

Electricity Generation

- Every fuel used for electricity generation has advantages and disadvantages. As such, it is important for electric utilities to have a diverse generating portfolio.
- An over reliance on one fuel can threaten reliability and leave consumers exposed to dramatic price increases.
- The American Public Power Association (APPA) supports federal policies that allow for electric utilities to generate electricity using fuel mixes best suited to their local community's needs and desires.

Background

Electricity is created from the conversion of a fuel or other source of energy into electrons. This process occurs on a large scale at an electricity generating plant, and on a smaller scale through distributed energy resources. Even with continuing advances in, and increased deployment of, energy storage technology, most electricity must be generated the instant it is used, requiring forms of generation that must always be available to “keep the lights on.” Electricity in the United States is generated by a range of fuels and technologies, including natural gas, coal, nuclear, hydropower, and non-hydropower renewable resources, such as solar, wind, biomass, and geothermal power. Public power utilities supply approximately 15 percent of electricity to end-users in the United States, but they only produce approximately 9.3 percent of the megawatt-hours (MWh) generated. Collectively, end-use public power utilities are net purchasers of power from other sources. This fact sheet uses the most recent utility-level data (2021) from the U.S. Energy Information Administration (EIA).¹

Major Fuel Sources for Electricity

Fossil Fuels: Natural Gas, Coal, and Oil

The two leading fuel sources used to generate electricity in the U.S. are natural gas and coal—in 2021, natural gas was responsible for 38.7 percent of total U.S. generation and 29.2 percent of total generation owned by public power, and coal accounted for 21.9 percent of the nation's generation and 29.9 percent of generation owned by public power. Oil was responsible for 0.5 percent of total U.S. generation and 0.2 percent of generation owned by public power in 2021.

The demand for natural gas in the electric sector has grown immensely in recent years because of lower capital costs, faster build times, and the lower carbon dioxide (CO₂) emissions of natural gas (it produces approximately half the CO₂ emissions as that produced by coal, on average). Despite these benefits, concerns with natural gas include significant historic price volatility; the need for additional pipeline construction in certain parts of the country; limitations on natural gas storage capabilities; and emissions.

¹ <https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php>

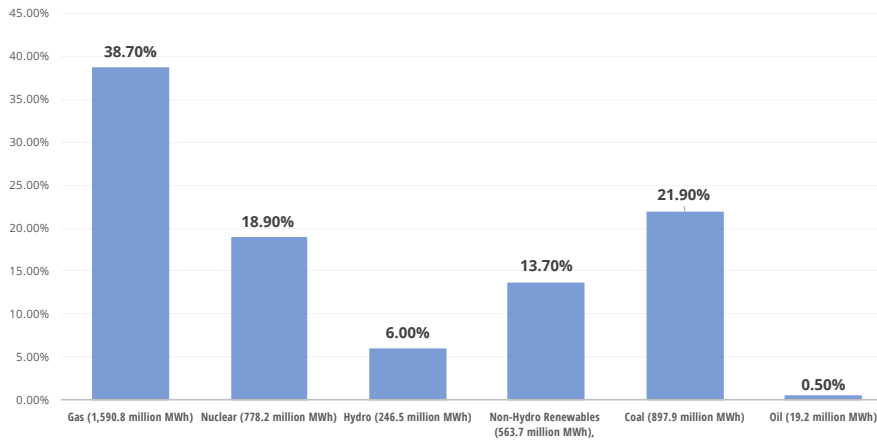


Figure 1 - Electricity Net Generation. Total (All Sectors) by Source, 2021 EIA data

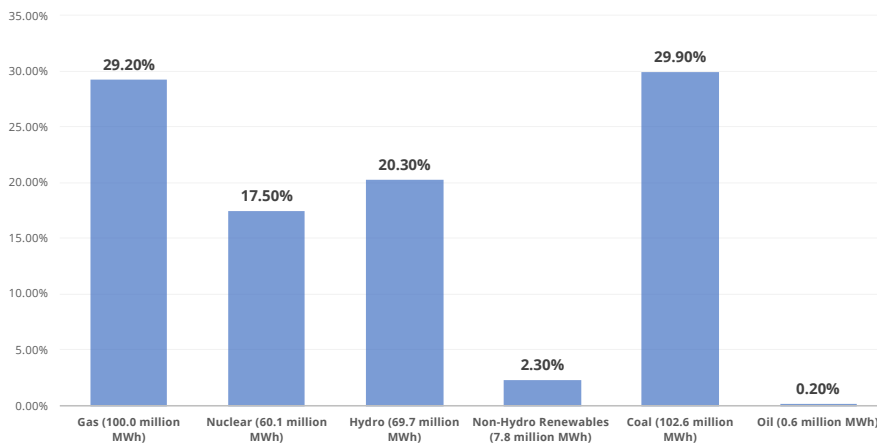


Figure 2: Public Power Generation by Source, 2021 EIA data

For many decades, coal was the leading fuel used to generate electricity. Its use has steadily declined due to several factors, such as lower natural gas prices, the cost of compliance with current and proposed environmental regulations, and the current lack of affordable technology to capture and sequester CO₂ on a commercial scale from power plants.

Oil is primarily used for emergencies, peak shaving, and as a source of backup generation in times of high electricity demand. It is also used as baseload generation in areas that have limited access to other generation resources, such as Alaska, Hawaii, and the territories of the U.S. (Note however, that the latter are not included in EIA’s data.)

Nuclear

Nuclear was responsible for 18.9 percent of total U.S. generation and 17.5 percent of total generation owned by public power utilities in 2021. Nuclear power is an extremely reliable source of baseload generation that produces no CO₂ or other air emissions (e.g., sulfur dioxide and nitrogen oxides). The main challenge associated with existing nuclear facilities is the disposal of nuclear waste. Nuclear facilities also have high capital costs given the complexity of the units and safety features that must be included and monitored on an ongoing basis. A promising new technology in nuclear is small nuclear reactors (SMRs), which are smaller scale plants that are less expensive to build and require less infrastructure. Please see APPA’s issue brief, “Nuclear Power,” for more information about SMRs and nuclear power.

Hydropower

Hydropower is the nation’s second largest source (behind wind) of emissions-free, renewable electricity, accounting for approximately 30.4 percent of domestic renewable generation and 6.0 percent of total electricity generation in 2021. For generation owned by public power utilities in 2021, hydro was responsible for 20.3 percent of total generation. It is a reliable source of baseload energy.

While hydropower is expanding into exciting new areas like tidal and in-stream, large dams still provide the bulk of the resource, and the impacts of those dams on fish and other wildlife will continue to be a concern for some stakeholders. Furthermore, as environmental mitigation measures have been addressed, hydropower output from these large dams has been reduced. Federal permitting has been, and will continue to be, a hurdle to any new hydropower development, large or small. Approximately three percent of the nation's more than 90,000 dams generate electricity.²

Non-Hydro Renewables

Non-hydro renewables were responsible for 13.7 percent of total U.S. generation and 2.3 percent of total generation owned by public power utilities in 2021. The main challenges facing non-hydro power renewables are the intermittent nature of wind and the sun; the need to have them backed up with dispatchable generation (typically natural gas); limited access to transmission lines; and financing. Some of these challenges may be mitigated in the future as more energy storage technologies are deployed. The benefits of renewable resources include that most of them do not emit pollutants or CO₂ and their ongoing fuel costs are low or non-existent.

Distributed Generation

Distributed generation (DG) is power produced at the point of consumption. More than 90 percent of DG is rooftop solar, but it can include small wind turbines, combined heat and power, fuel cells, microturbines, and other sources. As of October 2021, approximately 37,000 MWs of distributed solar capacity has been installed in the United States.³

Under a policy called net-metering, customers with on-site generation are credited for the amount of kilowatt-hour sales sold back to the distribution grid. This rate can vary per utility, but is generally set at the retail rate, as opposed to the wholesale rate, which is the rate utilities use to purchase power for their customers.

Due to this rate structure, concerns have arisen that net metering customers are not paying their fair share of the costs of keeping the grid operating safely and reliably. DG also has operational issues that pose challenges for utilities, such as maintenance of electric grid system balance, safety issues for line-workers, load forecasting impairment, and increased strain on the distribution system. Potential benefits of DG include the need to build less new generation, reduced air pollution and greenhouse gas emissions, and in some cases, mitigation against outages on the distribution grid. For more information on DG, see APPA's issue brief, "Distributed Energy Resources."

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² <https://nid.usace.army.mil/#/>

³ <https://www.seia.org/solar-industry-research-data>

The American Public Power Association is the voice of not-for-profit, community-owned utilities that power 2,000 towns and cities nationwide. We represent public power before the federal government and protect the interests of the more than 49 million people that public power utilities serve and the 96,000 people they employ.