Florida Peaker Power Plants

Energy Storage Replacement Opportunities

Across Florida, 35 gas- and oil-fired peaker power plants and peaking units at larger plants help meet statewide peak electric demand. These facilities include primarily gas turbines as well as internal combustion engines and steam turbines. One-third burn primarily oil, and two-thirds burn natural gas, although many burn both. Nearly half of Florida's peaker units are located at larger plants, including two located at coal plants. Many of Florida's peaker units are aging—24 are over 40 years old—and operated infrequently. Most are both larger and less efficient than similar plants nationwide. These features suggest that they may be good targets for replacement with energy storage and solar, demand response, and other clean alternatives. The siting of many of these units at larger plants, however, means that careful planning is required to ensure that energy storage replacements are not charged with high-emission resources (e.g. coal), which could inadvertently increase emissions. While Florida's peaker units are located in both rural and urban areas, the latter tend to be located near minority and low-income populations which experience high levels of cumulative environmental, health, and socioeconomic burdens. Investments in distributed energy storage and clean energy resources in historically underresourced communities near some of these plants have the potential to mitigate a source of pollution while providing resilience benefits to the surrounding community.

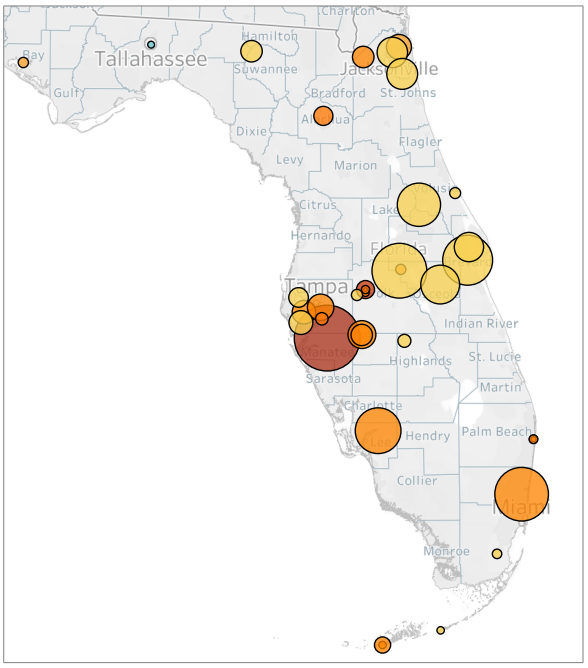

Figure 1: Peaker plants across Florida

Florida State Policy and Regulatory Environment

Florida has limited policies in support of renewable energy resources or energy storage. Electricity is provided by five investor-owned utilities along with dozens of municipal utilities and rural electric cooperatives. Many of these utilities own their own electric generation, and some have set their own energy storage targets or begun to procure energy storage. Florida Power & Light, for example, recently announced a plan to bring online a 409-megawatt battery storage system in 2021. The municipal utilities may provide a route for local input to influence the procurement of energy storage, solar, and other resources, which may be particularly valuable in hurricane-prone regions where storage can provide backup power in the case of electric outages.

Florida Peaker Plants

Peak electricity demand in Florida is partially met by 35 gas turbines, internal combustion engines, and steam turbines. Features of some of these plants suggest that they may be good candidates for replacement with energy storage or a portfolio of cleaner energy technologies, including:

- **Aging:** Twenty-four are over 40 years old.

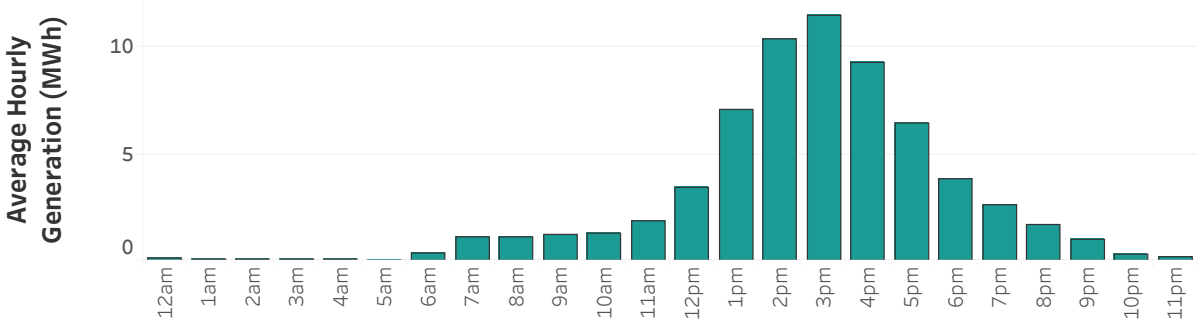

Figure 2: Average hourly generation from the Indian River peaker plant. The plant typically meets peak afternoon loads. It runs an average of 4.9 hours each time it starts up and has a capacity factor of 0.7 percent. Batteries can serve a similar role on the grid.

- **Inefficient:** Twenty-five are less efficient than similar units nationwide.
- **Infrequently used:** Twenty-four 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. Three units report negative generation because they use more electricity on site than they supply to the grid.

Data on Florida peakers are limited, but some of the peakers with short runtimes (see **Figure 2**) may be well suited for replacement with energy storage. Plants with longer runtimes may need to be replaced with a mixed portfolio of cleaner resources that can meet similar grid needs, such as solar, storage, and demand response. In addition, plans for two new peakers may provides an opportunity to invest in cleaner energy resources instead.

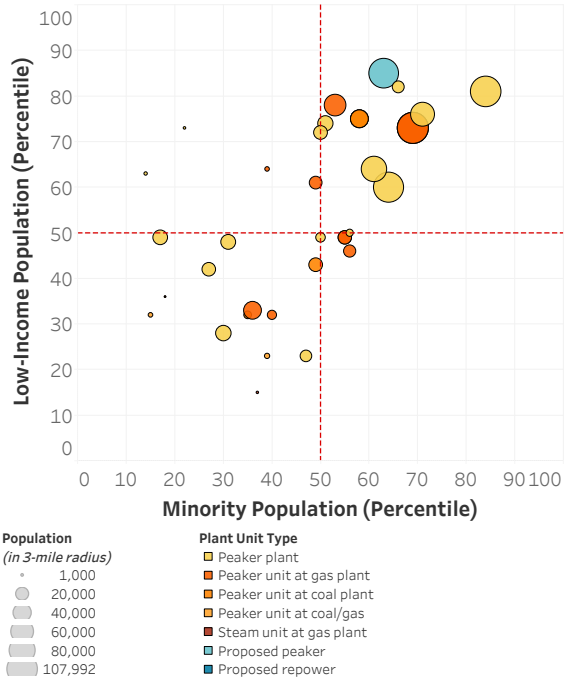

Figure 3: Demographics near Florida peaker plants. Bubbles reflect population size. Axes mark state percentiles for low-income (double federal poverty limit) and minority populations living within three miles of each facility.

Nearby Populations

Florida peaker plants are located in a mix of rural and urban areas, with populations in a three-mile radius ranging from nearly no one to more than 100,000 near the Tom G Smith facility. These nearby communities also reflect a mix of demographic characteristics: some have very high proportions of low-income population and minority populations, while others do not (see **Figure 3**). Many of these communities also experience 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**. In Florida, urban plants tend to be located in areas where nearby communities have a higher proportion of low-income and minority populations and experience higher cumulative burdens than elsewhere in the state. In addition to reducing emissions,

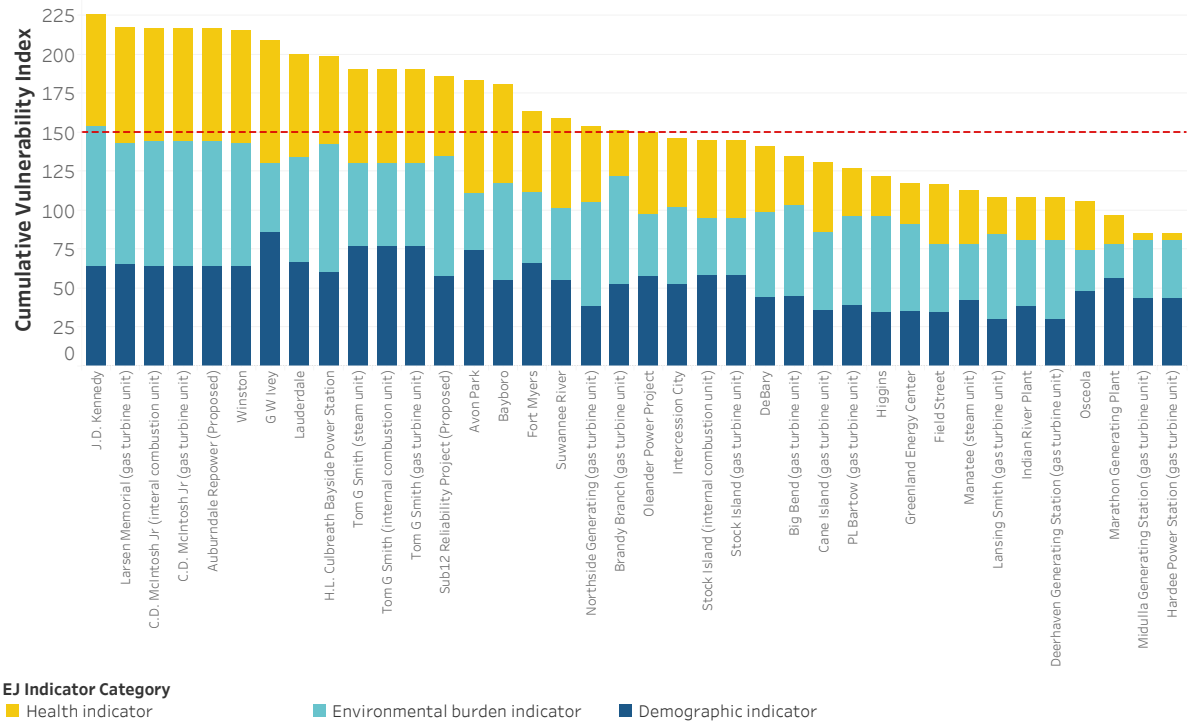

Figure 4: The cumulative vulnerability index reflects a set of environmental, human health, and demographic indicators for populations living within three miles of each plant. The score is based on a comparison of indicators to statewide values: if a plant ranked at the median percentile for all indicators,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

distributed energy storage can play an important role in providing electricity to vulnerable populations during grid outages. Energy storage can be used to provide backup during outages following hurricanes, or to create resilient cooling centers for vulnerable populations during heat waves.

Emissions and the Environment

One-third of Florida peaker plants and units burn primarily oil and the remainder use primarily natural gas, although many burn both. The oil-burning facilities, as well as a few of the older natural gas turbines and internal combustion engines, have high nitrogen oxide (NO_x) emission rates—pollution per unit of electricity generated. NO_x is a precursor to ozone and particulate matter, which can have cardiovascular and respiratory impacts. Energy storage can help replace plants with high emission rates, but care must be taken to ensure that the electricity used to charge the batteries does not have high emission rates.

Summary

Florida peak demand is met by an aging fleet of stand-alone peaker plants and peaker units at larger plants. The state's oil-burning plants are used infrequently and have high pollutant emission rates when they are operated, suggesting they might be good candidates for replacement. Some report negative generation due to more on-site consumption of electricity than is provided to the grid. Florida peakers are located in rural and urban areas with a wide range of demographics statewide, although the urban plants tend to have more low-income and minority populations living nearby. While the state has limited policies to support storage or renewable energy resources, individual utilities have begun to procure these resources. The municipal utilities, in particular, may respond to local desires for energy storage in nearby communities, especially in the context of improved resilience in the face of hurricanes or other natural disasters. In the attached table, we provide operational, environmental and demographic data for Florida 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 affected communities to determine replacement priorities and strategies.

Florida 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]	**Age**[3]	**Capacity factor**[4]	**Run hours/ start**[5]	**Heat rate**[6] MMBtu/ MWh	**CO_2 rate**[7] tons/ MWh	**NO_x rate**[8] lbs/MWh	**% MWh high ozone days**[9]	**Pop.**	**% non-white** (percentile)[10]	**% low-income** (percentile)[11]	**CVI**[12]
Auburndale Repower (676)	Proposed	Polk	Natural gas	130	NA	NA	NA	NA	NA	NA	NA	35,584	48% (58)	52% (75)	216
Avon Park (67)	Unknown; retiring?	Highlands	Natural gas	67	52	0.6%	NA	17.7	1.1	6.4	NA	15,885	56% (66)	58% (82)	183
Bayboro (627)	Operating	Pinellas	Oil	227	47	0.2%	NA	14.5	1.2	12.4	NA	72,410	51% (61)	44% (64)	180
Big Bend (gas turbine unit[13] (645)	Operating	Hillsborough	Natural gas	62	51	2.9%	5.1	9.6	0.6	0.8	1.1%	21,114	38% (49)	31% (43)	134
Brandy Branch (gas turbine unit[14] (7846)	Operating	Duval	Natural gas	185	19	6.5%	8.6	9.7	0.6	0.4	0.5%	2,347	30% (39)	44% (64)	151

[1]Primary fuel; many plants burn both oil and natural gas.
[2]Installed nameplate capacity (plant size).
[3]Age of oldest unit in 2020.
[4]Percent of time running as compared to running all year at full capacity.
[5]Average number of hours plant runs each time it is turned on.
[6]Heat rates are energy burned per unit of electricity generated; high heat rates reflect low efficiency.
[7]Direct carbon dioxide emissions per unit of electricity generated; does not include upstream emissions.
[8]Nitrogen oxides (NO_x) emitted per unit of electricity generated; NO_x contributes to ozone and particulate matter formation.
[9]Percent of generation on days nearby monitors record exceedances of federal ozone standards.
[10]Percentile minority population indicates percent of census tracts across the state with lower fraction of non-white populations.
[11]Percentile low-income population indicates percent of census tracts across the state with lower fraction of households below double the federal poverty limit.
[12]Cumulative Vulnerability Index combines state percentiles for demographic, health and environmental exposure indicators. A median on all values would score 150.
[13]Gas turbine unit at 1,822 MW gas plant.
[14]Gas turbine unit at 1,062 MW gas combined cycle plant.

C.D. McIntosh Jr (gas turbine unit)[15] (676)	Operating	Polk	Natural gas	27	47	1.5%	NA	NA	NA	NA	NA	35,584	48% (58)	52% (75)	216
Cane Island (gas turbine unit)[16] (7238)	Operating	Osceola	Natural gas	42	26	0.8%	4.0	11.0	0.7	0.9	2.1%	9,490	31% (40)	26% (32)	130
DeBary (6046)	Operating	Volusia	Natural gas	748	45	1.6%	6.9	13.5	0.8	1.1	0.6%	24,645	24% (31)	34% (48)	141
Deerhaven Generating Station (gas turbine unit)[17] (663)	Operating	Alachua	Natural gas	145	44	0.6%	7.1	13.5	0.8	0.4	0%	6,618	26% (35)	26% (32)	108
Field Street (7954)	Operating	Volusia	Oil	48	19	0%[18]	NA	NA	NA	NA	NA	24,138	13% (17)	35% (49)	116
Fort Myers[19] (612)	Operating	Lee	Natural gas	835	46	2.8%	7.7	10.7	0.7	1.6	0%	18,204	39% (49)	42% (61)	163
GW Ivey (665)	Operating	Miami-Dade	Natural gas	36	66	0.6%	NA	21.2	1.3	59	NA	104,970	85% (84)	57% (81)	209
Greenland Energy Center (56799)	Operating	Duval	Natural gas	381	9	9.3%	13.0	10.7	0.6	0.3	0.1%	15,087	37% (47)	21% (23)	117
H.L. Culbreath Bayside Power Station[20] (7873)	Operating	Hillsbor-ough	Natural gas	280	11	2.1%	5.0	9.7	0.8	9.7	0.9%	16,709	46% (56)	33% (46)	198

[15]Gas turbine unit at 957 MW gas peaker plant.
[16]Gas turbine unit at 735 MW gas combined cycle plant.
[17]Gas turbine unit at 471 MW coal plant.
[18]Field Street reports net negative generation, meaning it uses more electricity on site than it supplies to the grid.
[19]Gas turbine unit at 2,680 MW gas combined cycle plant
[20]Gas turbine unit at 1,800 MW gas combined cycle plant.

Hardee Power Station (gas turbine unit)[21] (50949)	Operating	Hardee	Natural gas	182	27	1.4%	6.5	13.1	0.8	0.4.	0.7%	281	14% (18)	27% (36)	85
Higgins (630)	Unknown; retiring?	Pinellas	Natural gas	153	51	1.5%	NA	17.8	1.0	6.6	NA	26,942	23% (30)	24% (28)	121
Indian River Plant (683)	Operating	Brevard	Natural gas	343	31	0.7%	5.1	14.7	0.9	1.0	0.8%	20,661	20% (27)	31% (42)	108
Intercession City (8049)	Operating	Osceola	Natural gas	1,197	46	3.8%	8.1	13.4	0.8	0.7	0.8%	10,268	40% (50)	35% (49)	146
J.D Kennedy (666)	Operating	Duval	Natural gas	370	47	2.0%	6.8	10.1	0.6	0.4	0.5%	64,158	64% (71)	53% (76)	225
Lansing Smith (gas turbine unit)[22] (643)	Operating	Bay	Oil	42	49	0.1%	NA	17.3	1.4	2.5	NA	2,392	12% (15)	26% (32)	108
Larsen Memorial (gas turbine unit)[23] (675)	Operating	Polk	Natural gas	22	58	0.0%	NA	36.1	2.2	0.2	NA	52,734	42% (53)	54% (78)	217
Lauderdale (613)	Operating	Broward	Natural gas	1,148	50	3.1%	6.0	10.5	0.7	0.5	0.6%	101,699	54% (64)	41% (60)	200
Manatee (steam turbine unit)[24] (6042)	Operating; retiring 2022	Manatee	Natural gas	1,727	44	11.2%	23.4	11.0	0.7	0.7	1.0%	677	28% (37)	16% (15)	112
Marathon Generating Plant (696)	Operating	Monroe	Oil	11	62	0.0%[25]	NA	NA	NA	NA	NA	5,846	45% (56)	35% (50)	96

[21]Gas turbine unit at 470 MW gas combined cycle plant.
[22]Gas turbine unit at 661 MW gas plant.
[23]Gas turbine unit at 134 MW gas combined cycle plant.
[24]Steam turbine unit at 2,951 MW gas plant.
[25]Marathon reports net negative generation, meaning it uses more electricity on site than it supplies to the grid.

Midulla Generating Station (gas turbine unit)[26] (7380)	Operating	Hardee	Natural gas	310	14	6.9%	6.4	11.8	0.7	1.0	1.0%	280	14% (18)	27% (36)	85
Northside Generating (gas turbine unit[27] (667)	Operating	Duval	Oil	248	46	0.1%	NA	18.4	1.5	13.7	NA	3,119	29% (39)	21% (23)	153
Oleander Power Project (55286)	Operating	Brevard	Natural gas	994	18	1.6%	10.3	11.3	0.7	0.4	2.0%	21,303	39% (50)	50% (72)	149
Osceola (55192)	Unknown; missing data	Osceola	Natural gas	600	19	NA	NA	NA	NA	NA	NA	1,309	11% (14)	43% (63)	105
PL Bartow (gas turbine unit[28] (634)	Operating	Pinellas	Natural gas	222	48	1.3%	NA	16.0	1.0	0.7	NA	35,571	27% (36)	26% (33)	126
Stock Island (gas turbine unit)[29] (6584)	Operating	Monroe	Oil	105	42	0.1%	3.3	9.9	0.8	1.6	0%	20,257	44% (55)	35% (49)	145
Stock Island (internal combustion unit)[30] (6584)	Operating	Monroe	Oil	22	55	0.1%	NA	9.9	0.8	0.5	NA	20,257	44% (55)	35% (49)	145
Sub12 Reliability Project (61080)	Proposed	Leon	Natural gas	19	NA	NA	NA	NA	NA	NA	NA	98,815	53% (63)	61% (85)	185
Tom G Smith (gas turbine unit)[31] (673)	Operating	Palm Beach	Oil	31	44	0.1%	16	38.3	1.8	42	0%	107,992	60% (69)	50% (73)	190

[26]Gas turbine unit at 897 MW gas combined cycle plant
[27]Gas turbine unit at 1,300 MW coal and gas plant.
[28]Gas turbine unit at 1,475 MW gas combined cycle plant
[29]Gas turbine unit at 126 MW gas peaker plant
[30]Internal combustion unit at 126 MW gas peaker plant.
[31]Gas turbine unit at 99 MW gas plant.

Tom G Smith (internal combustion unit)[32] (673)	Operating	Palm Beach	Oil	10	55	0.0% [33]	NA	NA	NA	NA	NA	107,992	60% (69)	50% (73)	190
Tom G Smith (steam turbine unit)[34] (673)	Operating	Palm Beach	Oil	27	59	1.2%	9.8	16.5	1.0	4.1	0%	107,992	60% (69)	50% (73)	190
Winston (7997)	Operating	Polk	Oil	50	19	0%[35]	NA	NA	NA	NA	NA	26,193	40% (51)	51% (74)	215

[32]Internal combustion unit at 99 MW gas plant.
[33]Tom G Smith IC unit reports net negative generation, meaning it uses more electricity on site than it supplies to the grid.
[34]Gas turbine unit at 99 MW gas plant.
[35]Winston reports fuel consumption and emissions, but zero electricity generation.