Simple Cycle Stationary Combustion Turbine EGUs

Technical Support Document

New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emissions Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule Proposal

Docket ID No. EPA-HQ-OAR-2023-0072

U.S. Environmental Protection Agency

Office of Air and Radiation

March 2023

Summary

- There are not consistent fleetwide or regional trends between intermittent renewables generation and simple cycle generation or capacity factor.
- Most simple cycle combustion turbines never operate above 12-operating month capacity factors of 15 or 20 percent. Simple cycle combustion turbines that operate at 12-operating month capacity factors above 15 or 20 percent mostly operate at higher loads (*i.e.*, they have 12-operating month duty cycles above about 70 percent) where units are more efficient and CO_2 emission rates are lower. Therefore, emission rates are relatively stable for simple cycle turbines operating above 15 or 20 percent capacity factor. Also, 29 better performing simple cycle units operating at or near higher duty cycles achieve 12-operating month CO_2 emission rates that are less than about 1100 lb/MWh-gross.
- Units with slightly higher capacity factors (above 25 or 30 percent) have similar duty cycles as those with capacity factors greater than 15 or 20 percent, so that they achieve similar emission rates.
- A 12-operating month capacity factor of 15 or 20 percent is a reasonable lower threshold for intermittent combustion turbines subject to a 12-operating month CO_2 emission rate standard of 1100 lb/MWh-gross.

Overview

The proposed 111b rulemaking covering new stationary combustion turbines proposes standards for what are analogous to different 12-operating month rolling average capacity factor thresholds. The rule does not differentiate simple cycle or combined cycle units explicitly, but instead differentiates baseload, intermediate, and low capacity factor units. The 2015 NSPS (80 FR 64509) established an electric sales threshold between baseload and non-baseload units based on the efficiency of the unit or 50 percent, whichever is lower. Commentors to that prior rulemaking suggested that capacity factors of simple cycle combustion turbines have increased due to increases in generation from intermittent renewables (*i.e.*, wind and solar photovoltaics) (*e.g.*, comments from OG&E at EPA-HQ-OAR-2013-0495-12581 and from Wolverine Power at EPA-HQ-OAR-2013-0495-12378). Generation from simple cycle combustion turbines has increased in recent years. Although trends vary by region, fleetwide increases in generation from simple cycle units have been proportional to increases in generation from combined cycle units. The capacity factors of combustion turbines have also increased but remain low (most units have capacity factors of less than 15 or 20 percent). Trends in capacity factor vary by region, although regions with increases in generation from intermittent renewables have not necessarily seen increases in the capacity factor of simple cycle combustion turbines and vice versa. Newer units also tend to operate with higher capacity factors than older units.

In the proposed rule, the upper threshold between baseload and intermediate units is defined based on other factors and is the subject of a different technical support document. The threshold between low and intermediate capacity units may be defined based on the conditions where emission rates of simple cycle combustion turbines are expected to be stable. As previously noted, most units operate with capacity factors that are less than 15 or 20 percent. At capacity factors less than 10 percent, emission rates are variable even for better performers. However, when units operate with higher capacity factors (above 15 or 20 percent) they tend to spend more time at higher loads (*i.e.*, units have duty cycles above 60 or 70 percent) where turbines are more efficient and CO_2 emission rates are lower. The few units with capacity factors above 25 or 30 percent have similar duty cycles as units with capacity factors greater than 15 or 20 percent. Units with capacity factors greater than 25 or 30 percent would likely achieve similar emission rates as units with capacity factors greater than 15 or 20 percent. The CO_2 emission rates of better performers are below around 1100 lb/MWh at higher loads (*i.e.*, duty cycles above around 70 percent), where most units with capacity factors greater than 15 or 20 percent tend to operate. New simple cycle combustion turbines with intermediate capacity factors (above 15 or 20 percent) would therefore be able to meet CO_2 emission rate standards of around 1100 lb/MWh.

1. General trends of simple cycle combustion turbines:

1.1. Generation from simple cycle turbines

Figure 1 shows electricity generation (TWh-net) from EIA Form 923 data (https://www.eia.gov/electricity/data/eia923/) for non-cogeneration facilities and select types of units (simple cycle combustion turbines, combined cycle combustion turbines, and solar photovoltaics plus wind generation). Methods for the analysis presented in section 1.1 are detailed in Appendix A.1. Generation from simple cycle units has almost doubled from 41 TWh-net in 2010 to 76 TWh-net in 2021. Generation from combined cycle units has also almost doubled from 645 TWh-net in 2010 to 1180 TWh-net in 2021. Generation from wind and solar (combined) has more than quadrupled from 95 TWh-net in 2010 to 488 TWh-net in 2021. Generation from each of these types of sources has increased by different degrees in recent years. Increases in generation from combined cycle units may be due to various factors (*e.g.*, changes in natural gas price, retirement of other baseload generation). Some of those factors could similarly affect the amount of generation from simple cycle combustion turbines, which may explain why the relative increases in generation from simple cycle and combined cycle units are proportional.

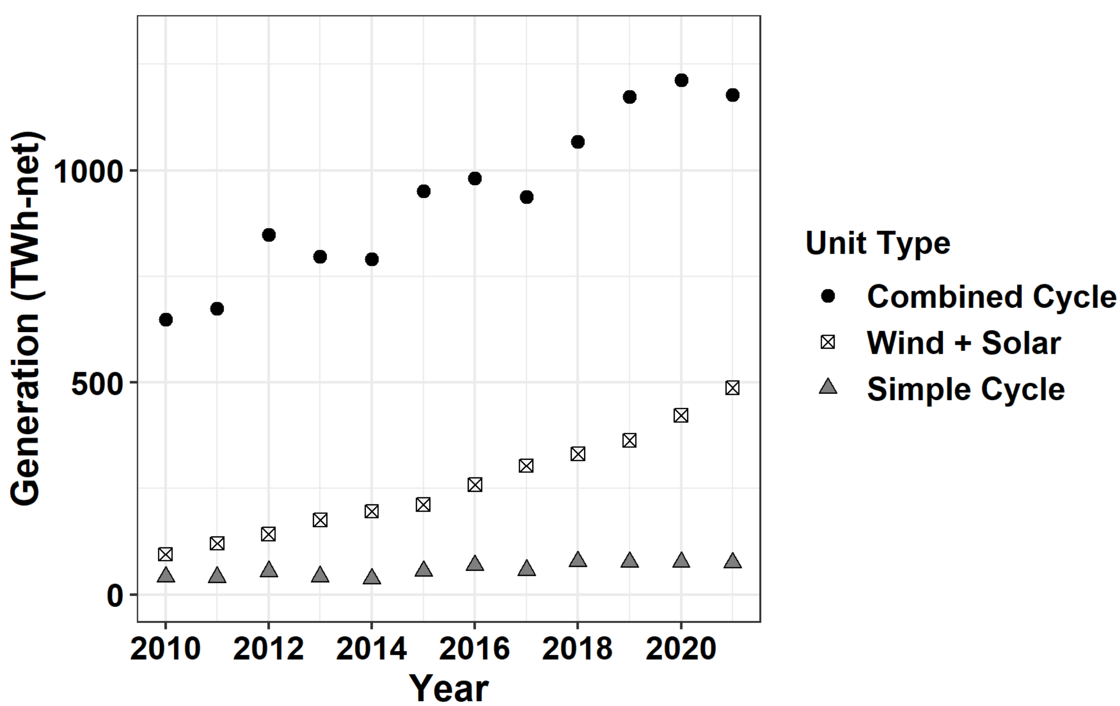

Figure 1: Generation (TWh-net) from simple cycle turbines, combined cycle units, and wind and solar for the years 2010 to 2021.

Figure 2 shows the fraction of generation from wind and solar relative to the total generation by North American Electric Reliability Corporation (NERC) region. Increases in the proportion of wind and solar generation are observable in WECC, RMO, and TRE regions. Figure 3 shows the fraction of generation from simple cycle combustion turbines relative to the cumulative generation from simple cycle and combined cycle units. The proportion of generation from simple cycle units has increased slightly from 0.035 in 2010 to 0.063 in 2021 for the WECC region and increased from 0.074 in 2010 to 0.17 in 2021 for the MRO region. For TRE, the proportion of turbine generation from simple cycle turbines in 2010 was 0.024 and in 2021 was 0.028. The proportion of turbine generation from simple cycle turbines in other regions has not appeared to increase but was greater than 0.05 in the RFC and SERC region. This is on a similar scale to the WECC and RMO regions, and greater than the proportion of turbine generation from simple cycles in TRE.

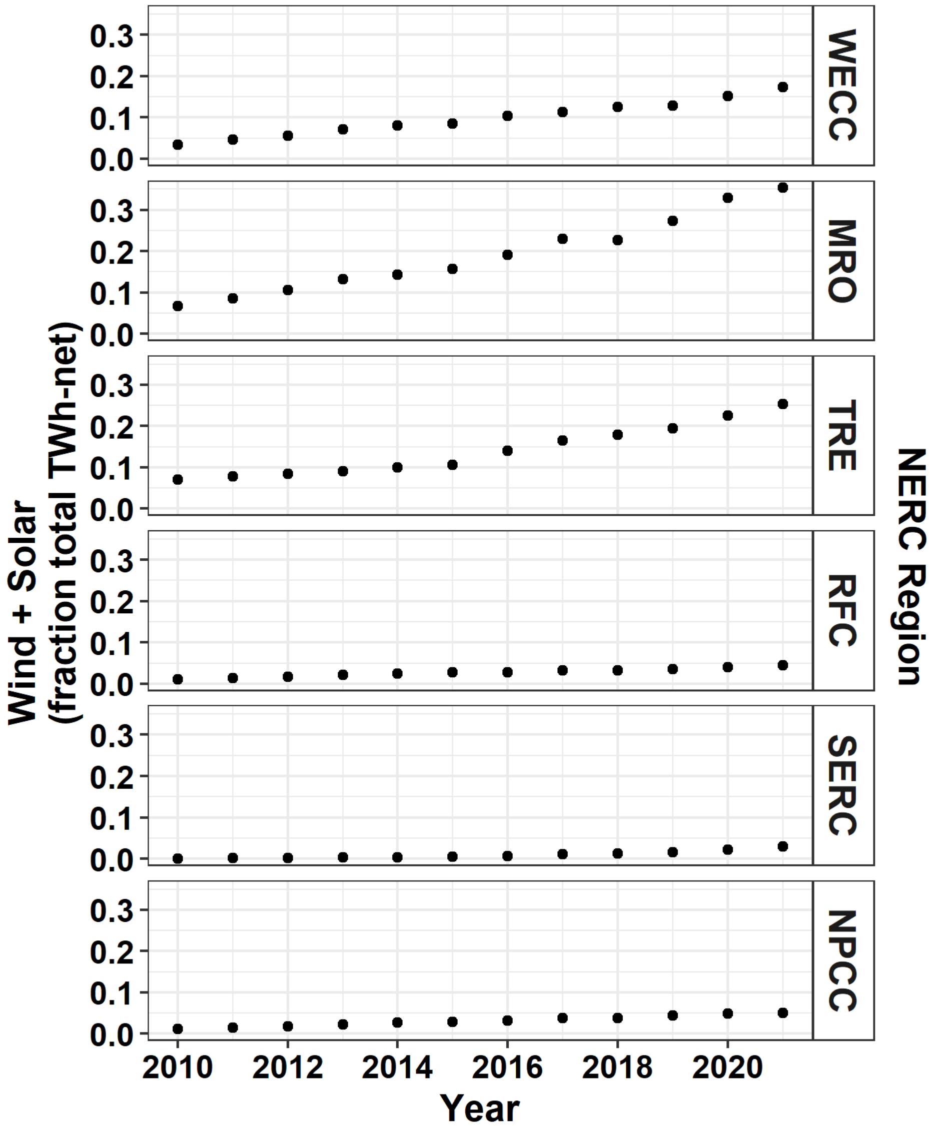

Figure 2: Wind and solar generation as a fraction of total generation by NERC region.

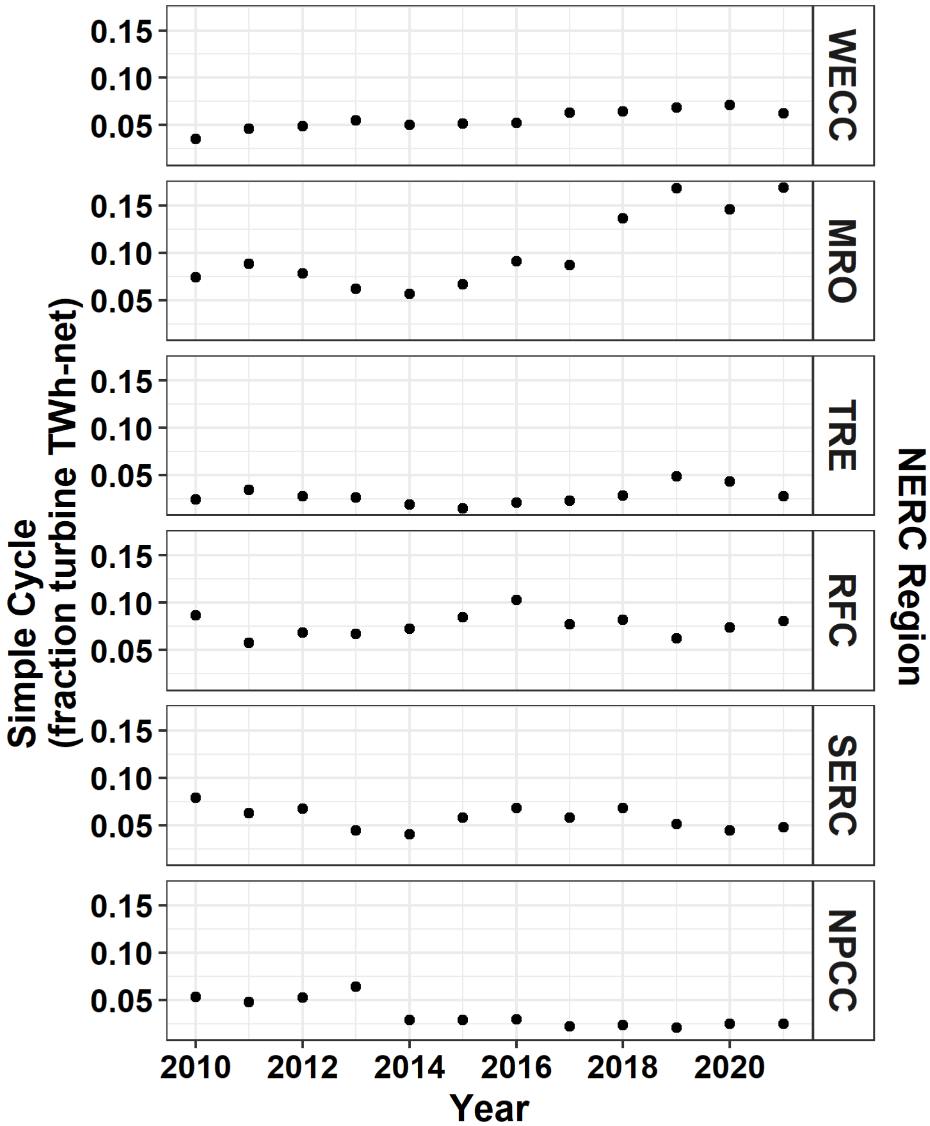

Figure 3: Simple cycle generation as a fraction of total turbine generation (simple cycle and combined cycle generation) by NERC region.

The fleetwide change in the amount of generation from simple cycle turbines has been proportional to the change in the amount of generation from combined cycle units. Regionally, there has been some increase in the proportion of generation from simple cycle turbines relative to the generation from combined cycle units. This has been observed in two out of three regions having more than 10 percent of their generation from wind and solar in 2021. However, other regions with less generation from wind and solar have a similar proportion of total turbine generation coming from simple cycle units. Whether there may have historically been a causal relationship between the generation from wind and solar and the generation from simple cycle combustion turbines, and whether such hypothetical trends could continue, remains unclear. Overall projections in generation sources are not the subject of this document. Importantly, the proposed rulemaking does not differentiate the operation of combustion turbines based on total generation or set fleetwide or regional caps on that basis. Instead, CO_2 emission rate-based standards are proposed that depend on the capacity factor of individual combustion turbine units.

1.2. Annual capacity factor of simple cycle turbines

Fleetwide annual capacity factors for simple cycle combustion turbines, determined from US EPA Clean Air Markets Program Data (https://campd.epa.gov/data), are shown in Figure 4. Units firing fuels other than natural gas, units that are unlikely to distribute electricity to the grid, or units that were associated with cogeneration (combined heat and power) were not included in this or any subsequent analyses. Capacity factors in the following sections are on a gross generation basis and relative to the nameplate capacity of the unit. The distributions of the annual capacity factors of individual units are displayed by a boxplot where the lower and upper vertical lines extend from the 10^{th} to the 90^{th} percentile, the lower and upper border of the box are the 25^{th} and 75^{th} percentile, and the central line is the median value (50^{th} percentile). Median capacity factors for simple cycle combustion turbines have increased from 1.6 percent in 2010 to 3.8 percent in 2021.

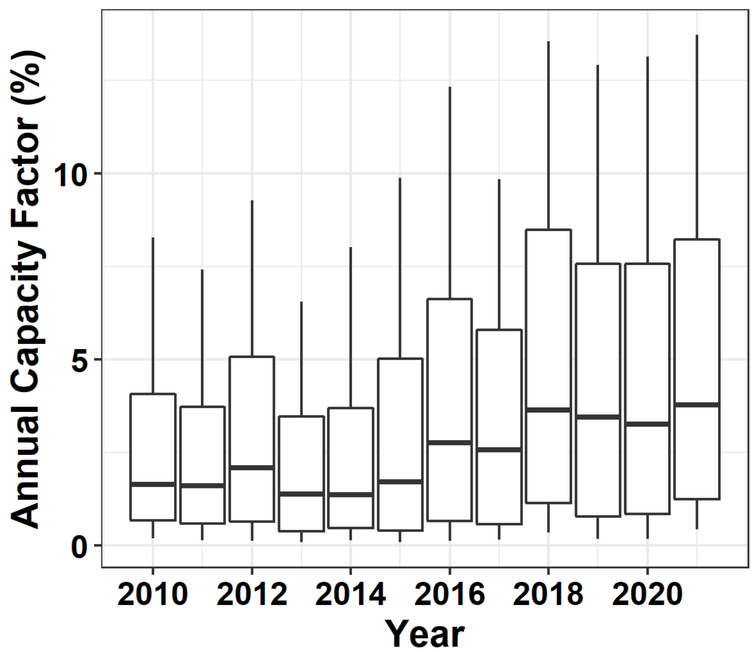

Figure 4: Capacity factor of simple cycle combustion turbines by year. Center lines show median values for annual capacity factor from simple cycle units. The upper and lower bounds of each box mark the 25th and 75th percentile of the distribution of annual capacity factors for each year. The upper and lower bounds of each set of vertical lines mark the 10th and 90th percentile of the distribution of annual capacity factors for each year.

The annual capacity factor of most units remains below 10 percent, and at least 90 percent of units have annual capacity factors less than 15 percent. Annual capacity factors vary by region (figure 5) and unit age (figure 6). In general, about 75 percent or more units have annual capacity factors less than 10 percent across every region. Increases in annual capacity factor by NERC region may be observed for certain regions (WECC, MRO, RFC). Referring to figure 2, more than 10 percent of the total generation in the WECC, MRO, and TRE regions were from intermittent renewables, while less than 5 percent of the total generation in the RFC region was from intermittent renewables.

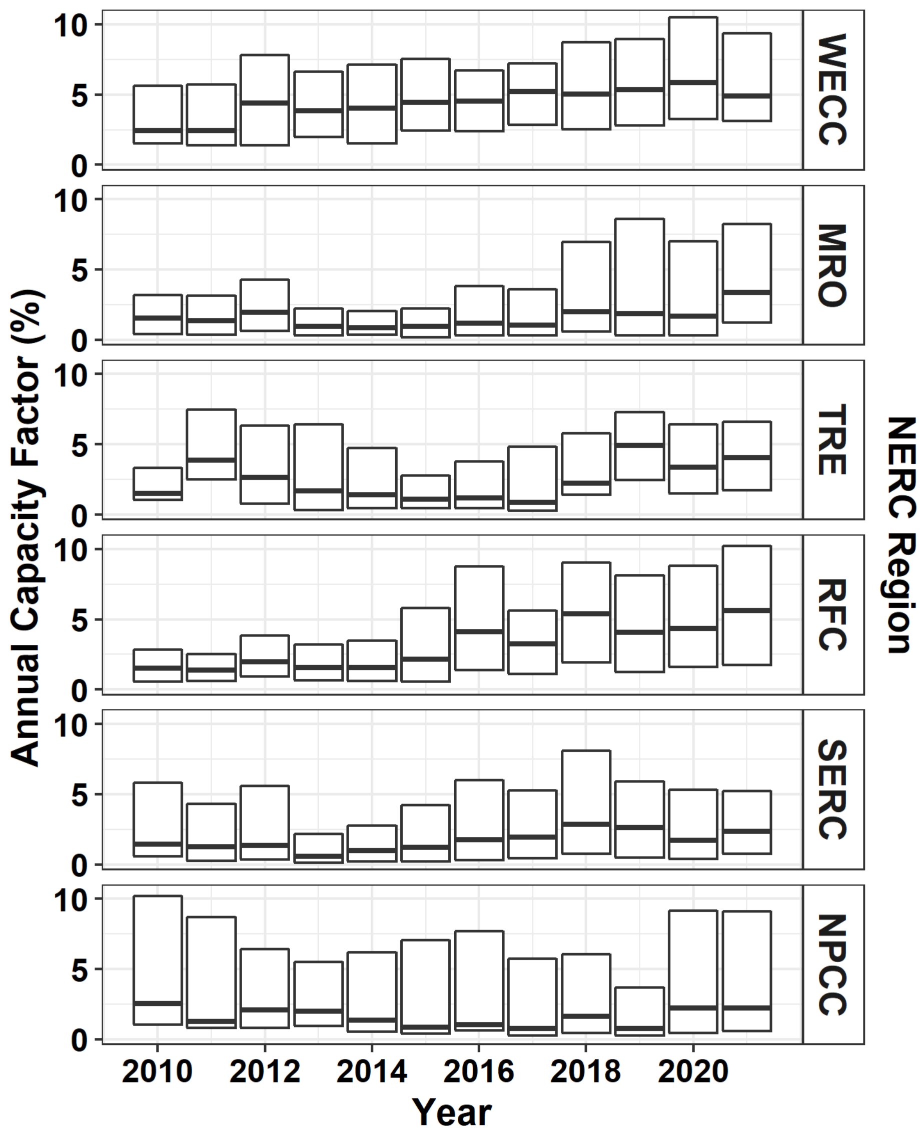

Figure 5: Annual capacity factor (based on gross generation) of simple cycle combustion turbines by year, grouped by NERC Region. Center lines show median values for annual capacity factor from simple cycle units. The upper and lower bounds of each box mark the 25th and 75th percentile of the distribution of annual capacity factors for each year.

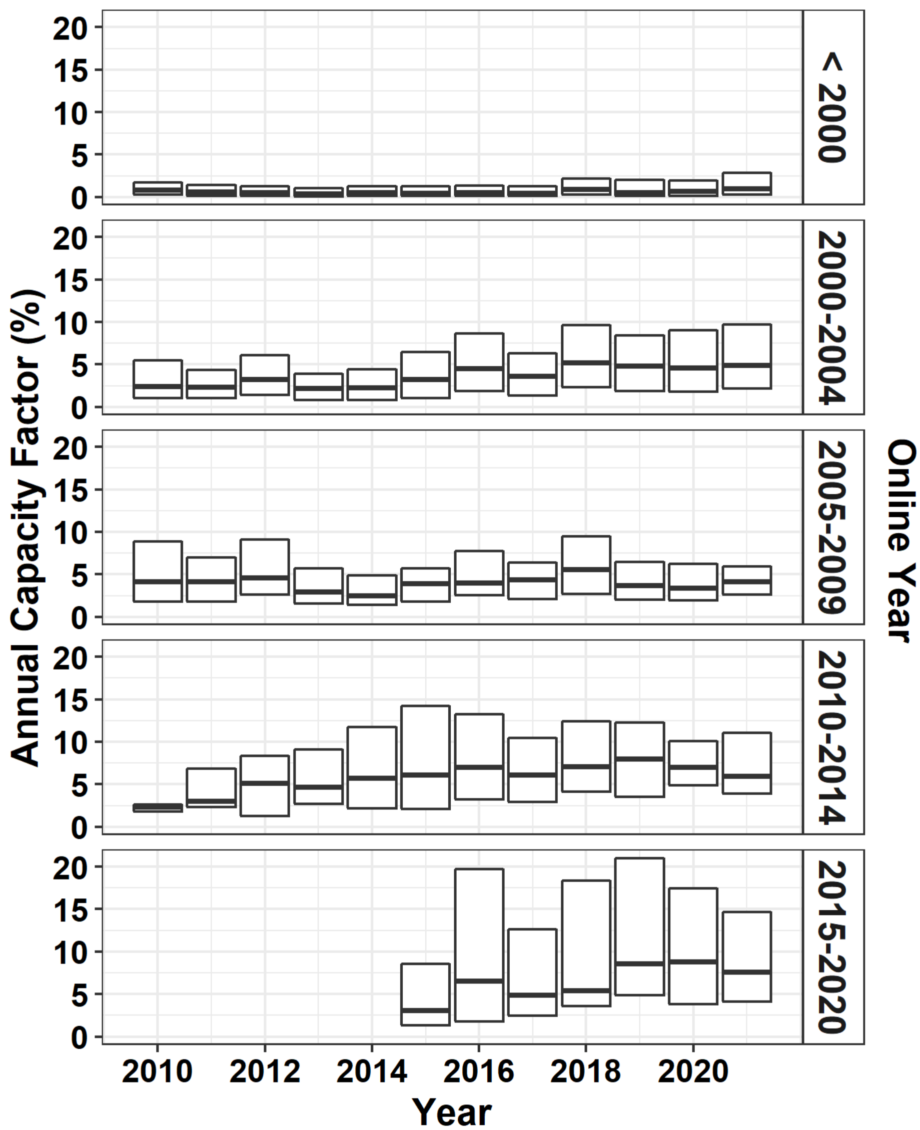

Figure 6: Annual capacity factor (based on gross generation) of simple cycle combustion turbines by year, grouped by year of initial commercial operation. Center lines show median values for annual capacity factor from simple cycle units. The upper and lower bounds of each box mark the 25th and 75th percentile of the distribution of annual capacity factors for each year.

Annual capacity factor may also depend on unit age (figure 6). Units that began commercial operation (online year) after the year 2000 appear to operate with higher annual capacity factors than older units. Most older units have capacity factors less than 3 percent. Units with online years between 2000 and 2014 had median annual capacity factors of about 5 percent. Newer units (online on or after 2015) have a median annual capacity factor of around 7.5 percent. Although newer units may operate more than older units, and units in some regions operate more than others, most units operate with annual capacity factors less than 10 percent, and very few units operate with annual capacity factors greater than 20 percent.

1.3. Conclusions:

- Fleetwide increases in generation from simple cycle combustion turbines have been proportional to increases in generation from combined cycle units.
- Regional trends of simple cycle capacity factor and generation are not always consistent with regional trends in intermittent renewable generation (solar photovoltaics and wind).
- The capacity factors of simple cycle combustion turbines have increased but remain low (usually less than 15 or 20 percent).

2. Capacity factor and CO_2 emission rate

2.1. Maximum 12-Operating Month Capacity Factor

To examine the capacity factor of simple cycle turbines further on a different averaging period, the maximum 12-operating month capacity factor for each unit (data from 2015-2021) is shown in figure 7.

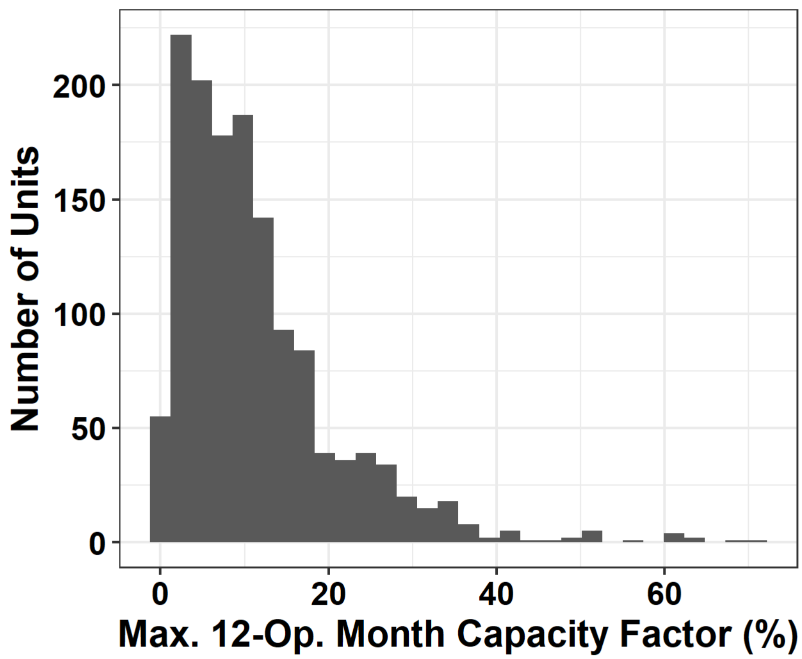

Figure 7: Maximum 12-operating month capacity factor (based on gross generation) of simple cycle combustion turbines for data from 2015 to 2021.

The total subset of units evaluated was 1415 combustion turbines with a total capacity of 122 GW. Summary data for select capacity factor cutoffs are shown in table 1. Most units (more than 80 percent) have never operated above a 20 percent 12-operating month capacity factor.

Table 1: Maximum 12-operating month capacity factor ranges.

Max. 12-Op. Month Capacity Factor Range (%)	Percent of Units (1415 total)	Percent of Units (122 GW total)
0-5	26.9	23.8
5-10	28.7	27.5
10-15	19.4	19
15-20	10.2	11.7
20-25	5.72	6.92
25-30	4.31	5.27
> 30	4.81	5.75

2.2. Duty Cycle vs Capacity Factor

Although capacity factor captures how much energy a unit generates during a given time period, it does not necessarily quantify what loads that unit operated at during that time period. Generally, units operate more efficiently and with a lower CO_2 emission rate near their nameplate capacity. Additionally, modern simple cycle combustion turbines have startup times of less than 15 minutes. Over a 12-operating month period, a unit could operate a small amount of time each month (*e.g.*, 5 percent) but spend most of that time at high loads (*i.e.*, near its nameplate capacity). In that case, a unit could have a low 12-operating month capacity factor but have a relatively low emission rate. Alternatively, a unit that cycles frequently could have a higher 12-operating month capacity factor but have a higher emission rate. Instead of 12-operating month capacity factor, 12-operating month duty cycle may be useful to quantify the proportion of generation at different loads and would thereby be more directly related to emission rate. 12-operating month capacity factor is defined as:

$$\frac{\sum_{i=1}^{12} generation\ in\ month\ i\ (MWh)}{Nameplate\ Capacity\ (MW) * \sum_{i=1}^{12} \boldsymbol{all}\ hours\ in\ month\ i}$$

Whereas 12-operating month duty cycle is defined as:

$$\frac{\sum_{i=1}^{12} generation\ in\ month\ i\ (MWh)}{Nameplate\ Capacity\ (MW) * \sum_{i=1}^{12} \boldsymbol{operating}\ hours\ in\ month\ i}$$

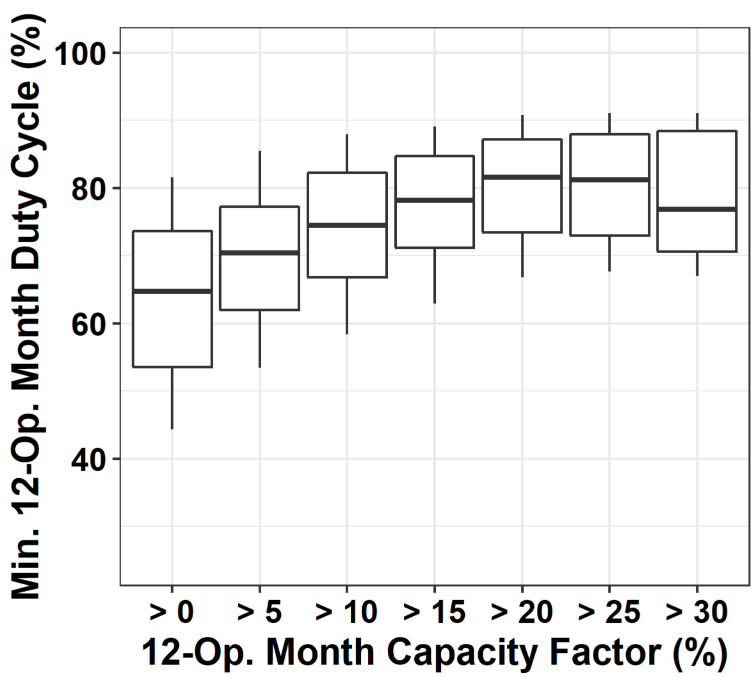

Figure 8: Minimum 12-operating month duty cycle for each unit in five different 12-operating month capacity factor groups. Center lines show median values for minimum 12-operating month duty cycle for each unit and capacity factor group. The upper and lower bounds of each box mark the 25th and 75th percentiles of each distribution. The upper and lower bounds of each set of vertical lines mark the 10th and 90th percentiles of each distribution.

The distributions of minimum 12-operating month duty cycle per unit and groups of 12-operating month capacity factor are shown in figure 8. Summary statistics are available in table 2. Most units operate with higher duty cycles at higher capacity factors. More than 90 percent of units with 12-operating month capacity factors above 15 percent never have 12-operating month duty cycles below 60 percent. More than 90 percent of units with 12-operating month capacity factors above 20 percent never have 12-operating month duty cycles below 65 percent. More than 75 percent of units with 12-operating month capacity factors greater than 15 percent never operate with 12-operating month duty cycles less than 70 percent.

Table 2: 12-operating month duty cycle and capacity factor.

12-Op. Month Capacity Factor	Minimum 12-Op. Month Duty Cycle				
	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
> 0 %	44.4	53.5	64.8	73.6	81.6
> 5 %	53.5	62	70.4	77.3	85.4
> 10 %	58.4	66.8	74.5	82.2	87.9
> 15 %	62.9	71.2	78.2	84.7	89.1
> 20 %	66.8	73.5	81.6	87.2	90.8
> 25 %	67.6	72.9	81.2	88	91.1
> 30 %	67	70.6	76.8	88.4	91

2.3. Emission Rates of Better Performers

12-operating month CO_2 emission rates (lb/MWh) versus 12-operating month capacity factors (%) are shown for select better performers using data from 2015-2021 in figure 9. Most units operate with capacity factors less than 20 percent. At lower capacity factors, (below around 10-15 %) emission rates appear more variable and range from about 1000 lb/MWh up to about 1400 lb/MWh, likely due to an increase in the amount of cycling and operation at low loads. 12-operating month CO_2 emission rates (lb/MWh) versus 12-operating month duty cycle (%) are shown for select better performers using data from 2015-2021 in figure 10. Emission rates appear to be a function of duty cycle. Most (29 out of 39 units evaluated) of the better performing units are likely able to operate with CO_2 emission rates below 1100 lb/MWh at or near 70 percent duty cycle (see Appendix B, Table B.1 for summary data). Some of the selected better performers are likely able to operate with emission rates less than 1100 lb/MWh at 60 percent duty cycle. At 50 percent duty cycle, some of the better performers may be able to operate with emission rates less than 1200 lb/MWh.

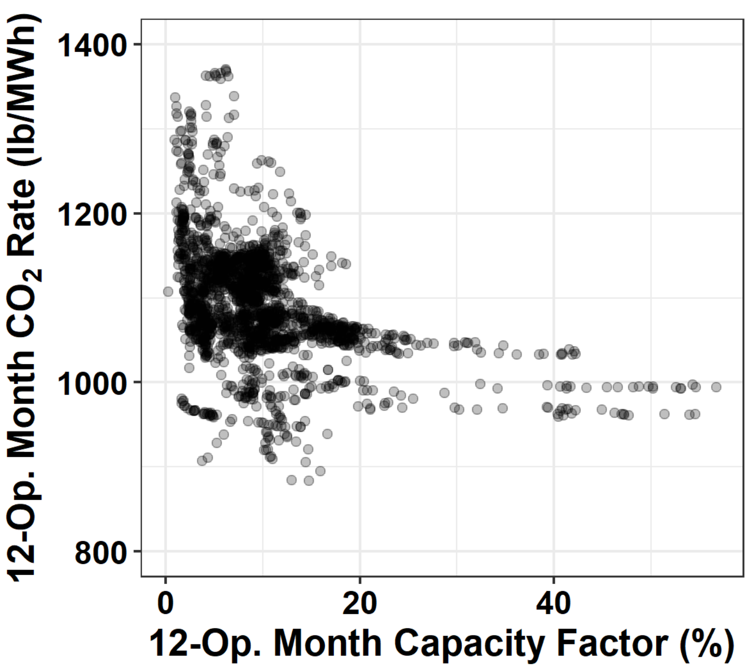

Figure 9: 12-operating month CO_2 emission rate (lb/MWh) versus 12-operating month capacity factor (%) for select better performers.

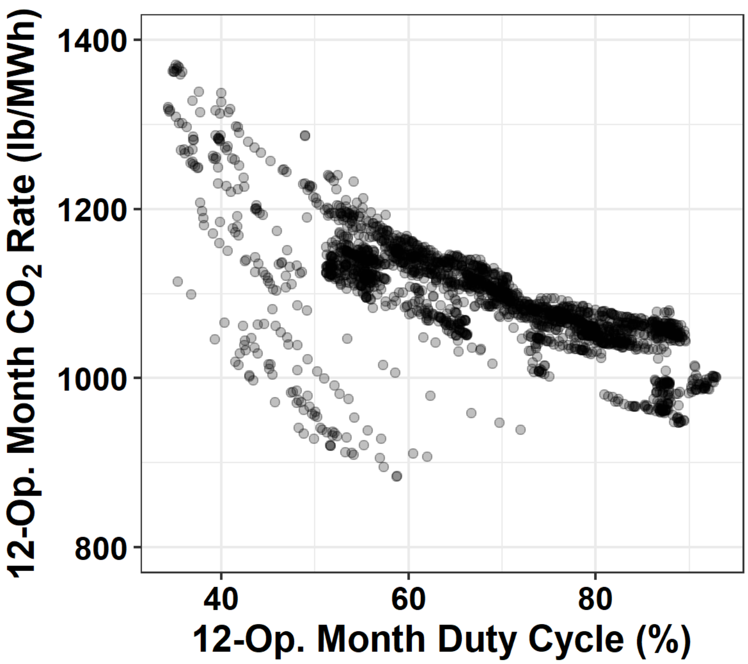

Figure 10: 12-operating month CO_2 emission rate (lb/MWh) versus 12-operating month capacity factor (%) for select better performers.

Referring back to the fleetwide data in figure 8 and table 2, when operating with 12-operating month capacity factors greater than either 15 or 20 percent, 90 percent of units never operate below 12-operating month duty cycles of 60 percent. From figure 10, best performers operate with CO_2 emission rates less than 1100 lb/MWh at duty cycles of 60 percent or greater. Therefore, new units that operate with capacity factors greater than either 15 or 20 percent should be able to meet a CO_2 emission rate standard of around 1100 lb/MWh. Shifting the capacity factor threshold lower than 15 to 20 percent would possibly require a higher emission rate standard. Most of the select better performing turbines in figure 10 are either GE-LM6000 or GE-LMS100 models. Including other manufacturers may require a slightly higher emission rate limit (*e.g.*, 1500 lb/MWh), but the overall trend of emission rates stabilizing above 15 or 20 percent would be the same.

2.4. Conclusions:

- Most simple cycle combustion turbines never operate above 12-operating month capacity factors of 15 or 20 percent.

- Simple cycle combustion turbines that operate at 12-operating month capacity factors above 15 or 20 percent mostly operate at higher loads (*i.e.*, they have 12-operating month duty cycles above 60 or 70 percent) where units are more efficient and CO_2 emission rates are lower.
- Units with slightly higher capacity factors (above 25 or 30 percent) have similar duty cycles as those with capacity factors greater than 15 or 20 percent, so that they achieve similar emission rates.
- Better performing simple cycle units that operate at or near higher loads (*i.e.*, duty cycles of about 70 percent) achieve 12-operating month CO_2 emission rates that are less than 1100 lb/MWh-gross.
- A 12-operating month capacity factor of 15 or 20 percent is a reasonable lower threshold for intermittent combustion turbines subject to a 12-operating month CO_2 emission rate standard of 1100 lb/MWh-gross.

Appendix A: Methods

A.1. EIA923 generation data:

EIA form 923 reports generation data by mover (source) type for power plants connected to the electric grid. EIA form 923 data were accessed from https://www.eia.gov/electricity/data/eia923/. The first sheet (Page 1 Generation and Fuel Data) for each year were compiled in R into a single data frame. Generation is reported on a net basis (*i.e.*, gross generation from the source less any electricity consumed by the plant). Data were filtered to exclude years prior to 2010 and data from combined heat and power plants. Generation data were summarized for each data year for combined cycle units (reported prime mover any of "CT" – combined cycle turbine part; "CA" – combined cycle HRSG and steam turbine part; or "CS" – combined cycle single shaft), simple cycle units (reported prime mover of "GT" – gas turbine), wind and solar photovoltaic plants (reported prime mover any of "PV" – photovoltaic; or "WT" – wind turbine), and total across all prime mover types. Generation data for the summarized combined cycle and simple cycle data excluded generation from fuel types other than natural gas. Generation data were separately summarized by NERC region and data year for combined cycle units, simple cycle units, wind and solar photovoltaic plants, and total generation across all prime mover types. NERC Regional Entities include the Northeast Power Coordinating Council (NPCC), Midwest Reliability Organization (MRO), SERC Reliability Corporation (SERC), ReliabilityFirst (RFC), Texas Reliability Entity (TRE), and Western Electricity Coordinating Council (WECC) (https://www.nerc.com/AboutNERC/keyplayers/Pages/default.aspx). Summarized data were used for figures 1-3.

A.2. CAMD Data

Facility level data (2010-2021), annual emission data (2010-2021), and monthly emission data (2015-2021) were accessed through the CAMPD custom data download tool (https://campd.epa.gov/data/custom-data-download). Data were filtered to exclude units other than simple cycle units (unit type "combustion turbine"). Nameplate capacity was determined based on the information reported in the CAMPD facility level data and matched back to the turbine's unit ID. Additional unit level information from NEEDS () and EIA form 860 () were incorporated into the data set. Annual plant level fuel use data for simple cycle turbines from EIA form 923 (EIA923 Schedules 2-5, "Page 1 Generation and Fuel Data") were also incorporated, as were EIA form 923 plant level disposition data (EIA923 Schedules 6-7, "Source and disposition"). Units were dropped from subsequent analyses if they were likely combined cycle units, fired significant amounts of fuels other than natural gas, were smaller than 25 MW, were at plants with low disposition to the electric grid, or if they were associated with combined heat and power.

A.2.1. Annual CAMD Data

After filtering the units on the preceding criteria, annual (calendar year) capacity factors for each unit were determined by dividing the total gross generation (MWh) by the product of the unit's nameplate capacity (MW) and the total number of hours in that calendar year (8760 hours for most years and 8784 hours for leap years). Percentiles of annual capacity factor were then determined for the entire population of units in each year (10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles). Percentiles were also determined for each NERC region by year. Percentiles were also determined by unit commercial operation date (online year). Those percentiles provide the data for figures 4-6.

A.2.2. Monthly CAMD Data

Using the same set of filtered units, monthly data were further filtered to remove units that were missing recent data, that entered operation in 2021, or that retired by 2021. Data were also restricted to 2015-2021. For each unit, 12-operating month values were then determined for mass of CO_2 (lbs), generation (MWh), operating hours, and available hours for each month with any operating data by summation of the monthly totals from the preceding 12 operating months. Operating hours are the time during which generation or emissions occurred. Available hours are the total number of hours in a month (*e.g.*, 720 hours). 12-operating month capacity factor was then calculated by dividing the 12-operating month generation (MWh) by the product of a unit's nameplate capacity (MW) and the 12-operating month *available* hours. 12-operating month duty cycles were determined by dividing the 12-operating month generation (MWh) by the product of a unit's nameplate capacity (MW) and the 12-operating month *operating* hours. 12-operating month emission rates were determined by dividing the 12-operating month CO_2 emissions (lbs) by the 12-operating month generation (MWh). Maximum 12-operating month capacity factors for each unit were determined (figure 7). For each set of capacity factor grouping (> 0 %, > 5 %, > 10 %, > 15 %, > 20 %), minimum 12-operating month duty cycles were determined for each unit with data in a group. The 12-operating month emission rates for the better performers were then plotted against their 12-operating month capacity factors and 12-operating month duty cycles in figures 9 and 10, respectively.

Appendix B: Data

Table B.1: Summary data for better performers with emission rate data near 70 percent duty cycle.

ORIS Code	Facility Name	State Abbr.	Unit ID	Nameplate Capacity (MW)	Commercial Operation Date	Turbine Model	Frame or Aeroderivative	12-Op. Month Duty Cycle (%, gross generation)	12-Op. Month CO2 Rate (lb/MWh-gross)
5083	Cumberland Energy Center	NJ	05001	103	2009-05-07	GE Co-LMS100PA-SAC (Steam)	Aeroderivative	87.9	1080
54	Smith Generating Facility	KY	SCT10	98	2009-11-21	GE Co-LMS100PB-DLE2	Aeroderivative	69.2	1104
54	Smith Generating Facility	KY	SCT9	98	2009-11-14	GE Co-LMS100PB-DLE2	Aeroderivative	67	1107
55279	Aurora	IL	AGS05	71	2001-04-21	GE Co-MS6001FA		66.3	1052
55279	Aurora	IL	AGS06	71	2001-04-21	GE Co-MS6001FA		64.3	1065
55279	Aurora	IL	AGS07	71	2001-04-26	GE Co-MS6001FA		65.5	1063
55279	Aurora	IL	AGS08	71	2001-05-04	GE Co-MS6001FA		66.1	1068
55279	Aurora	IL	AGS09	71	2001-05-14	GE Co-MS6001FA		65.1	1077
55279	Aurora	IL	AGS10	71	2001-05-23			65.5	1056
55486	Washington Parish Energy Center	LA	CTG01	207	2020-09-19	GE 7FA	Frame	71.8	1089
55486	Washington Parish Energy Center	LA	CTG02	207	2020-10-01	GE 7FA	Frame	75.2	1074
56238	Groton Generating Station	SD	CT001	93.5	2006-06-22	GE Co-LMS100PA-SAC (Water)	Aeroderivative	69	1017
56238	Groton Generating Station	SD	CT002	95	2008-07-01	GE Co-LMS100PA-SAC (Water)	Aeroderivative	62	907
56569	Niland Gas Turbine Plant	CA	1	60.5	2008-04-23	GE Co-LM6000PD Sprint	Aeroderivative	70.6	1104
56569	Niland Gas Turbine Plant	CA	2	60.5	2008-04-13	GE Co-LM6000PD Sprint	Aeroderivative	69.3	1123
56606	Culbertson Station	MT	CT01	100	2010-06-18	GE Co.-LMS100PA-SAC	Aeroderivative	72	939
56674	Winchester Power Park	TX	1	48	2009-05-06	GE Co-GE LM6000	Aeroderivative	70.2	1079
56674	Winchester Power Park	TX	2	48	2009-05-16	GE Co-GE LM6000	Aeroderivative	71.8	1096
56674	Winchester Power Park	TX	3	48	2009-05-20	GE Co-GE LM6000	Aeroderivative	70.9	1090
56674	Winchester Power Park	TX	4	48	2009-06-13	GE Co-GE LM6000	Aeroderivative	70.8	1082
56803	Panoche Energy Center	CA	1	108	2009-04-09	GE Co-LMS100PB-DLE2	Aeroderivative	74.7	1084
56803	Panoche Energy Center	CA	2	108	2009-04-18	GE Co-LMS100PB-DLE2	Aeroderivative	77.3	1085

56803	Panoche Energy Center	CA	3	108	2009-04-13	GE Co-LMS100PB-DLE2	Aeroderivative	76.1	1076
56803	Panoche Energy Center	CA	4	108	2009-04-17	GE Co-LMS100PB-DLE2	Aeroderivative	75.2	1095
57515	Walnut Creek Energy Park	CA	GT1	100	2012-12-31	GE Co-LMS100PB-DLE2	Aeroderivative	71.2	1080
57515	Walnut Creek Energy Park	CA	GT2	100	2013-01-12	GE Co-LMS100PB-DLE2	Aeroderivative	70.1	1093
57515	Walnut Creek Energy Park	CA	GT3	100	2013-02-09	GE Co-LMS100PB-DLE2	Aeroderivative	70	1095
57515	Walnut Creek Energy Park	CA	GT4	100	2013-02-09	GE Co-LMS100PB-DLE2	Aeroderivative	73.7	1088
57515	Walnut Creek Energy Park	CA	GT5	100	2013-03-08	GE Co-LMS100PB-DLE2	Aeroderivative	70.2	1109
57555	Pio Pico Energy Center LLC	CA	CTG1	106	2016-08-06	GE Co-LMS100PA-SAC (Water)	Aeroderivative	70.1	1115
57555	Pio Pico Energy Center LLC	CA	CTG2	106	2016-07-22	GE Co-LMS100PA-SAC (Water)	Aeroderivative	69.8	1104
57555	Pio Pico Energy Center LLC	CA	CTG3	106	2016-07-03	GE Co-LMS100PA-SAC (Water)	Aeroderivative	70.3	1095
59882	Exelon West Medway II	MA	J4	100	2019-02-08	GE LMS100	Aeroderivative	69.4	1088
59882	Exelon West Medway II	MA	J5	100	2019-03-02	GE LMS100	Aeroderivative	68.9	1106
61241	Victoria City Peaking Facility	TX	CT1	50	2019-12-17	GE Co-LM6000PC Sprint	Aeroderivative	70.1	1109
61241	Victoria City Peaking Facility	TX	CT2	50	2019-12-17	GE Co-LM6000PC Sprint	Aeroderivative	70.5	1120
7266	Woodland Generation Station	CA	1	50.4	1993-12-03	GE Co-LM5000-PD (STIG)	Aeroderivative	70.9	1088
7307	Redding Power Plant	CA	6	50	2010-11-12			86.3	998
7449	NCPA Combustion Turbine Project #2	CA	NA1	50	1996-04-01	GE Co-LM5000-PD (STIG)	Aeroderivative	81	981