

New Jersey Peaker Power Plants

Energy Storage Replacement Opportunities

Across New Jersey, 15 gas- and oil-fired peaker power plants and peaking units at larger plants help meet statewide peak electric demand. These facilities are primarily reliant on combustion turbines designed to ramp up quickly and meet peak demand. One third of New Jersey peaker plants primarily burn oil, and two thirds are over 30 years old; these facilities in particular have high rates of greenhouse gas and criteria pollutant emissions for every unit of electricity generated. Moreover, these plants are located disproportionately in low-income and minority communities, where vulnerable populations already experience high levels of health and environmental burdens. Many of the New Jersey peakers operate infrequently, suggesting they may be good targets for replacement with energy storage. The state has also set aggressive clean energy and energy storage deployment targets, providing an opportunity to replace inefficient, high-emitting peaker plants in vulnerable communities throughout the state with energy storage and solar.

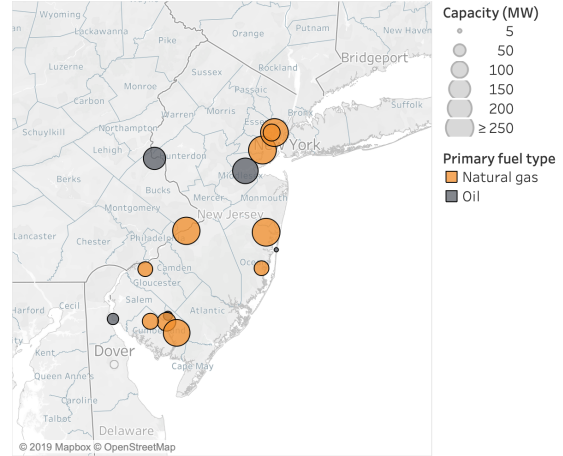


Figure 1: Peaker plants across New Jersey

State policy and regulatory environment

New Jersey has enacted a suite of policy targets to support clean energy adoption and emission reductions that could facilitate replacement of peakers with solar and storage. Key targets include:

- **2030:** Deployment of 2,000 MW of energy storage, with a 2021 target of 600 MW
- **2030:** 50% of electricity from renewable resources, including a solar carve-out and offshore wind targets
- **2050:** 80% reduction in greenhouse gas emissions below 2006 levels

The grid in New Jersey is operated by PJM, which typically defines local requirements for power capacity on the grid. PJM classifies locational delivery areas (LDAs), and the EMAAC LDA which covers New Jersey is considered at least partially transmission-constrained. Local solar and storage deployments may be valuable in these transmission-constrained areas.

New Jersey peaker plants

Peak electricity demand in New Jersey is partially met by 14 gas turbines and one small internal combustion engine. Features of some of these plants suggest that they should be prioritized for replacement with energy storage, including:

- **Aging:** Ten are over 40 years old.
- **Short runtimes:** Five of the eight plants for which we have data run less than five hours each time they are started up, which aligns well with battery operation (see Figure 2).

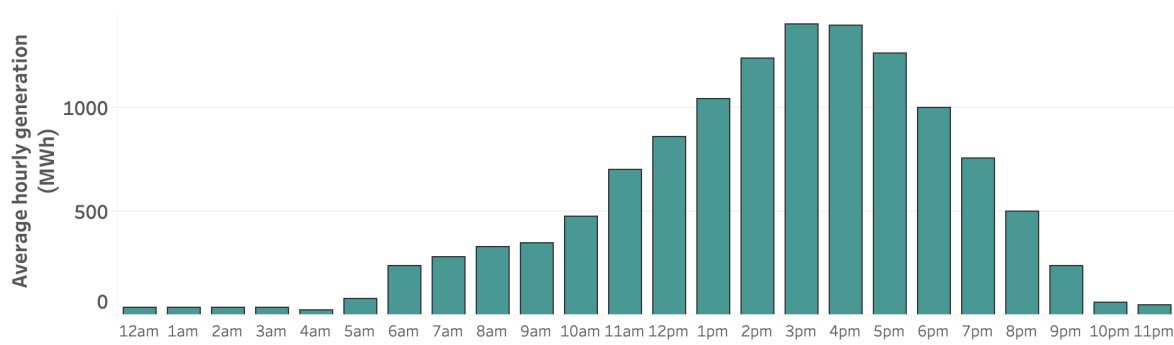


Figure 2: Average hourly generation from the Essex peaker plant. The plant typically meets peak afternoon loads. It also runs an average of 4.9 hours each start up. Batteries can serve a similar role on the grid.

- **Infrequently used:** 11 operate at a capacity factor of 2% or less—that is, they generate 2% of the electricity that they would if they were on constantly at full power all year. The five oil-fired peakers all operate at a capacity factor of 0.6% or less.

The net capacity of facilities with a capacity factor under 2% is 1,400 MW, well below the state’s 2030 energy storage target of 2,000 MW. The total peaking capacity in New Jersey is 2,732 MW.

Emissions and the environment

One third of New Jersey peaker plants and units burn primarily oil and the remainder primarily use natural gas, although many burn both. The oil-burning facilities in particular, as well as a couple older natural gas turbines, have high nitrogen oxide (NO_x) emission rates—pollution per unit of electricity generated. NO_x is a precursor to ozone and particulate matter formation. The state is considered out of attainment of federal ozone standards; operation of these plants on hot summer days to meet air conditioning demands can exacerbate these poor air quality conditions. Notably, between 2016 and 2018, the Ocean Peaking Power plant generated 12% of its electricity on days exceeding local air quality standards.

Nearby populations

New Jersey peaker plants are located in a mix of urban and rural areas, with populations in a three-mile radius ranging from nearly no one (for the peaking unit located at Salem nuclear power plant) to 250,000 near the Kearny plant. Populations living within three miles of these plants tend to be disproportionately low-income and minority populations: communities near all but two plants are above the 50th percentile statewide for low-income populations (that is, they have low-income households

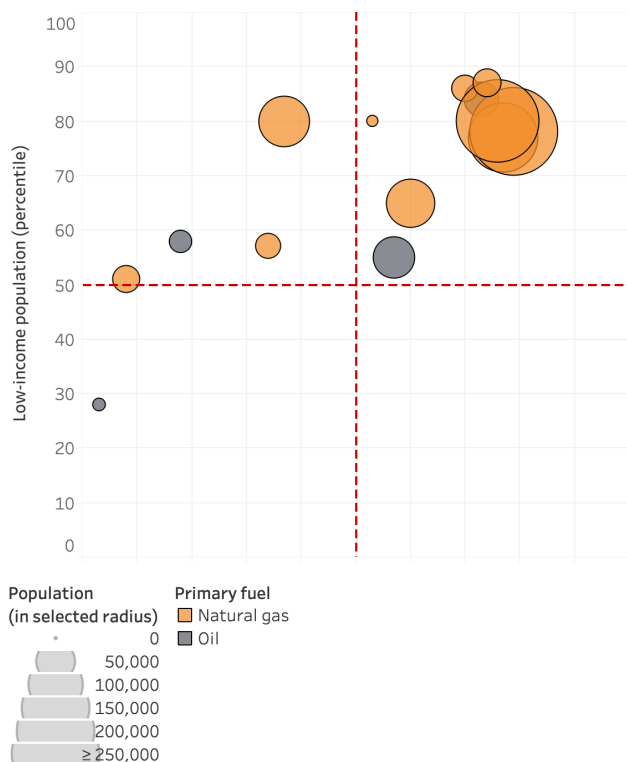


Figure 3: Demographic distribution of New Jersey peaker plants. Bubbles reflect population size. Axes mark percentiles for low-income and minority populations living within three miles of each facility.

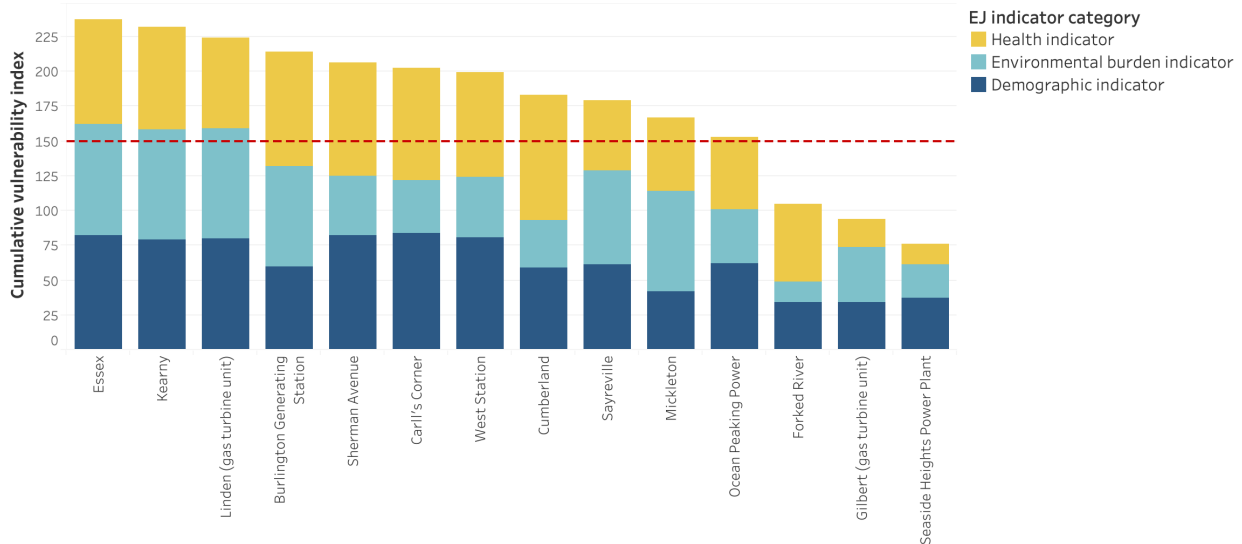


Figure 4: The cumulative vulnerability index reflects a set of environmental, human health and demographic indicators for populations living within three miles of each plant. The score is based on a comparison of indicators to statewide values: if a plant ranked at the median percentile for all indicators, it would score 150, which is indicated by the red dashed line. Salem not shown (no score).

than half of New Jersey census tracts), and communities near nine plants are above the 50th percentile for minority populations (see Figure 3). Many communities also have a high cumulative exposure to environmental health burdens from numerous sources. We developed a cumulative vulnerability index that integrates data on health burdens (asthma, heart attacks, premature birth rates); environmental burdens (ozone, particulate matter, toxics, traffic proximity, lead paint, and hazardous facilities); and demographic indicators (low-income, minority, linguistically isolated, and non-high school educated populations). The cumulative vulnerability index for populations living within three miles of each facility is shown in Figure 4.

Summary

New Jersey peak demand is met by an aging fleet of peaker power plants located disproportionately in the state’s low-income and minority communities. The state’s oil-burning plants, in particular, are used infrequently but have high pollutant emission rates when they are operated, suggesting they might be good candidates for replacement. The state’s energy storage targets provide an opportunity to target the more inefficient and polluting facilities, particularly in disadvantaged communities, for replacement with cleaner alternatives. In the attached table, we provide operational, environmental and demographic data for New Jersey peakers and nearby populations. Indicators such as nearby population, emission rates, heat rate (a measure of inefficiency), operation on poor air quality days, capacity factor, and typical run hour can also inform whether a given plant might be a good target for replacement with storage or solar+storage.

New Jersey peaker plant operational and demographic data. For methods see www.psehealthyenergy.org.

Name (EIA ID)	Plant description			Operation and emissions									Demographics (3-mile radius)			
	Status	City	Fuel ¹	MW ²	Load zone ³	Age ⁴	Capacity factor ⁵	Run hours/start ⁶	Heat rate ⁷ MMBtu/MWh	CO ₂ rate ⁸ tons/MWh	NO _x rate ⁹ g/MWh	% MWh high ozone days ¹⁰	Pop.	% non-white (percentile) ¹¹	% low-income (percentile) ¹²	CVI ¹³
Burlington Generating Station (2399)	Operating	Burlington	Natural gas	242	PSEG	52	2.0%	3.9	9.8	0.6	447	0%	75,794	48% (60)	28% (65)	214
Carll's Corner (2379)	Operating	Upper Deerfield	Natural gas	84	AECO	46	1.8%	—	24.3	1.5	8,058	4.3%	25,279	69% (74)	51% (87)	202
Cumberland (5083)	Operating	Millville	Natural gas	231	AECO	29	8.2%	—	9.0	0.5	122	2.6%	4,102	39% (53)	42% (80)	183
Essex (2401)	Operating	Newark	Natural gas	94	PSEG	48	1.2%	4.9	10.0	0.6	382	0%	221,376	73% (76)	42% (80)	237
Forked River (7138)	Operating	Forked River	Natural gas	77	JCPL	30	1.4%	—	13.8	0.8	1,010	5.8%	23,741	6% (8)	19% (51)	105
Gilbert GT ¹⁴ (2393)	Operating	Milford	Oil	161	JCPL	49	0.4%	4.1	11.6	0.8	622	0%	5,254	3% (3)	17% (28)	94

¹Primary fuel; many plants burn both oil and natural gas

²Installed nameplate capacity (plant size)

³Load zones within PJM, indicating utility service area.

⁴Age of oldest unit in 2019

⁵Percent of time running as compared to running all year at full capacity

⁶Average number of hours plant runs each time it is turned on

⁷Heat rates are energy burned per unit of electricity generated; high heat rates reflect low efficiency

⁸Direct carbon dioxide emissions per unit of electricity generated; does not include upstream emissions

⁹Nitrogen oxides (NO_x) emitted per unit of electricity generated; NO_x contributes to ozone and particulate matter formation

¹⁰Percent of generation on days nearby monitors record exceedances of federal ozone standards

¹¹Percentile minority population indicates percent of census tracts across the state with lower fraction of non-white populations

¹²Percentile low-income population indicates percent of census tracts across the state with lower fraction of households below double the federal poverty limit

¹³Cumulative Vulnerability Index combines state percentiles for demographic, health and environmental exposure indicators. A median on all values would score 150.

¹⁴Gas turbine unit at 512 MW gas combined cycle plant

Kearny (2404)	Operating	Kearny	Natural gas	605	PSEG	52	7.1%	6.6	10.0	0.6	153	0%	251,073	78% (79)	40% (78)	232
Linden GT¹⁵ (2406)	Operating	Linden	Natural gas	384	PSEG	52	1.5%	5.0	12.3	0.8	290	0%	155,967	74% (77)	39% (77)	224
Mickleton (8008)	Operating	Mickleton	Natural gas	71	AECO	45	1.0%	—	26.0	1.5	13,071	0%	20,393	22% (34)	22% (57)	167
Ocean Peaking Power (55938)	Operating	Lakewood	Natural gas	383	JCPL	16	9.8%	10.5	10.0	0.6	142	11.7%	83,116	25% (37)	42% (80)	153
Salem GT¹⁶ (2410)	Operating	Lower Alloways Creek Township	Oil	383	PSEG	48	0.02%	1.5	30.9	2.5	16,820	0%	—	—	—	—
Sayreville (2390)	Operating	Sayreville	Oil	212	JCPL	47	0.2%	—	17.9	1.2	1,216	0%	55,684	44% (57)	21% (55)	179
Seaside Heights Power Plant (58172)	Operating	Seaside Heights	Oil	6	—	7	0.6%	—	11.9	1.0	16,611	—	16,346	13% (18)	23% (58)	76
Sherman Avenue (7288)	Operating	Vineland	Natural gas	113	AECO	28	4.7%	7.5	12.8	0.8	417	4.8%	22,610	63% (70)	49% (86)	206
West Station (6776)	Operating	Vineland	Oil	27	—	47	0.3%	—	16.2	1.3	2,894	—	38,848	67% (73)	46% (84)	199

¹⁵Gas turbine unit at 1,062 MW gas combined cycle plant

¹⁶Gas turbine unit at 2,330 MW nuclear power plant