New Jersey Peaker Power Plants

nergy 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 40 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, solar, demand response and other clean alternatives.

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; intermediary 2021 target of 600 MW.

2030: 50 percent of electricity from renewable resources, including a solar carve-out and o shore wind targets.

2050: 80 percent reduction in greenhouse gas emissions below 2006 levels.

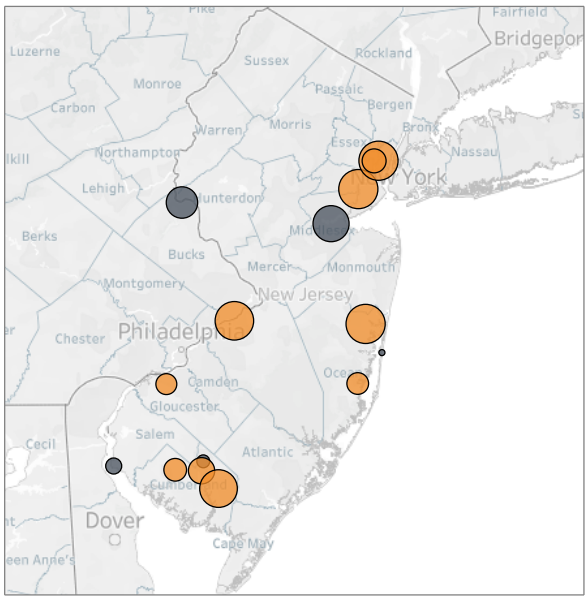

Figure 1: Peaker plants across New Jersey

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 is 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 or a portfolio of cleaner energy technologies, including:

Aging: Ten are over 40 years old.

Short runtimes: Six of the fourteen 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).

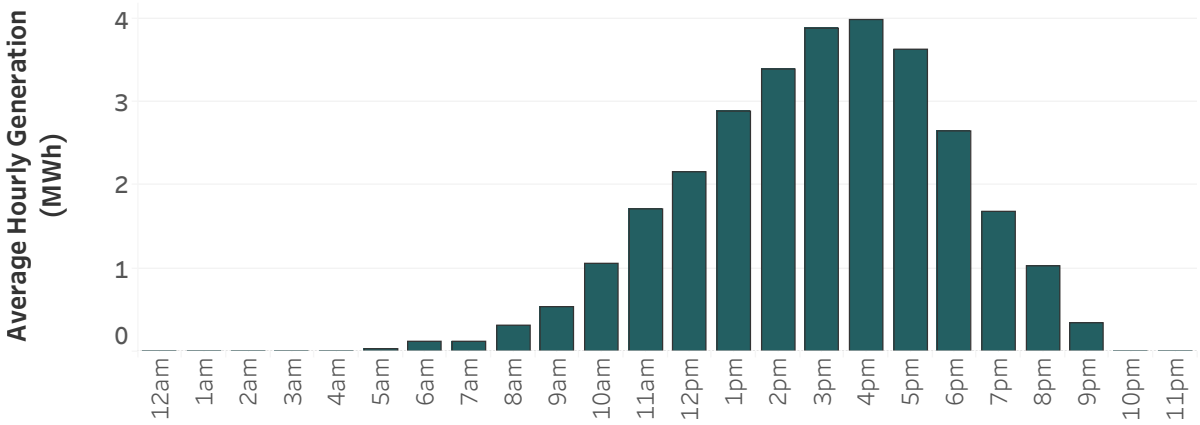

Figure 2: Average hourly generation from the Essex peaker plant. The plant typically meets peak afternoon loads. It ran an average of 6.1 hours each time it started up in 2016, but by 2018 its average run time had declined to 2.6 hours per start, and its capacity factor declined from 2.6 to 0.2 percent. Batteries can serve a similar role on the grid.

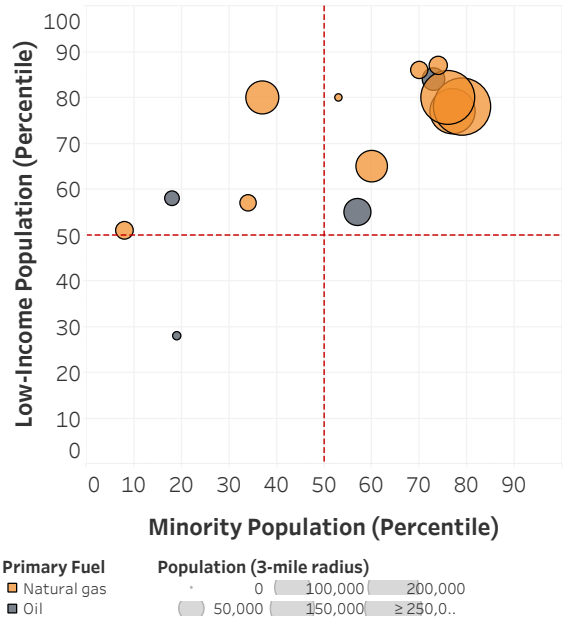

Figure 3: New Jersey power plants are located in low-income and largely minority communities. Bubbles reflect population size. Axes mark state percentiles for low-income (double federal poverty limit) and minority populations living within three miles of each facility.

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

The net capacity of facilities with a capacity factor under 2 percent is 1,400 MW, well below the state's 2030 storage target of 2,000 MW. New Jersey's total peaking capacity is 2,732 MW. Plants with longer runtimes might be best replaced with a mixed portfolio of cleaner resources that can meet similar grid needs, such as solar, storage and demand response.

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 more low-income households 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 iso-

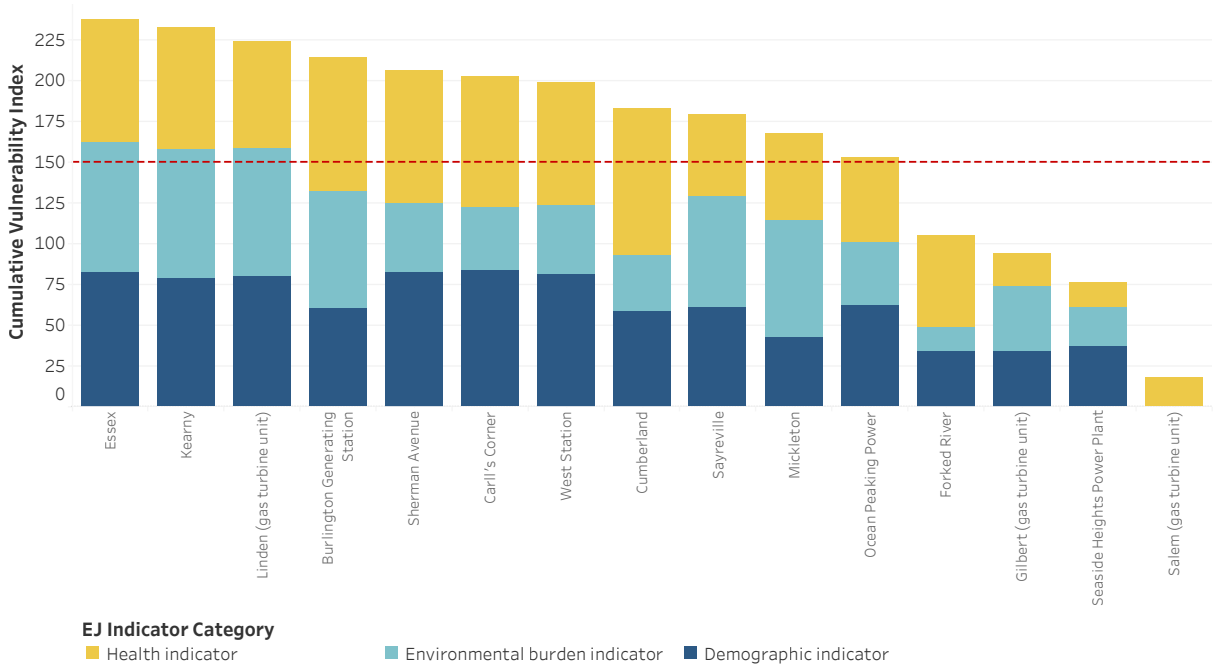

Figure 4: The cumulative vulnerability index re ects a set of environmental, human health and demographic indicators for populations living within three miles of each plant. The score is based on a comparison of indicators to statewide values: if a plant ranked at the median percentile for all indicators, it would score 150, which is indicated by the red dashed line. (Note: Salem has limited data available.)

lated, and non-high school educated populations). The cumulative vulnerability index for populations living within three miles of each facility is shown in **Figure 4**.

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) emission rates—pollution per unit of electricity generated. NO 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 10 percent of its electricity on days exceeding local air quality standards.

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 (fuel used per megawatt-hour), operation on poor air quality days, capacity factor, and typical run hours can also inform whether a given plant might be a good target for replacement with storage, solar+storage, demand response, or other clean alternatives. These data should be accompanied by engagement with a ected communities to determine replacement priorities and strategies.

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

	Plant description					Operation and emissions							Demographics (3-mile radius)			
Name (EIA ID)	**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 rate**[9] lbs/MWh	**% MWh high ozone days**[1]	**Pop.**	**% non-white** (percentile)[11]	**% low-income** (percentile)[12]	**CVI**[13]
Burlington Generating Station (2399)	Operating	Burlington	Natural gas	242	PSEG	53	2.0%	3.8	9.8	0.6	1.0	7.9%	75,794	48% (60)	28% (65)	214
Carll's Corner (2379)	Operating	Upper Deer eld	Natural gas	84	AECO	47	1.8%	5.8	24.3	1.5	17.8	3.9%	25,279	69% (74)	51% (87)	202
Cumberland (5083)	Operating	Millville	Natural gas	231	AECO	30	8.2%	7.8	9.0	0.5	0.3	1.0%	4,102	39% (53)	42% (80)	183
Essex (2401)	Operating	Newark	Natural gas	94	PSEG	49	1.2%	5.1	10.0	0.6	0.8	3.2%	221,376	73% (76)	42% (80)	237
Forked River (7138)	Operating	Forked River	Natural gas	77	JCPL	31	1.4%	6.2	13.8	0.8	2.2	7.9%	23,741	6% (8)	19% (51)	105

[1]Primary fuel; many plants burn both oil and natural gas.
[2]Installed nameplate capacity (plant size).
[3]Load zones within PJM, indicating utility service area.
[4]Age of oldest unit in 2020.
[5]Percent of time running as compared to running all year at full capacity.
[6]Average number of hours plant runs each time it is turned on.
[7]Heat rates are energy burned per unit of electricity generated; high heat rates re ect low efficiency.
[8]Direct carbon dioxide emissions per unit of electricity generated; does not include upstream emissions.
[9]Nitrogen oxides (NO) emitted per unit of electricity generated; NO contributes to ozone and particulate matter formation.
[1] Percent of generation on days nearby monitors record exceedances of federal ozone standards.
[11]Percentile minority population indicates percent of census tracts across the state with lower fraction of non-white populations.
[12]Percentile low-income population indicates percent of census tracts across the state with lower fraction of households below double the federal poverty limit.
[13]Cumulative Vulnerability Index combines state percentiles for demographic, health and environmental exposure indicators. A median on all values would score 150.

Gilbert GT[14] (2393)	Operating	Milford	Oil	161	JCPL	50	0.4%	4.7	11.6	0.8	1.4	0%	5,254	3% (3)	17% (28)	94
Kearny (2404)	Operating	Kearny	Natural gas	605	PSEG	53	7.1%	6.0	10.0	0.6	0.3	3.9%	251,073	78% (79)	40% (78)	232
Linden GT[15] (2406)	Operating	Linden	Natural gas	384	PSEG	53	1.5%	4.9	12.3	0.8	0.6	8.6%	155,967	74% (77)	39% (77)	224
Mickleton (8008)	Operating	Mickleton	Natural gas	71	AECO	46	1.0%	6.2	26.0	1.5	28.8	6.1%	20,393	22% (34)	22% (57)	167
Ocean Peaking Power (55938)	Operating	Lakewood	Natural gas	383	JCPL	17	10.1%	13	10.1	0.6	0.3	9.7%	83,116	25% (37)	42% (80)	153
Salem GT[16] (2410)	Operating	Lower Alloways Creek Township	Oil	383	PSEG	49	0.02%	1.3	30.9	2.5	37.1	0%	—	—	—	—
Sayreville (2390)	Operating	Sayreville	Oil	212	JCPL	48	0.2%	3.4	17.9	1.2	2.7	0.1%	55,684	44% (57)	21% (55)	179
Seaside Heights Power Plant (58172)	Operating	Seaside Heights	Oil	6	—	8	0.6%	—	11.9	1.0	26.6	—	36.7	NA% (18)	23% (58)	76
Sherman Avenue (7288)	Operating	Vineland	Natural gas	113	AECO	29	4.7%	7.8	12.8	0.8	0.9	4.4%	22,610	63% (70)	49% (86)	206
West Station (6776)	Operating	Vineland	Oil	27	—	48	0.3%	3.6	16.2	1.3	6.4	2.1%	38,848	67% (73)	46% (84)	199

[14]Gas turbine unit at 512 MW gas combined cycle plant.
[15]Gas turbine unit at 1,062 MW gas combined cycle plant.
[16]Gas turbine unit at 2,330 MW nuclear power plant.