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 under-resourced communities near some of these plants have the potential to mitigate a source of pollution while providing resilience benefits to the surrounding community.

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 provide an opportunity to invest in cleaner energy resources instead.

**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 (NOx) emission rates—pollution per unit of electricity generated. NOx 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.

<table>
<thead>
<tr>
<th>Name (EIA ID)</th>
<th>Status</th>
<th>City</th>
<th>Fuel</th>
<th>MW</th>
<th>Age</th>
<th>Capacity factor</th>
<th>Heat rate</th>
<th>CO₂ rate</th>
<th>NOₓ rate</th>
<th>% MWh high ozone days</th>
<th>Pop.</th>
<th>% non-white (percentile)</th>
<th>% low-income (percentile)</th>
<th>CVI</th>
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</thead>
<tbody>
<tr>
<td>Auburndale Repower (676)</td>
<td>Proposed</td>
<td>Polk</td>
<td>Natural gas</td>
<td>130</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>35,584</td>
<td>48% (58)</td>
<td>52% (75)</td>
<td>216</td>
</tr>
<tr>
<td>Avon Park (67)</td>
<td>Unknown; retiring?</td>
<td>Highlands</td>
<td>Natural gas</td>
<td>67</td>
<td>52</td>
<td>0.6%</td>
<td>NA</td>
<td>17.7</td>
<td>1.1</td>
<td>6.4</td>
<td>NA</td>
<td>15,885</td>
<td>56% (66)</td>
<td>58% (82)</td>
</tr>
<tr>
<td>Bayboro (627)</td>
<td>Operating</td>
<td>Pinellas</td>
<td>Oil</td>
<td>227</td>
<td>47</td>
<td>0.2%</td>
<td>NA</td>
<td>14.5</td>
<td>1.2</td>
<td>12.4</td>
<td>NA</td>
<td>72,410</td>
<td>51% (61)</td>
<td>44% (64)</td>
</tr>
<tr>
<td>Big Bend (gas turbine unit) (645)</td>
<td>Operating</td>
<td>Hillsborough</td>
<td>Natural gas</td>
<td>62</td>
<td>51</td>
<td>2.9%</td>
<td>5.1</td>
<td>9.6</td>
<td>0.6</td>
<td>0.8</td>
<td>1.1%</td>
<td>21,114</td>
<td>38% (49)</td>
<td>31% (43)</td>
</tr>
<tr>
<td>Brandy Branch (gas turbine unit) (7846)</td>
<td>Operating</td>
<td>Duval</td>
<td>Natural gas</td>
<td>185</td>
<td>19</td>
<td>6.5%</td>
<td>8.6</td>
<td>9.7</td>
<td>0.6</td>
<td>0.4</td>
<td>0.5%</td>
<td>2,347</td>
<td>30% (39)</td>
<td>44% (64)</td>
</tr>
</tbody>
</table>

### Notes:
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 (NOₓ) emitted per unit of electricity generated; NOₓ 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.
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Location</th>
<th>Type</th>
<th>Operating</th>
<th>County</th>
<th>Fuel Type</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.D. McIntosh Jr (gas turbine unit)</td>
<td>Operating</td>
<td>Polk</td>
<td>Natural gas</td>
<td>27</td>
<td>47</td>
<td>1.5%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>35,584</td>
<td>48% (58)</td>
</tr>
<tr>
<td>Cane Island (gas turbine units)</td>
<td>Operating</td>
<td>Osceola</td>
<td>Natural gas</td>
<td>42</td>
<td>26</td>
<td>0.8%</td>
<td>4.0</td>
<td>11.0</td>
<td>0.7</td>
<td>0.9</td>
<td>2.1%</td>
<td>9,490</td>
<td>31% (40)</td>
</tr>
<tr>
<td>DeBary (6046)</td>
<td>Operating</td>
<td>Volusia</td>
<td>Natural gas</td>
<td>748</td>
<td>45</td>
<td>1.6%</td>
<td>6.9</td>
<td>13.5</td>
<td>0.8</td>
<td>1.1</td>
<td>0.6%</td>
<td>24,645</td>
<td>24% (31)</td>
</tr>
<tr>
<td>Deerhaven Generating Station (gas turbine unit)</td>
<td>Operating</td>
<td>Alachua</td>
<td>Natural gas</td>
<td>145</td>
<td>44</td>
<td>0.6%</td>
<td>7.1</td>
<td>13.5</td>
<td>0.8</td>
<td>0.4</td>
<td>0%</td>
<td>6,618</td>
<td>26% (35)</td>
</tr>
<tr>
<td>Field Street (7954)</td>
<td>Operating</td>
<td>Volusia</td>
<td>Oil</td>
<td>48</td>
<td>19</td>
<td>0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>24,138</td>
<td>13% (17)</td>
</tr>
<tr>
<td>Fort Myers (612)</td>
<td>Operating</td>
<td>Lee</td>
<td>Natural gas</td>
<td>835</td>
<td>46</td>
<td>2.8%</td>
<td>7.7</td>
<td>10.7</td>
<td>0.7</td>
<td>1.6</td>
<td>0%</td>
<td>18,204</td>
<td>39% (49)</td>
</tr>
<tr>
<td>GW Ivey (665)</td>
<td>Operating</td>
<td>Miami-Dade</td>
<td>Natural gas</td>
<td>36</td>
<td>66</td>
<td>0.6%</td>
<td>NA</td>
<td>21.2</td>
<td>1.3</td>
<td>59</td>
<td>NA</td>
<td>104,970</td>
<td>85% (84)</td>
</tr>
<tr>
<td>Greenland Energy Center (55799)</td>
<td>Operating</td>
<td>Duval</td>
<td>Natural gas</td>
<td>381</td>
<td>9</td>
<td>9.3%</td>
<td>13.0</td>
<td>10.7</td>
<td>0.6</td>
<td>0.3</td>
<td>0.1%</td>
<td>15,087</td>
<td>37% (47)</td>
</tr>
<tr>
<td>H.L. Culbreath Bayside Power Station (7873)</td>
<td>Operating</td>
<td>Hillsborough</td>
<td>Natural gas</td>
<td>280</td>
<td>11</td>
<td>2.1%</td>
<td>5.0</td>
<td>9.7</td>
<td>0.8</td>
<td>9.7</td>
<td>0.9%</td>
<td>16,709</td>
<td>46% (56)</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Status</th>
<th>County</th>
<th>Fuel Type</th>
<th>P</th>
<th>N</th>
<th>C</th>
<th>O</th>
<th>G</th>
<th>Y</th>
<th>TW</th>
<th>TW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardee Power Station (gas turbine unit)</td>
<td>Operating</td>
<td>Hardee</td>
<td>Natural gas</td>
<td>182</td>
<td>27</td>
<td>1.4%</td>
<td>6.5</td>
<td>13.1</td>
<td>0.8</td>
<td>0.4</td>
<td>0.7%</td>
</tr>
<tr>
<td>Higgins (630)</td>
<td>Unknown; retiring?</td>
<td>Pinellas</td>
<td>Natural gas</td>
<td>153</td>
<td>51</td>
<td>1.5%</td>
<td>NA</td>
<td>17.8</td>
<td>1.0</td>
<td>6.6</td>
<td>NA</td>
</tr>
<tr>
<td>Indian River Plant (683)</td>
<td>Operating</td>
<td>Brevard</td>
<td>Natural gas</td>
<td>343</td>
<td>31</td>
<td>0.7%</td>
<td>5.1</td>
<td>14.7</td>
<td>0.9</td>
<td>1.0</td>
<td>0.8%</td>
</tr>
<tr>
<td>Intercession City (8049)</td>
<td>Operating</td>
<td>Osceola</td>
<td>Natural gas</td>
<td>1,197</td>
<td>46</td>
<td>3.8%</td>
<td>8.1</td>
<td>13.4</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8%</td>
</tr>
<tr>
<td>J.D Kennedy (666)</td>
<td>Operating</td>
<td>Duval</td>
<td>Natural gas</td>
<td>370</td>
<td>47</td>
<td>2.0%</td>
<td>6.8</td>
<td>10.1</td>
<td>0.6</td>
<td>0.4</td>
<td>0.5%</td>
</tr>
<tr>
<td>Lansing Smith (gas turbine unit) (643)</td>
<td>Operating</td>
<td>Bay</td>
<td>Oil</td>
<td>42</td>
<td>49</td>
<td>0.1%</td>
<td>NA</td>
<td>17.3</td>
<td>1.4</td>
<td>2.5</td>
<td>NA</td>
</tr>
<tr>
<td>Larsen Memorial (gas turbine unit) (675)</td>
<td>Operating</td>
<td>Polk</td>
<td>Natural gas</td>
<td>22</td>
<td>58</td>
<td>0.0%</td>
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<td>36.1</td>
<td>2.2</td>
<td>0.2</td>
<td>NA</td>
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<tr>
<td>Lauderdale (613)</td>
<td>Operating</td>
<td>Broward</td>
<td>Natural gas</td>
<td>1,148</td>
<td>50</td>
<td>3.1%</td>
<td>6.0</td>
<td>10.5</td>
<td>0.7</td>
<td>0.5</td>
<td>0.6%</td>
</tr>
<tr>
<td>Manatee (steam turbine unit) (6042)</td>
<td>Operating; retiring 2022</td>
<td>Manatee</td>
<td>Natural gas</td>
<td>1,727</td>
<td>44</td>
<td>11.2%</td>
<td>23.4</td>
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<td>0.7</td>
<td>0.7</td>
<td>1.0%</td>
</tr>
<tr>
<td>Marathon Generating Plant (696)</td>
<td>Operating</td>
<td>Monroe</td>
<td>Oil</td>
<td>11</td>
<td>62</td>
<td>0.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>5,846</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Operating</th>
<th>County</th>
<th>Fuel Type</th>
<th>Output (kW)</th>
<th>Capacity Factor</th>
<th>Efficiency</th>
<th>CO2 Emissions (Mg/kW-h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midulla Generating Station (gas turbine unit)</td>
<td>Operating</td>
<td>Hardee</td>
<td>Natural gas</td>
<td>310</td>
<td>14</td>
<td>6.9%</td>
<td>6.4</td>
</tr>
<tr>
<td>Northside Generating Station (gas turbine unit)</td>
<td>Operating</td>
<td>Duval</td>
<td>Oil</td>
<td>248</td>
<td>46</td>
<td>0.1%</td>
<td>NA</td>
</tr>
<tr>
<td>Oleander Power Project (55286)</td>
<td>Operating</td>
<td>Brevard</td>
<td>Natural gas</td>
<td>994</td>
<td>18</td>
<td>1.6%</td>
<td>10.3</td>
</tr>
<tr>
<td>Osceola (55192)</td>
<td>Unknown; missing data</td>
<td>Osceola</td>
<td>Natural gas</td>
<td>600</td>
<td>19</td>
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<td>NA</td>
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<tr>
<td>PL Bartow (gas turbine unit) (634)</td>
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<td>Pinellas</td>
<td>Natural gas</td>
<td>222</td>
<td>48</td>
<td>1.3%</td>
<td>NA</td>
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<td>Stock Island (gas turbine unit) (6584)</td>
<td>Operating</td>
<td>Monroe</td>
<td>Oil</td>
<td>105</td>
<td>42</td>
<td>0.1%</td>
<td>3.3</td>
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<tr>
<td>Stock Island (internal combustion unit) (6584)</td>
<td>Operating</td>
<td>Monroe</td>
<td>Oil</td>
<td>22</td>
<td>55</td>
<td>0.1%</td>
<td>NA</td>
</tr>
<tr>
<td>Sub12 Reliability Project (61080)</td>
<td>Proposed</td>
<td>Leon</td>
<td>Natural gas</td>
<td>19</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Tom G Smith (gas turbine unit) (673)</td>
<td>Operating</td>
<td>Palm Beach</td>
<td>Oil</td>
<td>31</td>
<td>44</td>
<td>0.1%</td>
<td>16</td>
</tr>
</tbody>
</table>

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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.
<table>
<thead>
<tr>
<th>Tom G Smith (internal combustion unit)</th>
<th>Operating</th>
<th>Palm Beach</th>
<th>Oil</th>
<th>10</th>
<th>55</th>
<th>0.0%</th>
<th>NA</th>
<th>NA</th>
<th>NA</th>
<th>NA</th>
<th>107,992</th>
<th>60% (69)</th>
<th>50% (73)</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom G Smith (steam turbine unit)</td>
<td>Operating</td>
<td>Palm Beach</td>
<td>Oil</td>
<td>27</td>
<td>59</td>
<td>1.2%</td>
<td>9.8</td>
<td>16.5</td>
<td>1.0</td>
<td>4.1</td>
<td>0%</td>
<td>107,992</td>
<td>60% (69)</td>
<td>50% (73)</td>
</tr>
<tr>
<td>Winston (7997)</td>
<td>Operating</td>
<td>Polk</td>
<td>Oil</td>
<td>50</td>
<td>19</td>
<td>0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>26,193</td>
<td>40% (51)</td>
<td>51% (74)</td>
</tr>
</tbody>
</table>

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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.