AMERICAN PUBLIC POWER ASSOCIATION
Powering Strong Communities

FACT SHEET January 2021

Electricity Generation

Summary

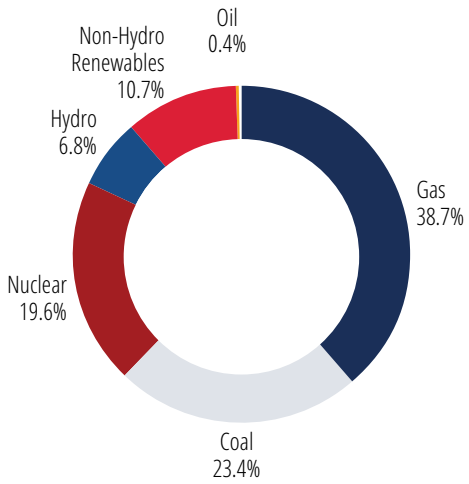
Congress is expected to address a number of energy and environmental issues that are important to public power in the first session of the 117th Congress. Democrats have control of both the House of Representatives and the Senate – albeit with very slim majorities. This is especially true in the Senate, where each party will hold 50 seats (50 Republicans and 48 Democrats plus two independents that caucus with them). In party-line votes in the Senate, Vice President Kamala Harris will be the tiebreaker, making Democrats the effective majority. Democratic leadership has indicated that their initial priorities in 2021 will be passing legislation to provide additional COVID-relief and increase investment in infrastructure. Climate change will be a central focus of House and Senate Democrats, with the House Energy & Commerce Committee expected to release updated climate legislation this winter. Infrastructure legislation will most likely include provisions to promote clean energy, energy efficiency, distributed energy resources, and electric vehicles, as well as extend various energy-related tax credits. Other public power priorities that may be addressed in 2021 include hydropower licensing reform, grid security, and energy workforce matters.

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 still 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, landfill methane gas, and geothermal power.

Each of the various generating technologies used to produce electricity has its advantages and disadvantages, which is why having a diversified portfolio of fuels—particularly generation sources that can be relied on most of the time—is a priority for electric utilities.

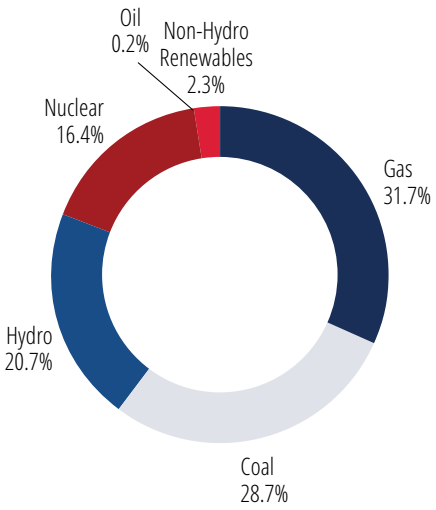
Figure 1 – Electricity Net Generation, Total (All Sectors) by Source, 2019



In terms of total U.S. power generation, according to the most recent data released by the Energy Information Administration (EIA), in 2019, natural gas produced 1.598 billion megawatt-hours (MWh) of electricity, coal produced 965 million MWh, nuclear produced 809 million MWh, hydro produced 282.6 million MWh, non-hydro renewables (wind, solar, biomass, geothermal, and other sources) produced 439.8 million MWh, and oil provided 18.4 million MWh. This data can also be seen in percentages in the chart above (Figure 1).

In terms of total generation produced by public power utilities, according to the most recent data (2019) from the EIA, public power entities produced 109.2 million MWh of electricity from coal, 120.5 million MWh from natural gas, 78.6 million MWh from hydro, 62.3 million MWh from nuclear, and 8.9 million MWh from non-hydro renewables. This data can be seen in percentages in the chart on the next page (Figure 2).

Figure 2 – Public Power Generation by Energy Source, 2019



It is important to note, however, that public power supplies approximately 15 percent of electricity to end-users in the United States, but it only produces approximately 10 percent of the MWh generated. So, end-use public power utilities as a whole are net purchasers of power from other sources (i.e., investor-owned utilities, independent power producers, joint action agencies, rural electric cooperatives, federal power marketing administrations, and the Tennessee Valley Authority).

Major Fuel Sources for Electricity:

Coal

For many years, coal was the leading fuel used to generate electricity because it was less expensive than other fuels and it provided reliable baseload generation. Its use has steadily declined due to several factors, such as lower natural gas prices and from the cost of compliance with current and proposed environmental regulations on carbon dioxide (CO_2) and criteria pollutant (such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x)) emissions resulting from coal combustion. In 2019, 23.4 percent of the nation's electricity and 28.7 percent of public power's electricity was generated from coal.

Coal also faces the major obstacle of its CO_2 content and the current lack of technology to capture and sequester CO_2 on a commercial scale from power plants. The major unknown going forward is the viability of carbon capture and sequestration or another, unknown technology that may reduce the CO_2 emitted from coal combustion.

Hydropower

Hydropower is the nation's second largest source (behind wind) of emissions-free, renewable electricity, accounting for approximately 39.1 percent of domestic renewable generation and 6.8 percent of total electricity generation in 2019. For public power in 2019, it was responsible for 20.7 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. With less than three percent of the nation's more than 80,000 dams generating electricity, this is problematic.

Natural Gas

Natural gas was responsible for 38.7 percent of total U.S. generation and 31.7 percent of total public power generation in 2019. Natural gas is used across all sectors, in varying amounts. The chart on page three (Figure 3) shows the proportion of natural gas use per sector. In 2019, the electric power sector accounted for the greatest proportion of natural gas use in the United States, with the industrial sector consuming the second greatest quantity of natural gas.

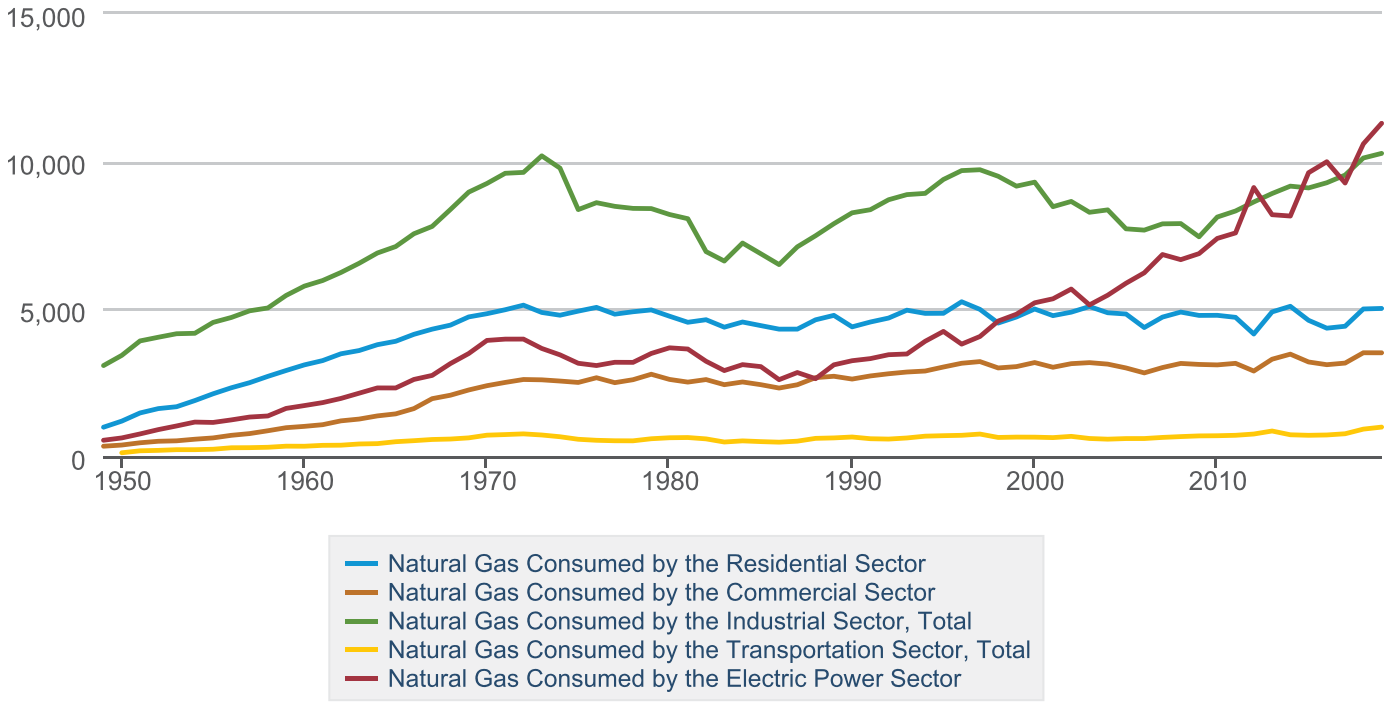
The demand for natural gas in the electric sector has grown and will continue to grow. This is partly a result of large amounts of natural gas capacity built by merchant generators in regional transmission organization regions because of lower capital costs and faster build time. The increased demand is also due to the lower CO_2 emissions profile of natural gas (it produces approximately half the CO_2 emissions as that produced by coal, on average).

As for electric generation usage, natural gas can be used to generate electricity in a variety of ways. The most basic natural gas-fired electric generation consists of a steam generation unit, where natural gas is burned in a boiler to heat water and produce steam, which then turns a turbine to generate electricity. Gas turbines and combustion engines are also used to generate electricity. In these types of units, instead of heating steam to turn a turbine, hot gases from burning fossil fuels (particularly natural gas) are used to turn the turbine and generate electricity.

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.

Figure 3 – Natural Gas Consumption by Sector

Billion Cubic Feet



eia Source: U.S. Energy Information Administration

Nuclear

Nuclear was responsible for 19.6 percent of total U.S. generation and 16.4 percent of total public power generation in 2019. The main challenge associated with existing nuclear facilities is the disposal of nuclear waste, which has been a highly politicized issue. 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.

The construction of new, large-scale, nuclear facilities also faces challenges, such as the ability of the owners to get financing and the regulatory approvals necessary to move forward. In addition, continued low natural gas prices make construction of combined cycle natural gas turbines far less expensive than constructing a nuclear power plant. TVA completed its Watts Bar 2 nuclear power plant, which started operation in October 2016, and construction is ongoing in Georgia on a new reactor at Vogtle. Nuclear power is an extremely reliable source of baseload generation that produces no CO_2 or air emissions (e.g., SO_2 and NO_x). But given low natural gas prices, relatively flat energy demand, and the high costs of construction, it is unclear if new, large-scale nuclear facilities will be constructed in the future.

A promising new technology that might spur the development of new nuclear is small modular reactors. These smaller scale plants are less expensive and require less infrastructure. Several APPA members are actively exploring deployment of this technology.

Non-Hydro Renewables

Non-hydro renewables were responsible for 10.7 percent of total U.S. generation and 2.3 percent of total public power generation in 2019. 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 baseload generation (typically natural gas); limited access to transmission lines; and financing. Concerns about integrating wind have arisen because the wind often blows when demand is not high, which thereby requires a ratcheting down of other resources that can often be uneconomic and cause stresses to the operation of a regional or sub-regional system. 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 CO_2 and their ongoing fuel costs are low or non-existent.

Oil

Oil was responsible for 0.4 percent of total U.S. generation and 0.2 percent of total public power generation in 2019. In the continental United States, 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 and Hawaii, and the territories of the United States. (Note however, that the latter are not included in EIA's data.)

Distributed Generation

Interest in distributed generation (DG) has increased over the last few years. As of September 2020, 26,505.8 MWh of distributed solar capacity have been installed in the United States. 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. 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 the 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."

APPA Position

Every fuel type has its advantages and disadvantages that require substantial risk management planning. Therefore, it is very important for today's electric utilities (where possible) to have a balanced generating portfolio with multiple fuel types. An over-reliance on one fuel can and will create potential risk that could substantially increase prices to consumers and reduce reliability. APPA supports federal policies that support and promote such fuel diversity in electric generation.

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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 to protect the interests of the more than 49 million people that public power utilities serve, and the 93,000 people they employ. Our association advocates and advises on electricity policy, technology, trends, training, and operations. Our members strengthen their communities by providing superior service, engaging citizens, and instilling pride in community-owned power.