

Energy Use and Renewable Energy Sources

Background

Our quality of life and economy depend on the availability of reliable sources of energy, most of which currently comes from the combustion of fossil fuels. Fossil fuels include coal, natural gas, and a variety of liquid fuels, such as gasoline, diesel fuel, and heating oil, that are derived from petroleum. Specifically, we use gasoline and diesel fuel for transportation; we use oil and natural gas to heat and cool residences and other buildings; and we use fossil fuel-generated electricity in a variety of ways, including manufacturing, heating and cooling, lighting, and communications. The combustion of fossil fuels releases carbon dioxide and other greenhouse gases (GHGs), which contribute to the increasing warmth of the earth's climate (see "Greenhouse Gas Emissions" in the NJDEP Environmental Trends series <https://www.nj.gov/dep/dsr/trends/ghg.pdf>).

Renewable energy sources are described as naturally replenishing and restore themselves over relatively short periods of time. They are inexhaustible in duration on human timescales, but limited in the amount of energy that is available per unit time without a storage mechanism. Renewable energy sources do not emit greenhouse gases while producing energy and are considered a fundamental strategy to mitigate climate change. Such sources include hydro, tidal, geothermal, solar, wind, and sustainably grown and harvested biomass.

The State of New Jersey is committed to increasing the deployment of renewable energy. The Clean Energy Act of 2018 (P.L. 2018, c.17) calls for Renewable Energy Credits (RECs) equal to 21% of the state's retail sales to originate from PJM Class 1 renewable sources by 2020 (which the State has already met), with subsequent goals of 35% by 2025, and 50% by 2030. It also strengthened the goals of New Jersey's renewable energy portfolio standard, established provisions for offshore wind and energy storage, mandated an energy efficiency resource standard, called for improved implementation of the state's solar renewable energy standard, and required the establishment of a Community Solar Energy Pilot Program.

Status and Trends

Energy Production

As shown in Figure 1, in 2017, fossil fuels were used to generate approximately half

of New Jersey's in-state electricity while nuclear power generated 45% and renewables provided the remaining 5%. Renewable energy is contributing an increasing share of the State's fuel mix for electricity generation. The Clean Energy Act of 2018 mandates that 3,500 megawatts (MW) of offshore wind electric generation capacity come online by 2030 and Governor Murphy's Executive Order 92 expanded that commitment to 7,500 MW by 2035. New Jersey's commitment to clean air has resulted in some of the lowest emission rates from power plants in the U.S. In 2018, the State's sulfur dioxide (SO₂) emission rate was the 5th lowest, nitrogen oxide (NO_x) emission rate the 2nd lowest, and carbon dioxide (CO₂) emission rate the 9th lowest in the country.¹

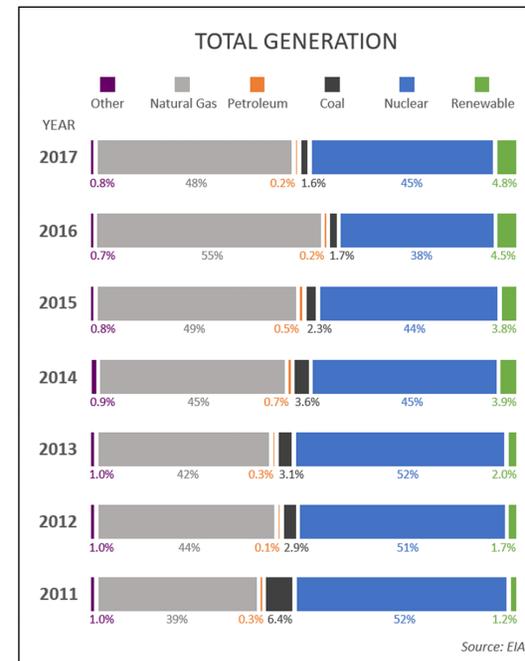


Figure 1: New Jersey's total energy generation by fuel type for 2011 - 2017.

Energy Consumption

As shown in Figure 2, total energy consumption in NJ peaked in 2005 and has been declining since then.² Low-cost natural gas and high-efficiency combined cycle generating units have displaced nearly all older coal-fired stations in the state. In

addition, an important trend in the 2019 Energy Master Plan is the State's recent declining reliance on electricity imports. In 2015, in-State electricity generation approximately equaled in-State consumption, and for the first time in 2016 it exceeded the state's electricity consumption. As of 2017, total energy consumption for NJ totaled approximately 2,110 trillion British Thermal Units (BTUs).³

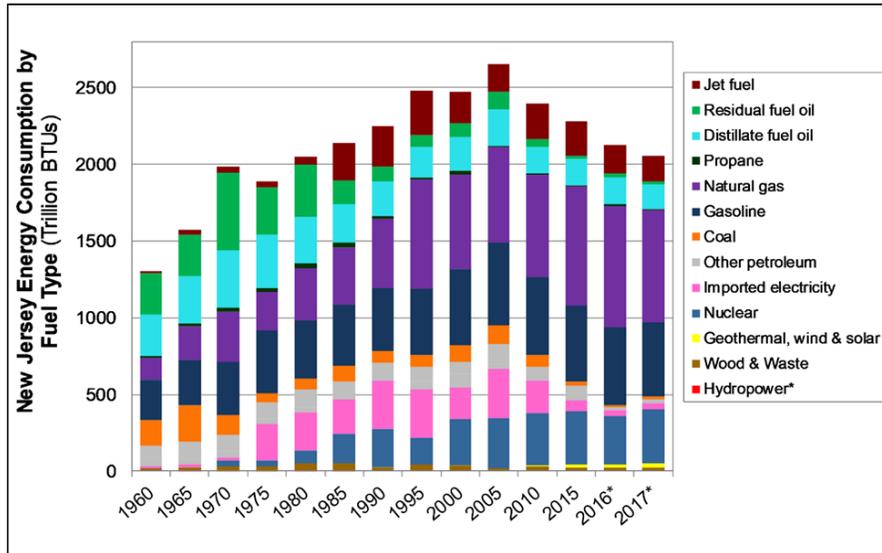


Figure 2: New Jersey's energy consumption by fuel type for 1960- 2017⁹ (x-axis is displayed in five year increments up through 2015, with 2016* and 2017* displayed as single year consumption). *Hydropower accounts for <1% of energy consumed in NJ.

Another way of understanding how energy is utilized in NJ is to view how it is divided among various sectors, as shown in Figure 3. One trend in total end-use energy consumption is the relative decrease in energy usage by the NJ industrial sector over time, which may reflect the overall trend toward decreased manufacturing and industrial activities in the region.^{4,5} Also, the sector with the largest portion of energy consumed in NJ continues to be transportation, accounting for 37% of energy consumed in 2017.³ The peak year of energy use by the transportation sector was 2008,³ which aligns with the peak year in the price of gasoline⁶ and occurred just prior to a global economic downturn. In addition, the number of vehicle miles traveled in NJ increased until 2007, dropped in 2008 then

increased each year through 2018 (see "Vehicle Miles Traveled" in the NJDEP Environmental Trends series <https://www.nj.gov/dep/dsr/trends/Vehicle%20Miles%20Traveled.pdf>).⁷

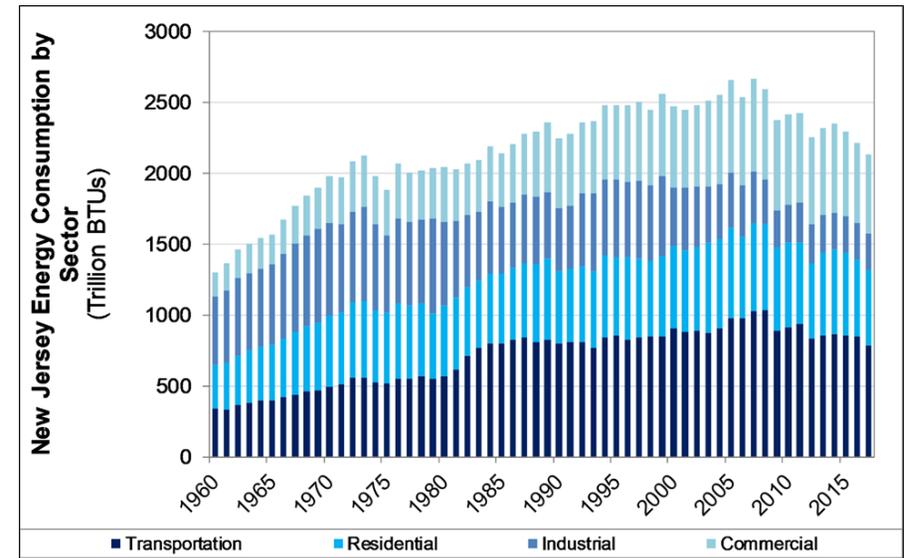


Figure 3: New Jersey's energy consumption by sector for 1960-2017.⁸

An additional area of consideration is energy consumption specifically for electricity. In 2017, NJ consumed approximately 678 trillion BTUs of electricity.³

Expenditures

In terms of cost, it has been predicted that, on a longer-term scale, there will be a steadily growing demand for energy and a decrease in the production of certain fossil fuels such as coal and gasoline, resulting in increased fossil fuel costs.^{8,9,10,11,12,13} Expenditures (relative to NJ's Gross State Product (GSP)) on total energy consumption in NJ have been declining. This decline includes a sharp drop in 2012 and a continued decrease since 2014 (Figure 4).

dropping over time but is still currently higher than the non-renewable energy sources.

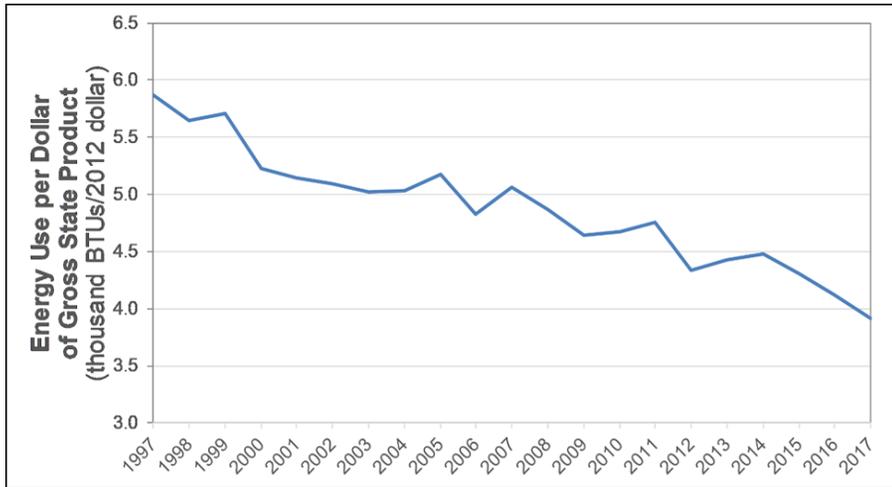


Figure 4: New Jersey's energy use per dollar of gross state product (all dollar values are set equivalent to the 2012 dollar value).¹⁴

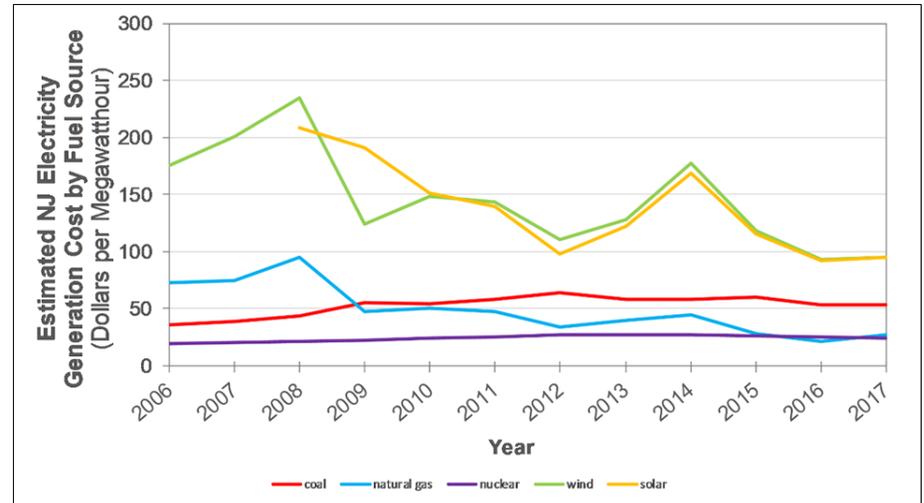


Figure 5: Estimated NJ Electricity Generation Cost by Fuel Source^{15,16,17,18,19,20}

Homeowners and commercial businesses that invested in solar arrays have earned money using Solar Renewable Energy Certificates (SRECs) for the energy generated by their solar PV installation. SRECs are proof that the utility is meeting the state's RPS requirement to include a minimum amount of solar power each year. SRECs were also used as a mechanism to encourage solar energy investments in New Jersey. Consistent with the May 2018 Clean Energy Act, NJBPU closed the SREC program on April 30, 2020 when New Jersey reached the milestone of 5.1% of the kilowatt-hours sold in the State being generated by solar electric power generators. The milestone triggered a shift to a transitional incentive program, recognizing that growth in the industry needed less support to continue. The Clean Energy Act directed NJBPU to develop this Transitional Renewable Energy Certificate (TREC) program, which opened May 1, 2020 and will be in effect for 15 years. Instead of following market prices, the TREC program offers a fixed price incentive of \$152 per MWh for solar generation.



Figure 5 shows the electric power generation costs from 2006 to 2017. Coal-fired electric and nuclear power generation costs have decreased slightly in the last few years. The cost of natural gas fired electricity generation has decreased primarily due to low gas prices and the deployment of more efficient combined cycle plants in recent years. The cost of a mega-watt hour of energy generated through a renewable source has been

(Shutterstock, 2020)

Impacts of U.S. Domestic Shale Gas on New Jersey

It is important to note that New Jersey does not possess shale gas resources due to its geology. Yet, with the recent advent and continuing improvement of advanced crude oil and natural gas production technologies, the US Energy Information Administration (EIA) has reported that U.S. domestic supply, largely from growing shale gas production, first outpaced domestic consumption in 2017 when the U.S. became a net exporter of natural gas.²¹

Production of Renewable Energy Resources

New Jersey's electric power sector's percentage of energy from renewable sources (approximately 4.8% as of 2017) is below the U.S. average (approximately 16% as of 2017).²² This is largely due to the fact that New Jersey does not have significant hydropower or onshore wind resources. Nuclear power remains an important New Jersey energy source whose generation produces no greenhouse gases, reducing the state's overall contributions to GHG emissions.

In 2017, 31% of New Jersey's 82 trillion BTUs of renewable energy was supplied by solar PV production.²³ NJ has been a leader in advancing solar capacity in the U.S. As of March 31, 2020, the State has more than 3,263 MW (3.263 gigawatts) of solar capacity per NJBPU Solar Activity Reports.²⁴ Solar capacity continues to grow on a national scale and at the state level. In 2019, the U.S. installed 13.3 gigawatts (GW) of solar PV capacity, bringing the cumulative total of installed capacity to 77.7 GW.²⁵ In the same year, New Jersey was ranked 7th in the U.S. for total installed solar capacity, only surpassed by California, North Carolina, Arizona, Texas, Florida, and Nevada, which are more favorably located in terms of solar radiation.²⁶ The State is ranked number 1 for megawatt (MW) of solar per square mile.²⁷

In the U.S., onshore wind power capacity continues to expand. In 2019, over 9,100 MW of wind capacity was added nationally for a cumulative total of approximately 105,600 MW of U.S. wind capacity.²⁸ While NJ has limited onshore wind resources (as of 2019, NJ had a total of 9 MW of installed, onshore wind capacity²⁹ and ranked 39th in the Nation for onshore wind capacity by the American Wind Energy Association (AWEA))³⁰, the State is strongly pursuing offshore wind resources. Governor Murphy has established an offshore wind goal

of 7,500 megawatts by 2035. Further, on June 16, 2020, Gov. Murphy announced that the \$300 million New Jersey Wind Port will include a manufacturing site, as well as a location to assemble turbine parts before they are shipped to wind farm locations offshore, creating an estimated 1,500 port construction and operation jobs.

Outlook and Implications

The current rate of growth of renewable power in New Jersey is not enough to replace fossil fuels in the near future. When renewable energy generation increases to levels equal to energy generated by fossil fuels today, there will be an added need for flexible, load-balancing generation to smooth out the variability and intermittency associated with most renewable technologies. The 2019 New Jersey Energy Master Plan acknowledges this in its advocacy of a balanced approach of energy efficiency, renewable energy, and cleaner, flexible conventional sources powered with biofuels.¹⁰

Nuclear power is currently vital in meeting New Jersey's electricity needs, providing nearly half of the State's in-state generation from a carbon-free source. Meeting the State's 2050 clean energy and climate goals would be that much more difficult without this continued reliance on nuclear power. To that end, the 2019 Energy Master Plan assumed the state's remaining nuclear powerplants (the Oyster Creek nuclear power plant closed in 2018³¹) will continue operation through at least the remaining life of their licenses. If these nuclear power plants were to close, notwithstanding significant development of in-State renewables or importation of out-of-state renewables, additional fossil fuel generation would be needed to compensate for the loss of the base load generation. Recent developments suggest that this could be satisfied by additional natural gas over the short term or new nuclear power plants over the long term. In 2018, Governor Murphy signed a new act (P.L. 2018 Chapter 16, May 23, 2018) which established a program to provide financial support to nuclear power plants if they could demonstrate hardship to the NJBPU. Each of the remaining plants were subsequently granted that support by the NJBPU. The Federal Nuclear Regulatory Commission (NRC) issued an Early Site Permit to PSEG (PSEG Power, LLC and PSEG Nuclear, LLC) in 2016,³² which in addition to numerous other measures and required approvals, may provide the opportunity for a new reactor to be built in the next 20 years.

New Jersey benefits from several initiatives that are intended to reduce the State's reliance on fossil fuels and promote cleaner energy, energy conservation, and

renewable energy. These State and regional initiatives include the following:

Energy-Related State Action on Global Warming

- In 2007, New Jersey adopted the Global Warming Response Act (GWRA), which called for reducing GHG emissions to the State's 1990 levels by 2020, followed by a further reduction of emissions to 80% below the State's 2006 levels by 2050. In 2019, New Jersey enacted amendments to the GWRA establishing new deadlines for several tasks, including establishment of a greenhouse gas emissions monitoring and reporting program and completion of a 2050 Recommendations Report which will outline pathways to achieve the 2050 limit.³³
- Much of the reduction necessary to meet the 2050 limit is expected to come from the implementation of the 2019 Energy Master Plan and recommendations in the soon to be released 2050 GWRA Recommendations Report. The 2019 Energy Master Plan provides a blueprint for achieving 100% carbon neutral energy by 2050 and reducing emissions 80% below the 2006 levels by 2050. It calls for the electrification of the transportation and building sectors and the decarbonization of electric generation. The Energy Master Plan includes a list of recommended policies to increase in-state electricity generation, improve grid reliability, encourage energy resiliency, and recognize the significant economic and environmental benefits of energy efficiency, conservation, renewable, and nuclear energy resources. It also accelerates the Renewable Portfolio Standard (RPS) solar requirement. Finally, the 2019 EMP is the first of its kind to comprehensively address emissions from the State's transportation sector, including recommendations to encourage electric vehicle adoption, electrify transportation systems, and leverage technology to reduce emissions and miles traveled.
- In 2018, Governor Murphy directed New Jersey to reenter the Regional Greenhouse Gas Initiative (RGGI) (N.J. Exec. Order No. 7, January 29, 2018). RGGI is a joint effort of nine states in the New England and Mid-Atlantic region to reduce greenhouse gas emissions from the electric generating sector by operating a carbon dioxide trading program. New Jersey was an original member of RGGI when it was founded in 2005, participated until withdrawing in 2012, and ultimately returned to full participation in RGGI in 2020. Funding from the RGGI auctions is dedicated to reducing greenhouse gas emissions in the state

through actions such as electrifying the transportation sector and support of carbon sequestration initiatives. In April of 2020, Governor Murphy released the RGGI Strategic Funding Plan which identifies how the state will invest RGGI proceeds over the next three years to help meet the state's climate, clean energy, and equity goals.

Energy Efficiency and Renewables

- In Executive Order 8, signed January 31, 2018, Governor Murphy directed DEP and the BPU to implement the Offshore Wind Development Act by developing wind energy off the coast of New Jersey to meet a goal of 3,500 megawatts of generation by 2030. Executive Order 92 was signed November 19, 2019 and revised this wind energy goal to 7,500 MW by 2035. In Executive Order 23, signed April 4, 2018, Governor Murphy directed DEP to develop guidance for implementing Environmental Justice in statutory and regulatory responsibilities.
- In Executive Order 28, signed May 23, 2018, Governor Murphy directed BPU, DEP and other state agencies to update the Energy Master Plan to advance the state's energy production profile to 100% clean energy by 2050 (E.O. 28 2018).
- In Executive Order 79, signed August 16, 2019, Governor Murphy ordered the establishment of the Wind Council, charged with developing a plan for creating the Wind Innovation and New Development (WIND) Institute (E.O. 79 2019). The WIND Institute would serve as a clearinghouse for education, research, innovation, and workforce training related to the development of offshore wind.
- In Executive Order 8, signed January 31, 2018, Governor Murphy directed all state agencies with responsibilities under the Offshore Wind Economic Development Act to fully implement the act in order to meet a goal of obtaining 3,500 MW from offshore wind by the year 2030.
- In 2018, Governor Murphy approved the Clean Energy Act (P.L. 2018 Chapter 17, May 23, 2018), which lays out several steps to improve and expand New Jersey's renewable energy programs and establishes energy reduction targets. This act requires the BPU to conduct an energy storage analysis and requires 21% of the energy sold in the state to be from Class I renewable energy sources by 2020; 35% by 2025; and 50% by 2030. In addition, the act directs

the state's solar program to make structural changes that ensure it will be sustainable in the long term.

- In March 2020, BPU published the Straw Proposal for the Energy Efficiency program transition. This proposal will help incentivize utilities and ratepayers' involvement. The proposal includes items such as cost recovery, performance incentives, utility targets, quantitative performance indicators, and reporting requirements.³⁴
- In June 2020, Gov. Murphy announced that the \$300 million New Jersey Wind Port will include a manufacturing site, as well as a location to assemble turbine parts before they are shipped to wind farm locations offshore.

More Information

The Department of Environmental Protection, through Air Quality, Energy & Sustainability (AQES), as well as other programs, continues to implement New Jersey's climate mitigation initiatives and to work with the NJBPU to expand clean energy, energy efficiency, renewable energy, and clean transportation alternatives in the State.

More information on the Energy Master Plan and other NJBPU initiatives is available at <https://www.nj.gov/emp>

More information on the RGGI program is available at <https://nj.gov/rggi/>

More information about New Jersey's Climate Initiatives can be found at <https://www.nj.gov/dep/climatechange/>

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