American Electric Power

Issues in Electricity

Nuclear power at AEP

Nuclear power is an important resource in our energy portfolio. AEP's 2,191MW Donald C. Cook Nuclear Plant in Bridgman, Mich., provides low-cost electricity to I&M customers. Together, the two units produce enough energy to power approximately 1.5 million homes and represent approximately 48 percent of I&M's power generation portfolio. In 2005, the plant received license extensions from the Nuclear Regulatory Commission permitting the units to run an additional 20 years beyond the duration of their original operating licenses – until 2034 and 2037, respectively.

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Nuclear

Nuclear plants currently generate about 20 percent of U.S. electricity. In fact, The U.S. is the world leader in nuclear capacity and generation. There are currently 61 active nuclear plants with 99 nuclear reactors spread across 30 states in the U.S. The U.S. Nuclear Regulatory Commission issues 40-year licenses for commercial reactors. In addition, operators of nuclear reactors have the opportunity to apply for a 20-year license extension, upping the potential lifespan of a reactor to 60 years.

While nuclear is considered a reliable and low-carbon resource, it does have potential risks associated with it -- chiefly safety issues. Since the 2011 Japanese earthquake, tsunami and subsequent nuclear accident at Fukushima, seismic analysis and the potential for damage to a U.S. nuclear plant from an earthquake has been under review. AEP's Cook Plant was among an initial group of 10 plants required to complete the analysis. The 10 plants, including Cook, must submit a detailed risk analysis to the NRC by June 30, 2017.

AEP's Donald C. Cook Nuclear Plant

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How nuclear power is generated

Primary system:

- Enriched uranium pellets fill metal fuel rods. These rods are placed in the reactor core.
- The uranium pellets are made of billions of atoms. Each atom contains a nucleus that consists of protons and neutrons. During fission, when a uranium atom splits, it releases neutrons that hit and split other uranium atoms. When more neutrons are released than absorbed in other atoms, the fission becomes self-sustaining. This is called a chain reaction. The energy from the splitting of atoms produces tremendous heat.
- Control rods stop and start fission. Control rods are made of materials that absorb neutrons. When they are inserted into the reactor core, they stop the chain reaction by absorbing the extra neutrons. When the control rods are removed, the extra neutrons resume splitting the atoms and the fission process begins again.
- Boric acid also controls fission. Boric acid, which is dissolved in the primary system water, also absorbs neutrons. The fission can also be controlled by changing the concentration of boron in the water.
- Concrete and steel protect from radiation. Radioactivity is released during the fission process. The containment building's thick concrete and steel walls shield the public from radiation.
- Thousands of gallons of water absorb the heat from the fission. The primary system is pressurized so water flowing through the pipes will not boil.

Secondary system:

- Heat is transferred from the primary system pipes to the secondary system pipes changes water into steam. Heat, not water or radioactivity, passes between these closed-loop systems.
- The steam in the secondary system turns the turbine fan blades. The turbine shafts are connected to the rotor that also turns inside the generator.
- Electromagnetism makes electricity. As the generator rotor turns, coils of wire spin in a magnetic field. This produces electricity in an outer set of coils. The electricity flows to a transformer. The transformer increases the voltage so the electricity can travel long distances.

Condensing system:

- Intake pipes draw over a million gallons of water per minute into a condensing system. As the water enters the condenser, heat from the steam in the secondary system transfers to the third system. As the steam in the secondary system cools it changes to water that is pumped back to the steam generator. The clean condensing system water discharges through pipes. This safe, efficient process produces electricity 24 hours a day, 365 days a year.