An Atlas of Electricity

*“Thirteen years have passed since the Northeast blackout of 2003, but questions over the safety, efficiency, and longevity of America's aging power grid continue to plague discussions about electricity in the U.S. To be sure, the power grid is smarter, more efficient, and more robust than it was a decade ago. Federal and local regulatory agencies have enacted new laws to enforce the safe and efficient generation and transmission of electricity, and technological advancements have reduced the risk of similarly catastrophic outages. But as nationwide electricity demands continue to grow, so too will concerns over the long-term reliability of the system.”*

*“Today, roughly half of the nation's power plants are over 30 years old, and the Federal Energy Regulatory Commission (FERC) has earmarked nearly 200 electricity-generating facilities for retirement in 2016 and 2017. While these plants will likely be replaced with cleaner, cheaper, and longer-lasting facilities, it's unclear who will bear the cost of these system-wide upgrades.”*

* **This multimedia story sheds light on the generation, transmission, and distribution of electricity in the United States—and how these systems and processes might change in the not-too-distant future.**
* **In 2015, the country consumed some 3,863,275 gigawatt hours (GWh) of electricity—the same amount as the entire European Union and Russia *combined*.**
* **Only China consumed more electricity than the U.S., and even then, just 3,762 kilowatt hours (KwH) per person to the United States' 12,985 KwH per person.**
* **The United States is able to sustain its electricity consumption habits by relying on domestically generated electricity; in short, it generates more electricity than it consumes.**

**Generating more electricity than one consumes makes sure that we are self-sufficient and not reliant on other countries for our electricity.**

Across the country, a constellation of more than 7,500 power plants work around the clock to generate electricity.

They operate by converting kinetic energy into electrical energy: typically, a rotating turbine moves a copper disc or wire between the poles of a magnet, which generates an electrical current.

Power plants come in all shapes and sizes and use different kinds of primary energy—fossil fuels, or wind power, to name a couple—to drive their turbines. Some power plants generate much more electricity than others.

Electricity is transmitted from power plants to distribution substations using high-voltage cables, which are optimized for long-distance delivery.

These transmission cables are like electricity superhighways, connecting distant communities to a common electricity grid.

At distribution substations, the incoming electrical currents are downgraded to safer voltages. Then, the electricity travels onward over lower-voltage power lines to end consumers, such as factories and houses.

If all of the distribution cables were laid out end-to-end, they would stretch for over 450,000 miles—nearly the distance to the moon *and back*.

**Private utility companies own and operate most of the power grid's physical infrastructure. These companies have self-organized into three regional power grids, or interconnections: the Eastern, Western, and Texas interconnections.**

**All of the utilities within a single interconnection are electrically linked, but there are only a few ties *between* interconnections. Consequently, it is difficult—and expensive—to transmit electricity from one interconnection to another.**

The longtime industry dominance of fossil fuels can be explained by a few different factors: for one, fossil fuel-fired power plants have enjoyed a strong head start over other methods of electricity production. In fact, the world's very first centralized power plant—Thomas Edison's Pearl Street Station, which began operating in 1882 in downtown Manhattan—was powered by coal. Second, fossil fuel-fired power plants are mechanically simpler than other kinds of power plants, and consequently, they're much cheaper to build and maintain. And third, the fossil fuels themselves—coal, gas, or petroleum—are abundant in the United States.

The second greatest providers of electricity in the U.S. are nuclear power plants. These megalithic structures use the natural heat generated by nuclear fission to boil water into steam; this steam then drives turbine in order to produce an electrical current.

Unlike fossil fuel-fired power plants, nuclear power plants do not require vast quantities of raw materials to function at full capacity.

In fact, one kilogram of enriched uranium produces approximately *three million times* the amount of energy as a single kilogram of coal.

Consider this: a 1,000-MW nuclear plant requires about 27 metric tons of raw fuel each year, while a 1,000-MW coal power plant requires about 2.5 million metric tons of fuel.