huge amount, it's a tiny, tiny, tiny amount compared to waste products from other on-demand energy sources. All of the used nuclear fuel generated in every U.S. nuclear plant in the past 50 years would fill a single football field to a depth of less than 10 yards. And the radioactive material left over from recycling would need storage for less than 300 years to become no more radioactive than ordinary bricks and stones.

Isn't it dangerous to store spent nuclear fuel?

No. Used fuel is currently being safely stored at power plants, first in big pools of water, then, after several years, in concrete casks. Used fuel is so well shielded that divers routinely plunge into the storage pools to complete surveillance inspections, and they do not get any significant dose of radiation.

Isn't it easy for terrorists to steal uranium or plutonium from nuclear plants and make bombs?

Plutonium is present only in spent fuel, and the spent fuel radiation levels, plus the very strong and thick steel and concrete structures where the spent fuel is kept, make this material essentially impossible to access and carry away (which means nuclear plants also don't provide terrorists with opportunities to steal radioactive materials for dirty bombs). Fresh fuel contains only uranium, which is very heavy and is inside fuel bundles that weigh roughly 1,000 pounds and are about 12 feet tall – again, very hard to steal. In addition, the uranium composition in commercial nuclear fuel is the wrong type for bombs – bombs need over 90% U^{235}, whereas commercial nuclear fuel is no more than 5% U^{235}. Finally, nuclear power plants have very tight security, including armed guards, to ensure that both fresh fuel and spent fuel remain safe.

Why should we build nuclear plants that take 12 years to construct, when solar and wind farms can go up in a couple of years?

Nuclear plants don't take that long to construct. In China it takes 5 years from initial construction to commercial operation of a nuclear plant. After the initial few years of construction, a nuclear power plant operates for up to 60 years (compared to about 15 years for wind turbines) producing emission-free electricity for 1 million homes with very low fuel costs. Countries like China have the ability to implement long-term energy policies effectively so they are building or planning to build almost 100 reactors in the next few decades to reduce their carbon footprint while providing low-cost electricity.

Why are nuclear plants being shut down for economic reasons?

Current U.S. energy policy gives wind and solar power generators investment tax credits to build wind farms; wind also receives production federal tax credits of $22 per megawatt-hour. These subsidies mask the true cost of producing electricity by these methods, and they also mean that wind and solar plants are paid to produce energy even when profits are zero and power prices are negative. The costs of this upside-down pricing system then effectively get charged against nuclear and fossil fuel plants, since they don't receive these subsidies. So it isn't that nuclear power generation isn't cost effective; what hurts nuclear plants economically is a lack of fair pricing that would reflect the true costs of each type of electricity generation.

Won't we run out of uranium fuel for reactors?

The U.S. has large uranium reserves and could also purchase uranium from politically stable, friendly countries like Canada and Australia that also have large uranium deposits. These reserves, plus the ability to recycle used nuclear fuel, mean we have enough fuel for nuclear reactors for thousands of years.

Why shouldn't we use thorium reactor plants? Aren't they safer than uranium-fueled reactors?

We may use the thorium cycle some day when uranium runs low, or in countries with little uranium. But uranium fuel technology (especially recycling) is much more developed than thorium technology and therefore more commercially viable. All of the arguments commonly made in favor of thorium reactors are also true for advanced uranium reactors, including the safety arguments, and uranium advanced reactors are far closer to commercialization than are reactors using thorium technology, so there are no strong reasons to abandon uranium in favor of thorium.