

Science Note: Nuclear Energy

Legislative Summary

The Missouri Nuclear Clean Power Act (HB 1784 in the 2020 regular session) allows electrical corporations to charge ratepayers for the cost of building clean baseload generating facilities (specifically new nuclear-fueled facilities) or renewable source generating facilities (including wind, hydropower, solar power, landfill methane, biomass, or any other renewable source of power that does not produce significant carbon emissions). This repeals Section 393.135, RSMo which prohibits electrical corporations from charging for non-operational properties (including construction and financing).

Science Highlights

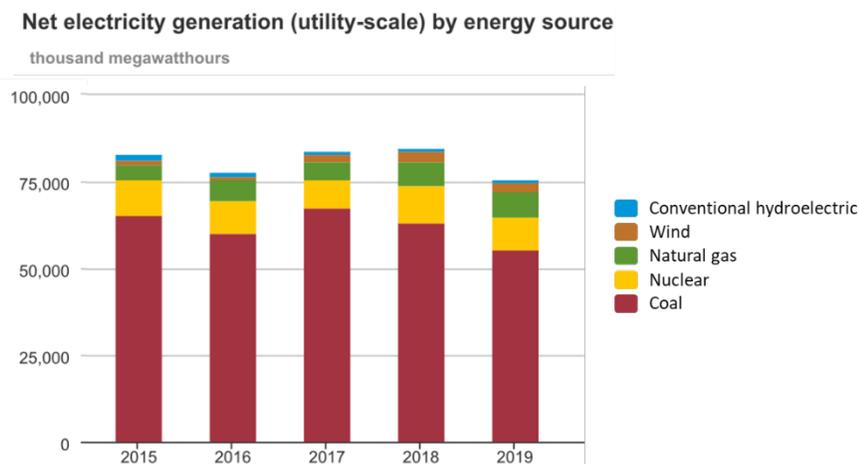
- Currently, 6% of Missouri’s electricity generation comes from renewable sources, and 12% comes from nuclear power.
- Nuclear energy could be used as a carbon free energy source to provide consistent, base load energy, as Missouri increases use of intermittent renewable energy.
- Disadvantages of nuclear power include problems with long-term waste storage, potential safety concerns, and excess costs during construction.

What is renewable energy and carbon-free energy?

Renewable energy is naturally replenishing (solar, wind, biomass, hydropower and geothermal).¹ Nuclear power is not considered renewable as it depends on mined uranium, a finite resource. However, nuclear energy does not emit carbon dioxide (CO₂), a greenhouse gas contributing to climate change, during its operation, and is considered a potential baseload power source alternative to fossil fuels.

What is Missouri’s energy portfolio?

Missouri currently generates most of its electricity from fossil fuels, primarily from coal. The top five energy sources for electricity generation in the last five years are shown in the figure below, based on data from the U.S Energy Information Administration.² A large portion of this coal (>90%) is imported from out-of-state.³ The Callaway Nuclear Generating Station is currently Missouri's only nuclear power plant and as of 2019 generated 12% of the state’s net electricity.⁴ Renewable energy sources (including hydroelectric, solar, wind, and biomass) generate approximately 6% of Missouri’s electricity. Of the renewable energy sources, wind energy is responsible for 2/3 of the renewable energy generation, followed by hydroelectric energy. Notably, electricity generation from solar energy has doubled since 2016.⁴



What is baseload power and intermittent energy?

Baseload power refers to minimum electric power delivered or required over a given period at a defined rate, as defined by the U.S. Energy Information Administration. Low-carbon energy sources with consistent output include nuclear, as well as renewables such as hydroelectric, geothermal and biomass. Intermittent electricity sources refer to electricity generated from sources that cannot be controlled to meet demands, such as solar power or wind power. These energy sources challenge traditional classification of baseload power.⁵ Geographic distribution of wind and solar energy production and energy storage (i.e. batteries) can also potentially mitigate some intermittency problems.⁶

What are the concerns of nuclear energy?

Nuclear energy has very low mortality rates (0.04 deaths per billion kWh produced) compared with other energy sources, however, exposure to radiation poses a potential threat to human health.⁷ High levels of radiation exposure from rare events can cause acute radiation syndrome, leading to burns, nausea and potentially death. Low level radiation occurs naturally and from man-made sources, and exposure can increase cancer risk over time.⁸ Nuclear energy plants emit small amounts of radioactive materials, typically less than federally defined minimums and are reported to the public annually. For comparison, coal power plants disperse as high or higher levels of radiation than nuclear power plants due to naturally occurring radioactive materials in coal.⁹

Reactors are designed to contain radiation in the case of an accident and during emergency situations such as floods, earthquakes, and tornadoes. After the most recent major nuclear accident at Fukushima, Japan, the Nuclear Regulatory Commission updated regulations for plants to include plans for more rare and extreme events.

Land contamination with radiation after an accident or in storing radioactive waste is another potential concern.⁷ There is no long-term plan for storage of high-level radioactive wastes (e.g. spent nuclear fuel) in the United States and currently these wastes are stored on-site.^{10,11} Fourteen states currently have restrictions on construction of new nuclear energy facilities, the majority awaiting identification of high-level waste disposal, although 2 states (Kentucky and Wisconsin) have lifted restrictions in the last 4 years.¹²

What is the economic viability of nuclear energy?

Baseload power or non-intermittent power sources are projected to lower electrical costs as electrical systems decarbonize.⁵ Recent expansion in electricity generation from natural gas has led to lower electricity prices. Subsequently, electricity production from nuclear power plants has become less competitive, leading to closures and challenges in financing to build new plants.¹³ Five states (Connecticut, Illinois, New Jersey, New York, and Ohio) have implemented programs to provide assistance to nuclear power plants and prevent closures.¹⁴

Many nuclear reactors become more expensive than initially estimated, with an average 117% mean cost escalation (for comparison, hydroelectric is 71%, wind 8% and solar 1%).¹⁵ One alternative to large nuclear reactors is the development of small, modular reactors (SMRs) which may require less upfront costs; however, this technology is still developing.^{16,17}

Limitations

- New nuclear reactors may improve economic viability and safety, but this technology is still developing.
- Although construction of a long-term radioactive waste began at Yucca Mountain in Nevada, political objections have limited further development on the project, and no new plan is underway.

Citations and Resources

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This science note was prepared by MOST Policy Initiative, Inc., a nonprofit organization aimed to improve the health, sustainability, and economic growth of Missouri communities by providing objective, non-partisan information to Missouri’s decisionmakers.

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