AMERICAN PUBLIC POWER ASSOCIATION
Powering Strong Communities

ISSUE BRIEF April 2019

Electricity Generation

Summary

Congress is expected to address a host of energy and environmental issues that are important to public power in the 116th Congress. In the House of Representatives, Speaker Nancy Pelosi (D-CA) has stated Democrats are interested in moving a comprehensive infrastructure package, which could include energy- and climate-related provisions. Other issues the House will likely examine in 2019 include climate change, electric vehicles, distributed energy resources, and other policies to promote clean energy. The House will also conduct vigorous oversight of the Trump Administration, including regulatory actions undertaken by the Environmental Protection Agency (EPA), Department of Interior (DOI), and other agencies.

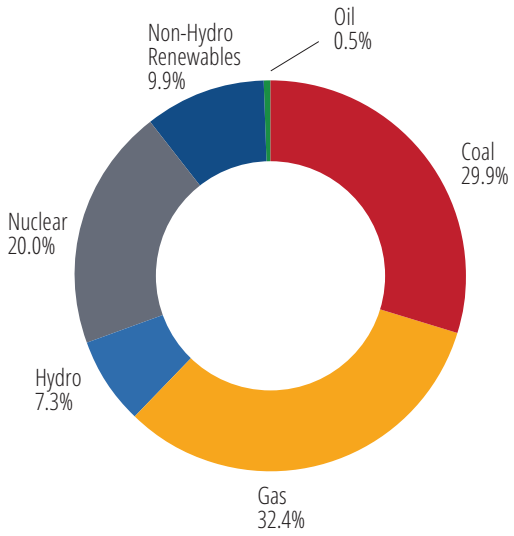
The Senate may also consider infrastructure legislation that would include an energy title. Other issues the Senate may examine include energy efficiency, hydropower licensing reform, nuclear power, distributed energy resources, and Endangered Species Act reform, among others. In addition, the Senate will continue vetting President Trump's nominees for vacant positions at the Federal Energy Regulatory Commission, EPA, Department of Energy, and DOI.

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. Electricity must be generated at the instant it is used, requiring forms of generation that must always be available to "keep the lights on."

The primary electricity generating technologies used in the United States are natural gas, coal, nuclear, and hydropower. A small but fast-growing portion of the generation portfolio comes from non-hydropower renewable sources of energy, such as solar, wind, landfill methane gas, and geothermal power from underground formations. However, some of these resources are not available 24 hours a day, seven days a week, and may be more expensive to construct and/or operate than traditional

Electricity Net Generation, Total (All Sectors) by Source, 2017



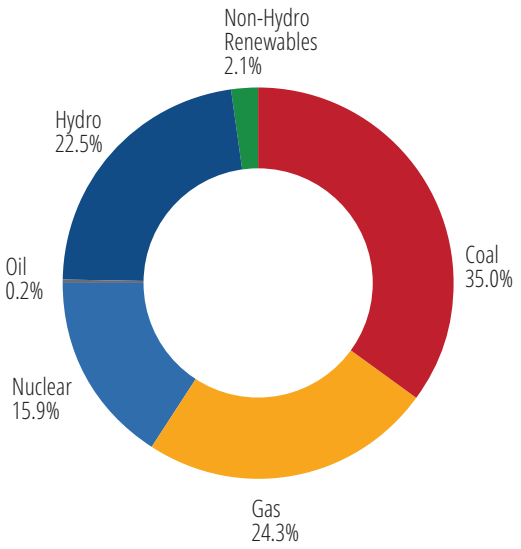
sources of electricity. Most of these energy sources are used to power turbines that generate electric energy.

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.

In terms of total U.S. power generation, according to the most recent data released by the Energy Information Administration (EIA), in 2017, natural gas produced 1.309 billion megawatt-hours (MWh) of electricity, coal produced 1.206 billion MWh, nuclear produced 805 million MWh, hydro produced 293.8 million MWh, non-hydro renewables (wind, solar, biomass, geothermal, and other sources) produced 420.1 million MWh, and oil provided 21.4 million MWh. This data can also be seen in percentages in the chart on page one.

In terms of total generation produced by public power utili-

Public Power Generation by Energy Source, 2017



ties, according to the most recent data released by the EIA, in 2017, public power entities produced 134.37 million MWh of electricity from coal, 93.46 million MWh from natural gas, 86.57 million MWh from hydro, 61.1 million MWh from nuclear, and 6.6 million MWh from non-hydro renewables. This data can be seen in percentages in the chart on this page. 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 are as a whole 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).

Challenges Faced by Some of the Major Fuel Sources:

Coal

Some fuel types face challenges not commonly contemplated or discussed when referencing such fuels. For example, when most people think of coal, they tend to focus on its emissions of carbon dioxide (CO_2) and criteria pollutants (such as sulfur dioxide (SO_2) and nitrogen oxides (NOx)) resulting from coal combustion. However, for utilities that depend heavily on coal, they must also factor transportation issues associated with coal. Approximately 29.9 percent of the nation's electricity was generated from coal in 2017, the majority of which is shipped by rail. A substantial amount of that coal has only one railroad option, and in most cases, only one viable transportation option available for all or a portion of its shipment. Therefore, a large amount of coal shipped for electricity generation is "captive" to a single railroad and the costs of making that shipment are frequently unreasonable, reflecting the monopolistic power of the carrier. For more information, see the American Public Power Association's (APPA or Association) issue brief, "Rail Competition and Antitrust Enforcement."

Several factors have worked to erode the advantage that coal-fired generation has historically derived from its traditionally lower fuel costs. These factors include the cost of compliance with current and proposed environmental regulations and lower natural gas prices because of the increased domestic supply of natural gas. 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 largest source of emissions-free, renewable electricity, accounting for approximately 43.2 percent of domestic renewable generation and 7.3 percent of total electricity generation in 2017. It is a reliable source of baseload (available most of the time) energy that can expand. However, the amount of electricity generated from this source will always depend on droughts and other hydrologic conditions that impact various parts of the country and world.

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 32.4 percent of total U.S. generation in 2017 and 24.3 percent of total public power generation in the same year. Natural gas is used across all sectors, in varying amounts. The chart on page three shows the proportion of natural gas use per sector. In 2017, 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.

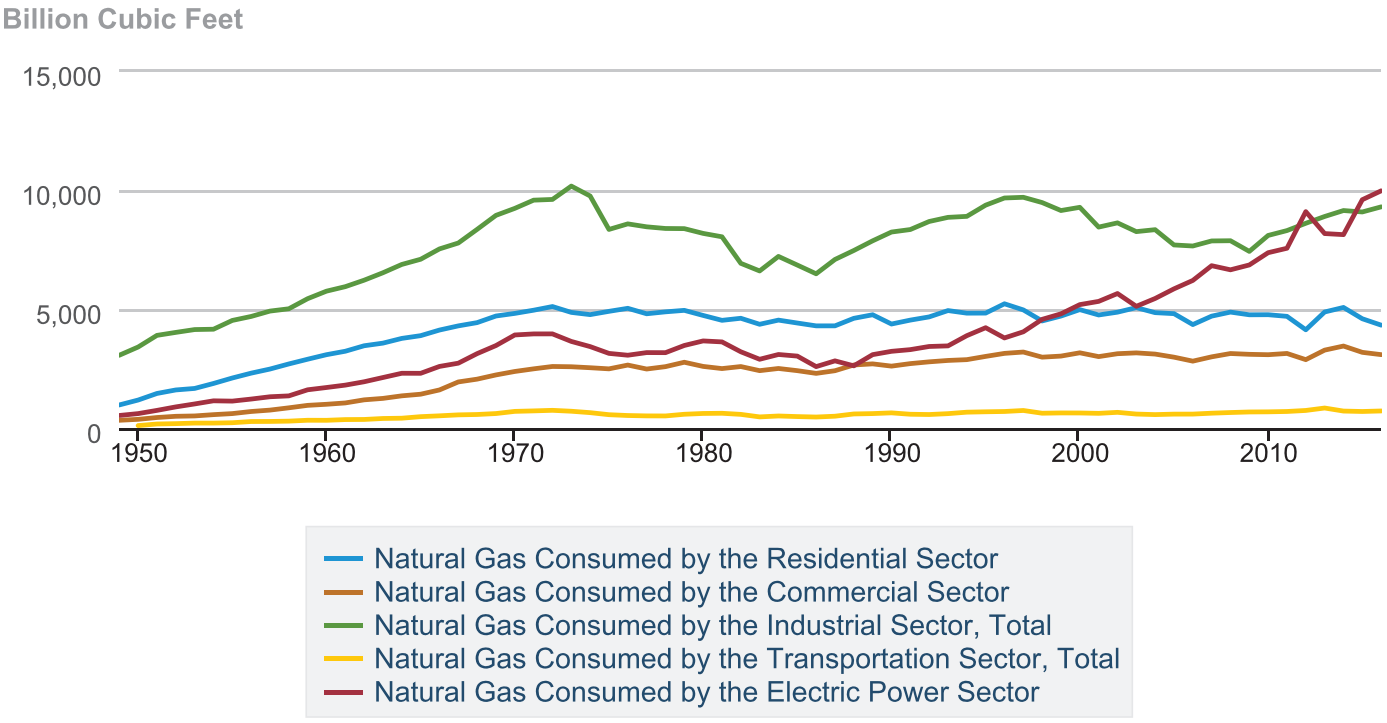
Despite these benefits, concerns with natural gas include: significant historic price volatility; the need for additional pipeline construction in certain parts of the country; the need for operational and scheduling modifications for natural gas delivery to electric generators; limitations on natural gas storage capabilities; and emissions.

Nuclear

Nuclear was responsible for 20 percent of total U.S. generation and 15.9 percent of total public power generation in 2017. 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 NOx). 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.

Natural Gas Consumption by Sector



eia Source: U.S. Energy Information Administration

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.

Oil

Oil was responsible for 0.5 percent of total U.S. generation and 0.2 percent of total public power generation in 2017. 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.)

Non-Hydro Renewables

Non-hydro renewables were responsible for 9.9 percent of total U.S. generation and 2.1 percent of total public power generation in 2017. 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. Most renewable resources, however, do not emit pollutants or CO_2 and their ongoing fuel costs are low or non-existent.

Distributed Generation

Interest in distributed generation (DG) has increased over the last few years. As of September 2018, 18.7 gigawatts 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."

American Public Power Association 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.

American Public Power Association Contact

Steve Medved, Government Relations Specialist, 202-467-2928 / smedved@publicpower.org

Paul Zummo, Director, Policy Research and Analysis, 202-467-2969 / pzummo@publicpower.org

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.