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**RE: COMMENTS OF THE LARGE PUBLIC POWER COUNCIL ON THE PROPOSED RULE TO  
REPEAL THE 2024 CARBON POLLUTION STANDARDS RULE  
Docket ID No. EPA-HQ-OAR-2025-0124**

The Large Public Power Council (LPPC) appreciates the opportunity to submit to the U.S. Environmental Protection Agency (EPA or Agency) the following comments on the Proposed Rule to repeal the Carbon Pollution Standards (CPS).<sup>1</sup>

LPPC is an association consisting of the 29 largest, non-federal public power systems in the nation. Together, our members serve 30.5 million American consumers across 22 states and territories. As not-for-profit utilities owned by and accountable to the communities we serve, our members deliver some of the cleanest, most reliable, most affordable electricity in the nation. LPPC supports strong federal and state action to expand generation technology options, support advanced grid capabilities, and enhance end-user services. Continued federal and state

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<sup>1</sup> *Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units*, 90 Fed. Reg. 25,752 (June 17, 2025) (Proposed Rule or Proposal).

investments in research, development, and demonstration of the full range of technologies are needed to achieve reliable, clean energy grid.

Many LPPC members are expanding electricity supply to meet soaring demand from data centers and advanced manufacturing, while leading the nation in decarbonizing electric generation and adopting innovative technologies, fuels, and investments in beneficial electrification and grid modernization.

Our comments do not take any position on whether EPA should repeal the CPS. Instead, they focus narrowly on the achievability and workability of the Phase 1 carbon dioxide (CO<sub>2</sub>) performance standards for new intermediate-load and baseload natural gas stationary source combustion turbines<sup>2</sup> established under section 111 of the Clean Air Act (CAA). These standards, as currently written, do not account for recurring real-world operating conditions—such as fluctuation loads, high ambient temperatures, and turbine efficiency degradation—that prevent compliance for most new combustion turbines, even with the use of the most efficient commercially available technology.

We urge EPA to promptly revise the Phase 1 standards to reflect achievable performance across the full range of operating conditions, as required by CAA section 111. Without timely revisions, the unachievable standards risk delaying or discouraging the deployment of critically needed dispatchable generation, thereby threatening grid reliability during a period of unprecedented demand growth.

Importantly, as explained in Section VII, setting a realistic, real-world CO<sub>2</sub> performance standard for new combustion turbines does not necessarily increase their total CO<sub>2</sub> emissions. When reduced turbine output is offset by zero-emission renewable generation, overall CO<sub>2</sub> mass emissions decline—even if emissions intensity (lbs. CO<sub>2</sub>/MWh) rises—because the turbines run less often and zero-emitting renewables provide more electricity to the electric grid. An unintended consequence of the current unachievable standards is that they can make it harder for electric utilities to meet rising demand with a balanced portfolio. By penalizing turbines that operate less frequently to integrate renewable energy into the power grid, these standards discourage the flexible, lower-mass-emission operation needed to integrate intermittent resources while ensuring reliability.

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<sup>2</sup> Reference to “new” stationary source combustion turbines in these comments also includes existing turbine units undergoing a reconstruction as set forth in 40 C.F.R. § 60.15.

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## I. SCOPE OF LPPC’S COMMENTS

One purpose of EPA’s Proposed Rule is to seek comments on two alternatives to repeal CO<sub>2</sub> performance standards that EPA established for fossil fuel-fired electric generating units (EGUs) established by the CPS.<sup>3</sup> Adopted in May 2024, the CPS established CO<sub>2</sub> performance standards that apply to both existing fossil fuel-fired EGUs under CAA section 111(b) and new natural gas stationary source combustion turbines under CAA section 111(d). The first alternative (referred to as the “Primary Proposal”) is based on a reconsideration of EPA’s regulatory authority to establish CO<sub>2</sub> performance standards for all affected new and existing EGUs under CAA section 111, including those CO<sub>2</sub> performance standards adopted by the CPS. The other alternative (referred to as the “Alternative Proposal”) is limited to EPA repealing many (but not all) of the CO<sub>2</sub> performance standards that were adopted by the CPS. EPA’s proposed regulatory determination for the repeal under the second alternative was primarily based on technical findings regarding how those standards were established under the CPS. That technical review found that the standards were not based on “adequately demonstrated” technologies for controlling CO<sub>2</sub> emissions and set unachievable CO<sub>2</sub> emissions limitations, contrary to the statute.

In addition, the Alternative Proposal also seeks comments on the achievability of the CO<sub>2</sub> performance standards that the CPS established for certain new combustion turbines and that would continue to apply if the Agency elected not to revoke its CO<sub>2</sub> regulatory authority under the Primary Proposal. LPPC’s comments are focused on only the achievability of those performance standards remaining under the Alternative Proposal. In addition to providing detailed technical comments on the achievability of those standards, the LPPC comments also address several related technical regulatory matters that are intended to assist in ensuring the workability and effective implementation of those standards. By contrast, LPPC is neither submitting comments nor taking any position on either one of the EPA’s proposed alternatives to repeal the CO<sub>2</sub> performance standards under CAA section 111.

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<sup>3</sup> *New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions From Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule*, 89 Fed. Reg. 39,798 (May 9, 2024) (CPS or Carbon Rule).

## II. OVERVIEW OF THE LPPC COMMENTS

Decarbonization of the electric power grid is already well underway with the rapid deployment of new wind, solar, and other clean energy sources in significant amounts across the nation. Many LPPC members are supportive of the transformation of the electric grid to cleaner sources of energy. They are proactively doing so in a manner that reflects varying resource mixes across diverse regions of the country as well as differing energy policy priorities and goals in those diverse regions.

At the same time, LPPC members are facing unprecedented growth in demand for electricity in their service territories. Like the rest of the electric power industry, LPPC members need substantial amounts of new dispatchable electricity generation over the next decade, both for meeting this explosion of new energy demand and to replace an aging fleet of existing power plants. Meeting this need for new generation includes LPPC members building and bringing on at least 60 gigawatts (GW) of new generation (including substantial amounts of new combustion turbine generation) over the next ten years.

One of LPPC's major concerns is the creation of regulatory barriers for the construction and deployment of new dispatchable thermal generation that is critically important for ensuring electric grid reliability. Accordingly, LPPC is providing detailed comments that EPA should address to remove impediments and improve the workability of the existing framework for the regulation of CO<sub>2</sub> emissions from new natural gas combustion turbines established by the 2024 CPS under section 111 of the CAA. The following is a brief overview of those LPPC comments.

The annual CO<sub>2</sub> emissions rates achievable in practice by new stationary combustion turbines will depend on both operational and site-specific factors that are beyond the control of power plant operators. The analysis in the LPPC comments below provides a detailed review of the factors that reduce the generating efficiency of the combustion turbine and thereby increase its CO<sub>2</sub> emissions rate on a CO<sub>2</sub> pounds-per-megawatt basis. The CPS did not account for these factors, which have resulted in EPA setting CO<sub>2</sub> performance standards that are not achievable by intermediate-load and baseload combustion turbines under the full range of recurring real-world operating conditions that many (if not most) new combustion turbines must now operate in.

The CO<sub>2</sub> performance standards adopted by the CPS are codified at Subpart TTTTa of the new source performance standards (NSPS) regulations and set CO<sub>2</sub> emission limitations of 1,170 lbs. CO<sub>2</sub>/MWh-gross for intermediate-load turbines (with annual capacity factors between 20% and 40%) and 800 lbs. CO<sub>2</sub>/MWh-gross for baseload turbines (with annual capacity factors at or

above 40%).<sup>4</sup> Generally referred to as “Phase 1” performance standards, they set CO<sub>2</sub> emission limitations that are based on highly efficient turbine technologies and apply upon the immediate startup of the affected intermediate-load or baseload turbine facility.

The Clean Air Act (CAA) requires the Agency to set the Phase 1 performance at levels that are achievable across the full range of operating conditions, including the “most adverse conditions which can reasonably be expected to recur.”<sup>5</sup> As set forth in more detail below, these standards proposed to be retained in EPA’s Proposed Alternative are not achievable at reduced and fluctuating loads, high ambient temperatures, and other operating conditions that are not optimal for maximizing generating efficiencies. To comply with this clear statutory mandate, EPA has a legal duty to remedy this technical flaw that has resulted in the CPS establishing CO<sub>2</sub> emissions limitations that are not achievable for new intermediate-load and baseload combustion turbines under the typical range of recurring operating conditions.

As a next step, LPPC urges EPA to initiate a supplemental rulemaking to revise those standards imposing unachievable CO<sub>2</sub> emissions limitations that are not achievable for new intermediate-load and baseload combustion turbines under the typical range of recurring operating conditions. EPA should initiate this supplemental rulemaking this fall so that a final rule to revise the Phase 1 performance standards occurs as early as possible in 2026. Taking prompt action to revise those standards within an expeditious timeframe is the best and most-effective way for EPA to remove the substantive regulatory uncertainties that could potentially delay the permitting, construction, and deployment of new combustion turbines. The removal of these potential regulatory barriers is critically important for allowing electric utilities to bring online additional dispatchable combustion turbine capacity that is needed to meet sharp increases in electricity demand across the nation and ensure electric grid reliability.

### **III. OPERATIONAL AND SITE-SPECIFIC FACTORS HAVE MAJOR EFFECTS ON THE CO<sub>2</sub> PERFORMANCE LEVELS OF NEW STATIONARY SOURCE COMBUSTION TURBINES.**

This section provides a detailed review of the operational and site-specific factors that reduce the generating efficiency of a combustion turbine, thereby increasing the turbine’s CO<sub>2</sub> emissions rate on a CO<sub>2</sub> pounds-per-megawatt basis. These factors include the size and type of combustion

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<sup>4</sup> Although not relevant to the discussion in the LPPC comments, it is noted that the CO<sub>2</sub> performance standard for certain small baseload combustion turbines is subject to adjustment based on the efficiency of the combustion turbine. For small baseload turbines with heat input ratings below 2,000 MMBtu/h, the CO<sub>2</sub> performance standard is set along a sliding scale from 800 and 900 lbs. CO<sub>2</sub>/MWh-gross. The specific value within this range depends on the turbine’s design efficiency. 89 Fed. Reg. at 39,948-49.

<sup>5</sup> *Nat’l Lime Ass’n v. EPA*, 627 F.2d 416, 431 n.46 (D.C. Cir. 1980).

turbine, the load level and operating profile, ambient temperature, the use of duct burners as well as various operating design and characteristics that may affect turbine efficiencies. This review explains the reasons why the Agency's limited and incomplete consideration of these site-specific factors result in the CPS setting CO<sub>2</sub> performance standards for intermediate-load turbines (1,170 lbs. CO<sub>2</sub>/MWh-gross) and baseload turbines (800 lbs. CO<sub>2</sub>/MWh-gross) that are not achievable for most combustion turbines under recurring, real-world conditions.<sup>6</sup>

This analysis is followed by a comprehensive review of turbine performance data providing actual CO<sub>2</sub> emissions rates being achieved by combustion turbines. The review includes an analysis of the CO<sub>2</sub> emissions rates that are achievable at various load levels (i.e., minimum, partial, and full load) for all types of combustion turbines based on publicly available performance data developed by turbine manufacturers. It also includes an analysis of CO<sub>2</sub> emissions data from EPA's Clean Air Markets Program Data (CAMPD), which provides highly accurate data on the hourly CO<sub>2</sub> emission rates achieved by all affected EGUs (including simple-cycle combustion turbines) based on EPA-certified continuous emissions monitoring systems (CEMS).

In both cases, the performance data indicates that most types and sizes of combustion turbines cannot meet the applicable CPS CO<sub>2</sub> performance standards under typical, real-world operating conditions. Aero-derivative and simple-cycle, frame turbines cannot achieve the CO<sub>2</sub> performance standard for intermediate-load turbines (1,170 lbs. CO<sub>2</sub>/MWh-gross) when the turbine units are not operating at full load level and steady state. High ambient temperatures, turbine degradation, and the use of duct burners also frequently increase the CO<sub>2</sub> emissions rate above the limitation of 1,170 lbs. CO<sub>2</sub>/MWh-gross. Similarly, baseload combustion turbines cannot achieve the applicable CO<sub>2</sub> performance standard set for baseload units (800 lbs. CO<sub>2</sub>/MWh-gross) when the combined-cycle units are not operating at full load or under other such suboptimal operating conditions.

#### **A. Achievable Performance Standards Must Account for the Size and Types of Combustion Turbines.**

Electric utilities do not have the ability to purchase new combustion turbines solely based on generating efficiency (which in turn limits CO<sub>2</sub> emissions to levels that will ensure compliance with the applicable CO<sub>2</sub> performance standards). There is neither one size nor one type of

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<sup>6</sup> The CPS classifies intermediate-load and baseload combustion turbines based on their annual capacity factor. An intermediate-load turbine includes those units that have moderate annual capacity factors above low-load, peaking output levels (between 20%-40%). By contrast, baseload turbines include those units operating with high annual capacity levels (greater than 40%).

intermediate-load and baseload turbine that electric utilities need to satisfy the demand of a widely and rapidly evolving electricity grid. Rather, the appropriate turbine size and type will depend on a variety of localized market requirements and electricity grid conditions that can frequently be beyond the control of electric utilities.

For example, if electric utilities need baseload generation to meet high-capacity needs, they may select large-frame combustion turbines that can generate 400 megawatt (MW) or 500 MW of electricity with relatively few startups and shutdowns of the generating facility. This baseload demand may typically be served by combined-cycle combustion turbines; however, some electric utilities opt for large-frame simple-cycle turbines for a variety of reasons unique to their electric generating systems. (Those unique reasons are discussed below.) By contrast, many electric utilities will need to call upon combustion turbines to meet fluctuating market demand or integrate intermittent renewable generation on their systems. In such cases, they will install aeroderivative turbines or small-frame combustion turbines that are capable of efficiently starting up and shutting down multiple times per day and operating in small increments of a few hours each day. If, however, small-frame turbines are determined to be the best option for meeting their utility system needs, the CO<sub>2</sub> emissions rates for those small-frame turbines may be higher than the CO<sub>2</sub> emission rates achievable by aeroderivative turbines.

As another example, some electric utilities may need new large-frame turbines to provide either baseload generation or long-term load “firming” capacity. In such cases, the size and type of the combined-cycle turbine will be determined based on the load levels and operating profile of the turbine units. The combined-cycle sizes will vary from large-frame units ranging from approximately 300 MW to 500 MW or more, to medium-frame units ranging from approximately 100 MW to 300 MW. In addition to MW size, the operation of combined-cycle units can vary significantly from one facility to another, ranging from steady operation to highly variable dispatch with frequent startups, including significant periods of low-load operation. The size, type, and operating cycle of the turbine is therefore determined by facility-specific factors that are tailored to the localized needs and electric grid requirements of each electric utility system.

The size of small-frame and aeroderivative turbines typically range from 40 MW to 150 MW. These smaller, simple-cycle turbines have been designed to meet short-term electricity demands with significant load fluctuations. In such cases, these smaller simple-cycle turbines may be needed to operate for short periods to meet peak electricity demands, particularly when intermittent solar or wind generation declines as demand increases. The selection of these simple-cycle turbines also is dictated by operational needs for short-term generation with frequent startups and significant periods of partial production, instead of steady operation at maximum capacity levels.

Furthermore, the size and type of new combustion turbines may not be determined solely by electric utilities' operational needs. Other factors beyond the control of the electric utility may dictate the turbine size and type selected by electric utilities. For example, one of the first steps in developing any power project is to obtain an interconnect approval in which the transmission service provider (frequently a different entity than the electric utility installing the combustion turbine) evaluates the allowable turbine facility generating capacity that can be accommodated at the interconnect location. As part of this study, the transmission service provider assesses any necessary grid upgrades and associated costs. These grid interconnect requirements often dictate the allowable turbine facility size. The choice and design of the turbine facility will therefore be determined to best match the maximum allowable facility size allowed under the interconnect agreement, with the utility requiring smaller units at multiple locations to meet its resource requirement.

As reflected in the CPS, large-frame combustion turbines with higher operating pressures and temperatures result in more-efficient combustion turbines. But, for the reasons discussed above, larger turbines are often not appropriate for meeting the system needs of the electric utility. It is far more efficient and, in fact essential, for the size and design of the combustion turbine to match the generating capacity requirements, operating profile of the facility, and interconnection constraints. There is no option for any electric utility simply to purchase the largest and most efficient turbine design.

In conclusion, electric utilities do not have the flexibility to purchase new combustion turbines solely to maximize their CO<sub>2</sub> emission rates on “pounds of CO<sub>2</sub> per-megawatt-hour” basis (lbs. CO<sub>2</sub>/MWh-gross) to ensure compliance with the current applicable CO<sub>2</sub> performance standards. Other operational needs and generating requirements may in fact dictate the selection of size and type of combustion turbine with significantly higher CO<sub>2</sub> emissions rates. Thus, the Agency should not adopt a one-size-fits-all approach for CO<sub>2</sub> performance standards. Instead, EPA should establish performance standards based on turbine size and type.

**B. Reduced and Fluctuating Load Levels Have the Greatest Impact on Both Turbine Efficiencies and CO<sub>2</sub> Emission Rates.**

EPA's factual predicate for setting the performance standards in the CPS was that combustion turbines will operate near or full-load and then shut down when they are no longer needed. Most of those turbine units do not operate in this binary manner. Nor do turbine units always operate at maximum production levels where they can optimize efficiencies and minimize their CO<sub>2</sub> emissions rates. Rather, combustion turbines frequently operate at a variety of load levels to meet fluctuating electricity demands and serve a variety of important functions necessary for

maintaining electric grid stability. This performance trend is described in Section VI of the LPPC comments, which provides a review of maximum hourly production levels and duty cycles for a large sampling of simple-cycle and combined-cycle combustion turbines based on 2024 CAMPD data.<sup>7</sup>

The following discussion provides a review of the operating characteristics illustrating the evolving role that combustion turbines play in providing reliable, dispatchable, and affordable electricity and ancillary services to the power grid. Importantly, many of these operating characteristics are determined by factors that are largely beyond the control of individual electric utility operators. Furthermore, the role and operating characteristics of combustion turbines are still evolving as the electric power sector continues to transition to clean energy, while—at the same time—also increasing its generating capacities to meet new electricity demand.<sup>8</sup>

### **1. Meeting Short-Term Peak Demands.**

Combustion turbines are designed to generate electricity under a wide range of operating modes to meet electricity demand and maintain electric grid reliability. One mode of operation is for combustion turbines to operate continuously at high output levels with few startups and shutdowns. Operating combustion turbines as a baseload generating unit is the most efficient way to operate combustion turbines and results in the lowest CO<sub>2</sub> emissions rate, expressed as lbs. CO<sub>2</sub>/MWh-gross. However, providing stable baseload generating capacity is just one of several major functions that combustion turbines typically must serve to meet the diverse needs of the electric grid. Another important function of combustion turbines is to generate electricity needed to meet short-term peak demands within a utility system.

Combustion turbines excel at meeting short-term peaks in power demand because they can be started quickly and reach full load rapidly for short periods of time. Aeroderivative and small-frame turbines are specifically engineered to respond quickly to sudden increases in electricity demand. They can ramp up to full output in minutes, making them ideal for providing peak

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<sup>7</sup> Section VI of the LPPC comments examines the actual hourly production levels that a selected sample of existing combustion turbines operated during calendar year 2024. This review indicates that many combustion turbines do not necessarily operate only at maximum full capacity levels but instead have duty cycles that require those units to operate at reduced and fluctuating load levels for extended periods of time due to the evolving role that combustion turbines play in supplying dispatchable, firm power to the electricity grid.

<sup>8</sup> However, predicting the exact role of combustion turbines within this highly dynamic landscape is nearly impossible, and will likely be as varied as the highly diverse demands placed on today's turbine generating capacity.

power during high-consumption periods or unexpected load spikes. These operating capabilities enable these combustion turbines to rapidly provide power during short periods of high electricity consumption when they can supplement power to the grid quickly when electricity demands are highest.

## **2. Firming and Integrating Renewable Energy.**

Combustion turbines also play a critical role in providing grid firming or renewable firming capacity to the electric grid. This means that they can quickly ramp up or down to compensate for the intermittent nature of renewable energy sources, thus balancing the grid and ensuring grid reliability. As renewable sources become more prevalent, combustion turbines will take on the critically important role of helping to balance the grid by compensating for the variability of renewable generation and then reduce load or shut down when not needed.

## **3. Maintaining Grid Stability.**

Combustion turbines are now frequently being operated at intermediate and minimum loads for extended time periods to maintain electric grid stability. Their rapid startup and load-following capabilities allow combustion turbines to serve as backup generation, ensuring grid reliability when other power sources are unavailable or cannot adjust quickly enough to fluctuating demand. Operating at less-than-full or high-load levels, combustion turbines play an important role in maintaining grid stability when either low-cost intermittent renewable generation or even dispatchable thermal energy resources (such as coal-fired or nuclear generation) are unavailable to meet electricity demand for a variety of reasons that are beyond the control of electric utilities. This trend will only continue to grow.

In addition, many combustion turbine units, once dispatched by the electric utility operators, will be operated under Automatic Generation Control, in which the grid operator dictates the load to the combustion turbine. Accordingly, the electric utility operators delegate control over exactly how their combustion turbines operate to meet fluctuating demand and maintain grid stability. They are operated by the grid operator to match the demand on the electric grid. Furthermore, with increased generation from intermittent resources, even baseload combustion turbines will operate with more frequent and load-variable cycles than their existing operating profiles today.

## **4. Ancillary Services.**

Combustion turbines also may be operated at lower-load levels to provide “volt-ampere reactive” (VAR) support, frequency regulation, and inertial response. The performance of these functions

is indispensable for maintaining electric grid stability (and even preventing blackouts under some extreme circumstances) by assuring voltage stability and balance supply-demand mismatches. In effect, low-load levels and load-cycling capabilities of combustion turbines increasingly act as a vital stabilizing force in the modern electric grid, supporting the integration of renewables and ensuring the reliable delivery of electricity through an integrated power grid.

## **5. Other Factors Reducing Load Levels.**

For the reasons discussed above, combustion turbines frequently operate at fluctuating load levels that are below their optimal (most-efficient) performance levels and thereby can substantially increase their CO<sub>2</sub> emission rates on “pounds of CO<sub>2</sub> per-megawatt-hour” basis (lbs. CO<sub>2</sub>/MWh-gross) to levels above the applicable performance standards. Other operating conditions also significantly contributing to increased CO<sub>2</sub> emissions are frequent startups and shutdowns and the operation at partial load of combustion turbines for extended periods of time.

In the case of startups and shutdowns, turbine efficiencies decrease, and CO<sub>2</sub> emission rates increase, due to suboptimal combustion conditions that occur at low operating temperatures and pressures and result in inefficient burning of fuel. Similar turbine inefficiencies and higher CO<sub>2</sub> emissions also result from electric utilities having to operate their combustion turbines at minimum stable load levels for extended periods of time. Combustion turbines can operate at minimum stable loads, which is typically around 40% to 50% of the turbine’s full output. Operating at these minimum load levels enables the turbines to comply with their applicable emission limitations for conventional air pollutants<sup>9</sup> and enables the ramping up production output to meet expected electricity output.<sup>10</sup>

As stated earlier, this flexibility is crucial for balancing the variable outputs from renewable resources and responding to rapid changes in demand. Electric utilities, for example, frequently may need to “park” their combustion units at these minimum stable load levels overnight to avoid a start-up-and-shutdown cycle to be available to respond to a forecast drop in wind generation or when maximum power generation may be needed the next morning. Similarly, it may be necessary for electric utilities to frequently park their turbine units at reduced load during

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<sup>9</sup> For example, the operation of the combustion turbine at minimum-load levels will allow the unit to operate its selective catalytic reduction systems at the minimum flue gas temperatures for reducing nitrogen oxides (NO<sub>x</sub>) emissions to levels required for meeting the applicable NO<sub>x</sub> emissions limitations.

<sup>10</sup> Turbine manufacturers define “minimum load conditions” as the lowest MW output at which a turbine can operate continuously without risking operational instability, maintaining compliance with applicable emissions limitations, or damaging turbine components.

the middle of the day when increased solar generation is able to meet a significant portion of the daytime generation need. Each of these operating conditions prevents the combustion turbines from operating continuously under optimal baseload conditions for maximizing generating efficiencies and minimizing CO<sub>2</sub> emissions rates.<sup>11</sup>

### **C. High Ambient Temperatures Significantly Lower Turbine Efficiencies and Increase CO<sub>2</sub> Emission Rates.**

Combustion turbines are more efficient at colder ambient temperatures and less efficient at hotter temperatures, with the amount of variation in efficiency depending on turbine type and operating conditions.<sup>12</sup> As a rule of thumb, every increase of 1°C in ambient temperature reduces the turbine thermal efficiency by about 0.5 to 0.9%.<sup>13</sup> The annual nationwide CO<sub>2</sub> performance standard must reflect site ambient temperature variations over a 12-month period to assure the achievability of that standard.

In addition, a performance standard achievable by all new combustion turbine units nationwide must reflect variations in turbine performance due to other temperature-related factors. For example, there are variations in unit baseload efficiency performance driven by site-specific ambient temperature factors. One such factor is the use of air-cooled condenser cooling technology in hot, arid climates to reduce water consumption. A turbine facility with such technology will not have the same baseload efficiency as a unit with a cooling tower in a cooler

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<sup>11</sup> Although not a factor that reduces load levels, it should be noted that electric utilities also frequently use duct burners with combined-cycle turbine combustion turbines to meet sharp, short-term increases in electricity demand. As discussed below in Section III.E, duct burners can rapidly increase generation from the combined-cycle facility by providing supplemental firing in the heat recovery steam generator, thereby quickly boosting both steam production and output from the steam turbine. While duct burners increase total output from the facility, the incremental electricity is generated less efficiently than the electricity generated by direct fuel combustion by the turbine and the recovery of the waste heat by the heat recovery steam generator.

<sup>12</sup> Hotter ambient air reduces gas turbine efficiency because it lowers air density, which decreases the mass flow through the turbine and increases compressor work, while simultaneously reducing the thermodynamic temperature gradient that drives the turbine cycle. By contrast, the inlet (combustion) air is denser on colder days and, thus, more total mass flows through the turbine. This, in turn, yields high mass flow rates for all exhaust constituents, including CO<sub>2</sub>, though typically not enough to outweigh the increase in MW output. Hence, the CO<sub>2</sub> intensity (lbs. CO<sub>2</sub>/MWh) is lower at colder ambient temperatures.

<sup>13</sup> See Gas Turbine World, *Turbine inlet air cooling systems: worth the cost?* (Feb. 4, 2025), available at [here](#); Wartsila Energy, *Technology Comparison on Combustion Turbines*, available [here](#); ADG Efficiency, *Gas Turbines and Ambient Temperature*, available [here](#).

climate, and such a facility will therefore suffer additional efficiency losses due to high temperatures.

**D. Permanent Degradation in Turbine Efficiency Is Another Important Factor That Should Be Reflected in the Performance Standards.**

Turbine manufacturer catalogs provide the performance levels for both efficiency and CO<sub>2</sub> emissions rates of each combustion turbine model. Those quoted performance levels are based on “new and clean” conditions and do not reflect the degradation of a new combustion turbine that may occur over time due to mechanical, chemical, and environmental factors. All combustion turbines experience a certain amount of degradation even if they are well-maintained. As explained by turbine manufacturers,<sup>14</sup> the primary causes of degradation within the turbine include the following:

- *Compressor fouling*, which results from material buildup of airborne particles, oil mists, or contaminants on compressor blades and can reach 5% over a year of operation if not cleaned regularly. This degradation can only be partially recovered by online and offline water washes.
- *Wear and tear of blade seals*, which increases air leakage, reduces compression efficiency, and lowers overall turbine efficiency and output. There are seals between the ends of the blades and these seals wear out over time. The electric grid’s demand for frequent fast starts can also contribute to excess wear of these seals, further degrading performance. Such degradation of the blade seals can result in significant loss in turbine efficiency due to increased air leakage and reduced compression efficiency.
- *Wear and fouling of other parts*, which typically occur with both the compressor and turbine blades over time and can only be recovered for the most part during major turbine overhauls.

Total heat rate degradation is generally in the range of 3% to 5% at the end of the interval between major overhauls<sup>15</sup> which typically occur every three to five years. While much of the

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<sup>14</sup> Gas Turbine Association, *Comments on the Proposed Carbon Pollution Standards Rule* at 9-10, Docket No. EPA-HQ-OAR-2023-0072 (filed on Aug. 8, 2023) (GTA Comments); GE Verona, *Comments on the Proposed Carbon Pollution Standards Rule* at 48, Docket No. EPA-HQ-OAR-2023-0072 (filed on Aug. 8, 2023) (GE Verona Comments). See also KGI LLC, *Gas Turbine Performance Degradation* (Oct. 12, 2017), available [here](#).

<sup>15</sup> See GTA Comments at 9-10; GE Verona Comments at 48.

degradation can be recovered, the non-recoverable loss in gas turbines is cumulative, with permanent degradation accumulating over the combustion turbine's lifetime. The permanent deterioration results from chemical and mechanical means that can cause irreversible loss of material structure, such as enamel erosion, cracks, metal fatigue or creep, and other turbine deterioration. For a well-maintained turbine, a total efficiency loss of about 2% can be expected by the end of life, even with regular major overhauls.<sup>16</sup>

#### **E. Duct Burners Can Significantly Increase Generation Output but Lower Turbine Efficiencies and Increase CO<sub>2</sub> Emissions Rates.**

Electric utilities frequently install duct burners in the heat recovery steam generator (HRSG) of a combined-cycle combustion turbine facility to increase the overall amount of electricity output produced by the facility. The duct burners are combustion devices located just after the gas turbine combustion stage of the facility in the HRSG where natural gas (or fuel oil in some limited cases) is combusted. The primary function of the duct burner is to increase the temperature of the exhaust gases from the combustion turbine used by the HRSG, which—in turn—can rapidly produce increased temperature of the steam for boosting the electricity generated by the steam turbine.<sup>17</sup>

Most combined-cycle combustion turbine facilities in the United States (about 75% or 219 GW of total installed combined-cycle generating capacity) operate with duct burners.<sup>18</sup> The main advantages of using duct burners include the following:

- *Rapid Increase in Power Output:* Duct burners allow electric utilities to quickly ramp up steam production and, consequently, power output. This capability is especially valuable during short-term periods of peak electricity demand or when rapid response is needed

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<sup>16</sup> Vedran Mrzljak, *et al.*, *Analysis of Gas Turbine Operation Before and After Major Maintenance* (Apr. 11, 2019), available [here](#).

<sup>17</sup> Energy Information Administration (EIA), *Most combined-cycle power plants have duct burners that add energy to the turbine exhaust* (June 15, 2022) (*EIA Report on Combine Cycle Combustion Turbines*), available [here](#); ProcureEaze, *Combined Cycle Plants: 5 Proven Ways to Optimize HRSG Duct Burners for Maximum Profitability* (Mar. 10, 2025) (*5 Proven Ways to Optimize HRSG Duct Burners*), available [here](#).

<sup>18</sup> *EIA Report Combined Cycle Combustion Turbines*, available [here](#). Currently, total combined-cycle generating capacity is over 292,000 MW as of 2024, with approximately 219,000 MW of this generating capacity equipped with duct burners. *Id.*; Mark Morey, *The U.S. combined-cycle gas turbine (CCGT) fleet is large and diverse* (Apr. 10, 2025), available [here](#).

due to significant fluctuations in electric grid power demands for a variety of reasons.<sup>19</sup> In effect, combustion turbines provide rapid, low-cost, and clean gas-fired peaking generation when needed to meet a sharp, short-term increases in electricity demand and thereby can perform critical functions for ensuring electric grid reliability.

- *Operational Optimization:* Duct burners enable combined-cycle turbine facilities to adjust steam and power output over a wide range of combustion turbine loads, making it easier to meet varying market demands and respond to operational challenges. For example, duct burners can quickly restore steam supply to the HRSG when one of the combustion turbines trips offline.
- *Support for Renewable Integration:* In regions with high renewable penetration (which is the general trend throughout the country), duct burners provide a fast-response capacity to stabilize the grid by ensuring an adequate supply of electricity. Renewable energy now provides about a quarter to a third of total U.S. generation (varying monthly), with solar and wind growing dramatically over the last ten years. Specifically, the United States has witnessed an eightfold increase in solar generation and more than double in wind generation, with these trends projected to continue even with the reduction in federal incentives being provided to electric power sector.<sup>20</sup>

While duct burners provide these important operational and electric grid advantages, the overall thermal efficiencies of the combined-cycle facilities will nonetheless decrease. These decreases in efficiencies will be 6% to 8%, as compared to the operation of the facilities without the supplemental firing through duct burners at steady baseload operation. The thermal efficiency reductions result from the fact that duct burners combust fuel after the combustion turbines where the maximum generation efficiency can be achieved.

Notably, EPA did not reflect the use of duct burners in setting the CO<sub>2</sub> performance standards for new combined-cycle combustion turbines under the CPS. Given their widespread use (about 75% of total installed combined-cycle generating capacity in the United States) as well as the critically important role that duct burners play for ensuring electric grid reliability and supporting renewable integration, EPA should not ignore the decreased thermal efficiencies and the increased CO<sub>2</sub> emissions that will result from the frequent, short-term use of duct burners at the

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<sup>19</sup> *EIA Report on Combine Cycle Combustion Turbines*, available [here](#); *5 Proven Ways to Optimize HRSR Duct Burners*, available [here](#).

<sup>20</sup> EIA, *Electricity Explained: Electricity generation, capacity, and sales in the United States* (July 16, 2024), available [here](#); see also EIA, *Short-Term Energy Outlook* (Feb. 7, 2023), available [here](#).

vast majority of the combined-cycle combustion turbines—even though they are not an integral component of a combined-cycle combustion turbine.

**F. Additional Adjustments Are Necessary to Ensure the Achievability of the CO<sub>2</sub> Performance Levels.**

There are several other technical matters that are necessary for EPA to address in setting CO<sub>2</sub> performance standards for new combustion turbines. One matter pertains to the impacts of commercial compliance margins on the performance guarantees typically provided by turbine manufacturers. As a general matter, turbine manufacturers provide up to a 5% “compliance margin” in the performance guarantees provided on the rated efficiency of turbine levels to account for the variability in performance levels across the new combustion turbine fleet.<sup>21</sup> Another matter is the turbine efficiency reductions and the corresponding CO<sub>2</sub> emission increases resulting from the backpressure from the use of selective catalytic reduction (SCR) systems for controlling NO<sub>x</sub> emissions.

**1. Performance Standards Should Reflect That Commercial Compliance Margins Lower Turbine Manufacturers’ Guarantees by 3% to 5%.**

Turbine manufacturers typically provide warranties (guarantees) on the performance levels of the new combustion turbines sold to electric utilities. These performance warranties are subject to commercial compliance margins of approximately 3% to 5% to the turbine performance ratings.<sup>22</sup> The commercial compliance margins serve as risk management tool to account for the variability in performance from one turbine to another across the turbine fleet given that the performance warrantee is typically based on median performance capability of the combustion turbine.<sup>23</sup>

In effect, these commercial margins create contractual buffers or cushions allowing manufacturers to meet the performance warranties within specified tolerance ranges rather than absolute values. It therefore allows turbine manufacturers to warrant turbine performance at a level within the range of fleet-wide performance, knowing that roughly half the turbines will do worse than the warranted performance level. In the event of any shortfall, electric utilities receive

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<sup>21</sup> See GTA Comments at 9; GE Verona Comments at 48.

<sup>22</sup> See GTA Comments at 9-10; GE Verona Comments at 48.

<sup>23</sup> While there may be ways for an electric utility to limit or possibly even eliminate the compliance margins, this is not the typical practice and may simply result in guarantees for less-efficient turbines with higher CO<sub>2</sub> emissions rates. Furthermore, manufacturers will likely impose significant cost premiums on any limitations placed on those guarantees.

compensation through the payment of commercial liquated damages only to the extent that the performance levels for the new turbines fall below the commercial compliance margins applied to the quoted efficiency performance levels.<sup>24</sup>

By contrast, compliance with the applicable CO<sub>2</sub> performance standards under the federal regulations established in NSPS Subpart TTTTa cannot be adjusted to reflect these variations set in the commercial compliance margins. Those NSPS regulations are not so forgiving. Each affected new combustion turbine must comply with the applicable performance standard set forth in Subpart TTTTa. No allowance or margin is provided to adjust the standards to account for these performance variations. As a result, EPA must adjust the stringency of the performance standards to account for the compliance margins made by turbine manufacturers and the resulting inherent margin of uncertainty that roughly half the combustion turbines will not achieve those CO<sub>2</sub> performance levels.

## **2. Backpressure from NO<sub>x</sub> SCR Systems Can Have Material Effects on Turbine Efficiencies and CO<sub>2</sub> Emissions Rates.**

Material efficiency losses can result from the backpressure created by SCR systems that combustion turbines must now typically install and operate to control their NO<sub>x</sub> emissions. According to the major turbine manufacturers, these SCR systems add significant backpressure and decrease plant performance.<sup>25</sup> These lost efficiencies should be reflected in the CO<sub>2</sub> performance standards that EPA sets for those combustion turbines required to be operating with such NO<sub>x</sub> SCR systems.

## **IV. SIMPLE-CYCLE TURBINES CANNOT ACHIEVE THE CO<sub>2</sub> PERFORMANCE STANDARD FOR INTERMEDIATE-LOAD TURBINES UNDER REAL-WORLD OPERATING CONDITIONS.**

The CO<sub>2</sub> performance standard set for intermediate-load combustion turbines is only achievable by a very limited number of high-efficiency (aeroderivative) combustion turbines and by the larger turbine frames combustion turbine units and, in these cases, only under optimal conditions.

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<sup>24</sup> Another important function of commercial compliance margins is to account for uncertainty during performance validation testing of the newly installed turbine. When demonstrating turbine performance, there is agreed-upon test tolerance measurement uncertainty used to adjust the “as-measured” performance.

<sup>25</sup> See GTA Comments at 10; GE Verona Comments at 49. The backpressure and the decrease in turbine performance occurs because NO<sub>x</sub> SCR systems decrease turbine efficiencies by restricting exhaust flows restrictions, thereby forcing the turbine to expend more energy expelling gases.

This assessment was consistently conveyed by all the turbine manufacturers in their comments to EPA in response to the proposed CPS in 2023.<sup>26</sup>

As noted above, CAA section 111 requires that EPA set performance standards that are achievable by all combustion turbine units nationwide within the relevant source category (here, intermediate-load combustion turbines). Furthermore, courts have interpreted the statute to require that EPA adopt a standard that is capable of being achieved by all affected sources across the full range of operating conditions, including the “most adverse conditions which can reasonably be expected to recur.”<sup>27</sup>

The following discussion provides further documentation of the unachievability of the performance standard based on review of the turbine manufacturers’ performance data for simple-cycle combustion turbines as well as actual CO<sub>2</sub> emissions rates currently being achieved by those combustion turbines.

**A. Gas Turbine World’s Performance Levels Are Not Representative of Simple-Cycle Turbine Performance Under Real-World Operating Conditions.**

The Gas Turbine World (GTW) publishes performance data and specifications for both simple-cycle and combined-cycle combustion turbines manufactured by the Original Equipment Manufacturers (OEM) in the United States, including GE Verona and Siemens Energy. Although not setting the CO<sub>2</sub> performance standards based on the GTW performance data, EPA nonetheless refers to this performance data as one benchmark that was considered in developing the standards. For example, EPA states in the 2023 Proposed CPS: “According to Gas Turbine World 2021, approximately three-fourths of simple-cycle combustion turbines have design efficiencies of 35 or higher and half of the simple-cycle combustion have design efficiencies of 36 percent or higher.”<sup>28</sup> Since these design efficiency levels are equivalent to meeting the applicable proposed performance standard,<sup>29</sup> the clear inference was that most new simple-cycle turbines would be able to meet this performance standard.

However, this inference is misguided. The GTW performance data indicates the performance levels that each combustion turbine can achieve *at ideal or optimal operating conditions*, when

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<sup>26</sup> GTA Comments at 12-15; GE Verona Comments at 19-20.

<sup>27</sup> *Nat’l Lime Ass’n*, 627 F.2d at 431 n.46.

<sup>28</sup> *New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units*, 88 Fed. Reg. 33,240, 33,285 (May 23, 2023) (2023 Proposed CPS).

<sup>29</sup> *See id.*

combustion turbines operate at baseload International Standards Organization (ISO) conditions with no backpressure due to the operation of a NO<sub>x</sub> SCR system, in a new and clean condition (without degradation), and no commercial margin applied. By contrast, the GTW performance data does not reflect any of the operational and site-specific factors described above in Section III of these comments that will significantly increase GTW-rated CO<sub>2</sub> emission rate levels.

For example, no consideration was given for reduced or fluctuating load levels that can greatly diminish turbine efficiencies and thereby significantly increase the unit's CO<sub>2</sub> emissions. Other unaccounted site-specific conditions that lessen turbine efficiencies include high ambient temperatures and elevation, compliance margins provided in technical or commercial guarantees, degradation in efficiencies over time, and the use of duct burners.

The GTW performance data can therefore be a useful tool only for benchmarking the relative performance of each combustion turbine model with consistent assumptions and methods at defined optimal conditions. However, *EPA should not rely on the GTW data in setting CO<sub>2</sub> performance standards for new combustion turbines because it does not provide an evaluation of turbine performance when operating under typical, real-world operating conditions.* Figures 1 and 2 below illustrate the differences between GTW performance levels at ideal conditions and those performance levels that are achievable under real-world operating conditions.

Figure 1 depicts the CO<sub>2</sub> emission rates based on the quoted GTW generic performance levels at ideal operating conditions, with those emissions rates compared to combustion turbine output.<sup>30</sup> The red horizontal line represents the performance standard of 1,170 lbs. CO<sub>2</sub>/MWh-gross that EPA established for intermediate-load combustion turbines under the CPS. This figure illustrates that even under ideal operating conditions the larger frame turbine units can only achieve the standard at higher output levels (above 200 MW) and that many of the frame and aeroderivative turbines operating at these ideal conditions cannot even meet the standard at the lower output levels (below 125 MW).

In comments submitted to the EPA on the 2023 Proposed CPS, the Gas Turbine Association (GTA) has prepared a graphic on the performance of the same fleet of simple-cycle turbines.<sup>31</sup> The performance levels in this graphic, provided below in Figure 2, adjust the GTW performance data to those performance levels that are achievable under real-world operating conditions. As

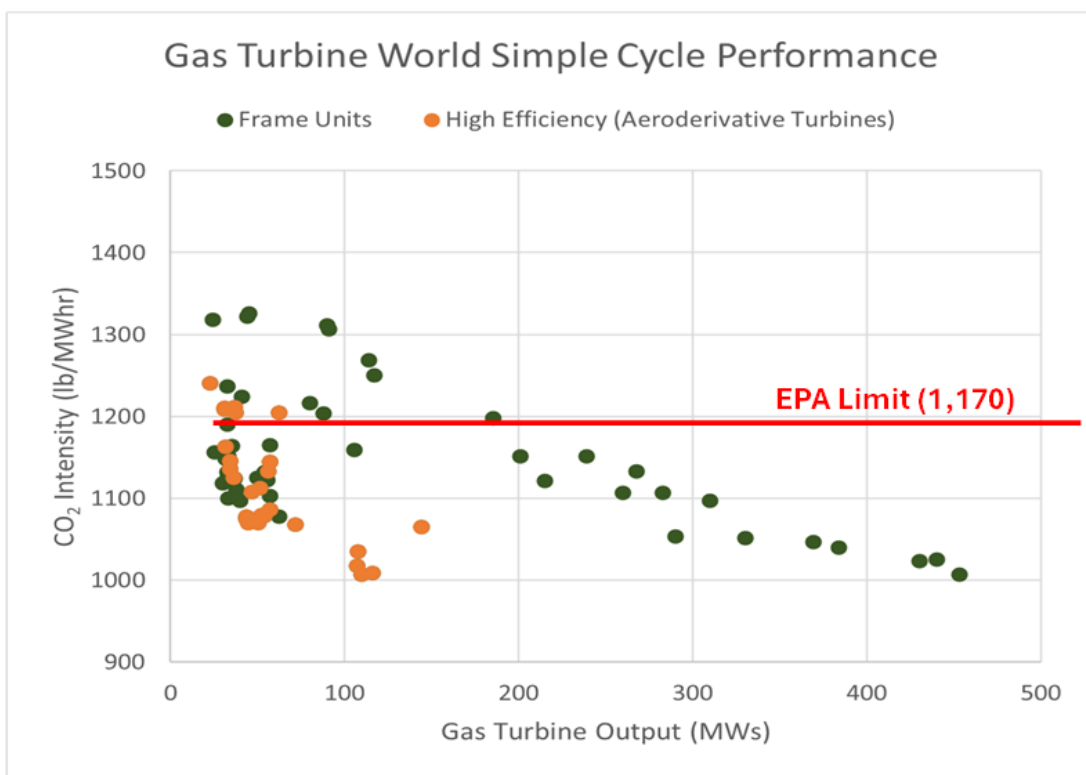
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<sup>30</sup> This graphic on GTW performance levels was prepared and presented to the LPPC membership by GE Verona and Siemens Energy at a LPPC Environmental Task Force meeting in late June 2025.

<sup>31</sup> GTA Comments at 11-14 (providing both graphic and discussion on GTW performance data).

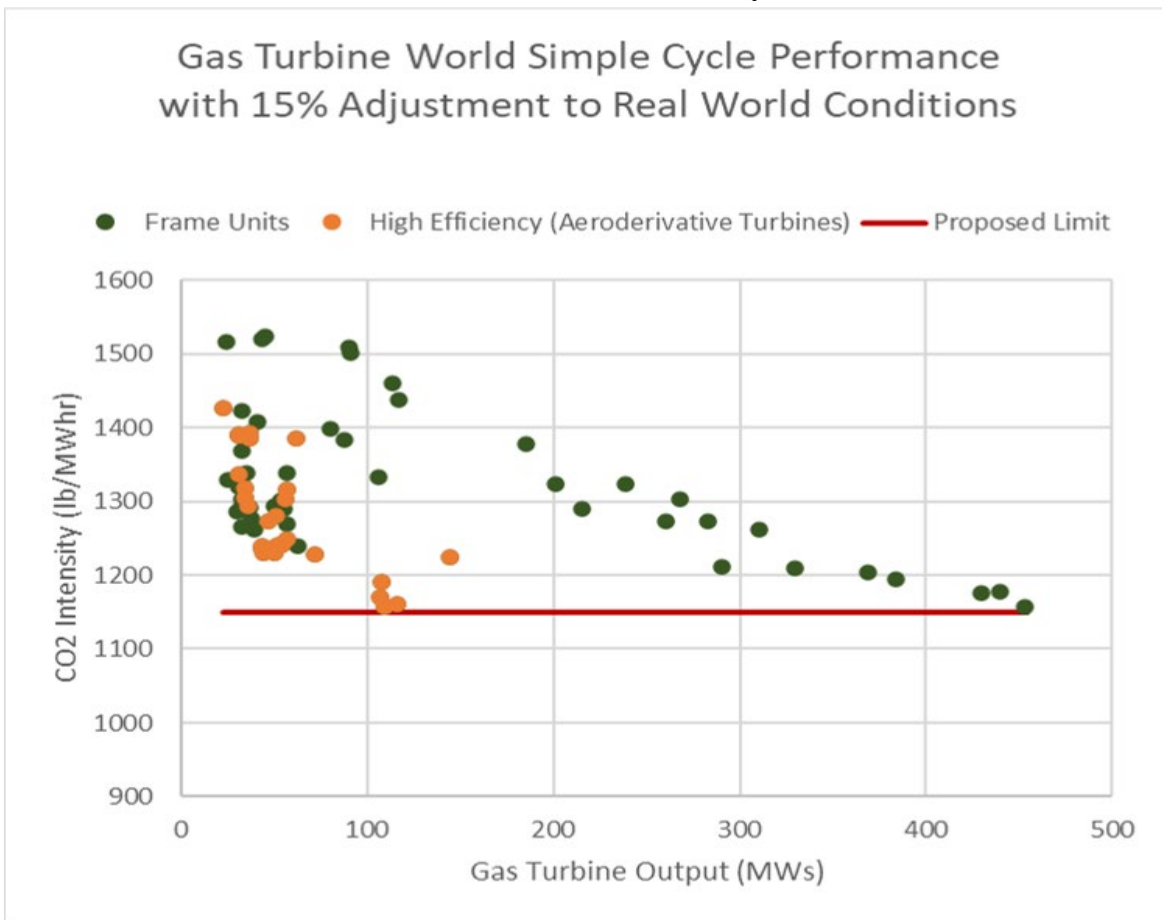
indicated in the GTA Comments, an adjustment factor of 15% was selected to account for the “combined effects of variable operation, commercial margin, and degradation” along with changes in temperatures and other site-specific matters.<sup>32</sup> *Once the GTW performance data is adjusted to reflect typical real-world conditions, almost all the combustion turbines have CO<sub>2</sub> emissions rates that exceeding 1,200 lbs. CO<sub>2</sub>/MWh-gross and thereby cannot comply with the performance standard that the CPS set for intermediate-load combustion turbines.*

**Figure 1**  
**Unadjusted GTW Performance Levels**  
**Performance Standards Achievable by Only Larger-Frame Turbines**



<sup>32</sup> *Id.* at 11 (explaining that value is based on a 13% compliance margin set for air permits with an “additional margin is needed to adjust from GTW performance to site specific quoted values”).

**Figure 2**  
**Adjusted GTW Performance Levels**  
**Performance Standards Unachievable by Most Turbines**

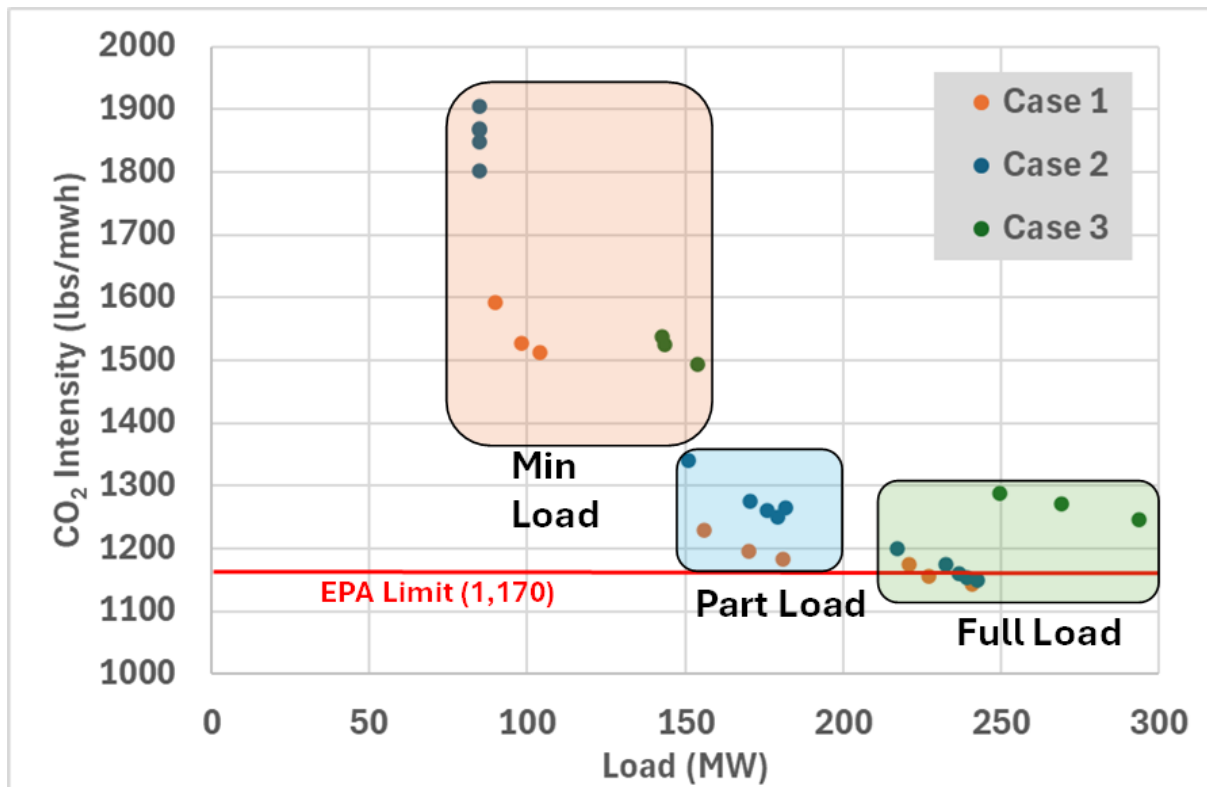


**B. OEM Performance Data Indicates That Most Intermediate-Load Combustion Turbines Cannot Meet the Performance Standard.**

As one would expect, the OEMs have completed extensive performance testing on the CO<sub>2</sub> emissions rates for the simple-cycle turbines that they manufacture. The OEM performance testing demonstrates what their turbines can achieve at various load levels and operating conditions. The publicly available data for these performance tests clearly indicates that a significant portion of the most advanced simple-cycle combustion turbines can only achieve the current standard of 1,170 lbs. CO<sub>2</sub>/MWh-gross for intermediate-load turbines at maximum or near-maximum steady baseload conditions. By contrast, these same, highly efficient simple-cycle turbines cannot meet this performance standard at minimum and partial loads in most cases.

The OEM performance data is reflected in Figure 3 below for the GE Verona F Class turbines that generally have a nameplate rating ranging from about 170 MW to 300 MW.<sup>33</sup> For the F Class turbines operated in simple-cycle mode, Figure 3 indicates that those turbine units cannot meet the applicable limitation of 1,170 lbs. CO<sub>2</sub>/MWh-gross while operating at minimum load conditions at any ambient temperature. Although varying for each turbine model, the minimum load condition is typically 50% below the turbine unit’s rated maximum or full (nameplate) capacity. Turbine manufacturers define “minimum load conditions” as the lowest MW output at which a turbine can operate continuously without risking operational instability, maintaining compliance with applicable emissions limitations, or damaging turbine components.

**Figure 3**  
**Performance Standard Unachievable at Most Load Levels**  
**F Class Simple-Cycle Combustion Turbines<sup>34</sup>**



<sup>33</sup> This graphic on performance levels was prepared and presented to the LPPC membership by GE Verona and Siemens Energy at a LPPC Environmental Task Force meeting in late June 2025.

<sup>34</sup> Each cluster in Figure 3 are plotted under three conditions: Case 1 at low temperatures, Case 2 at ISO temperatures, and Case 3 at high temperatures.

At the minimum load levels, the Class F turbines can achieve CO<sub>2</sub> emissions rates well above the 1,170 lbs. CO<sub>2</sub>/MWh-gross standard, ranging from about 1,500 to 1,900 lbs. CO<sub>2</sub> lbs./MWh-gross. Similarly, F Class turbines operating at partial loads (ranging from 50% to 75% of maximum capacity) also are unable to comply with this performance standard in any case. The level of noncompliance depends on a variety of factors, including the percentage difference between partial and full load levels (or cycling on and off) as well as whether the turbine unit is operating at other reasonably foreseeable suboptimal operating conditions such as high ambient temperatures. Finally, Figure 3 highlights that even when operating at optimum full load levels, most Class F turbines cannot meet the performance standards under most ambient temperatures.<sup>35</sup>

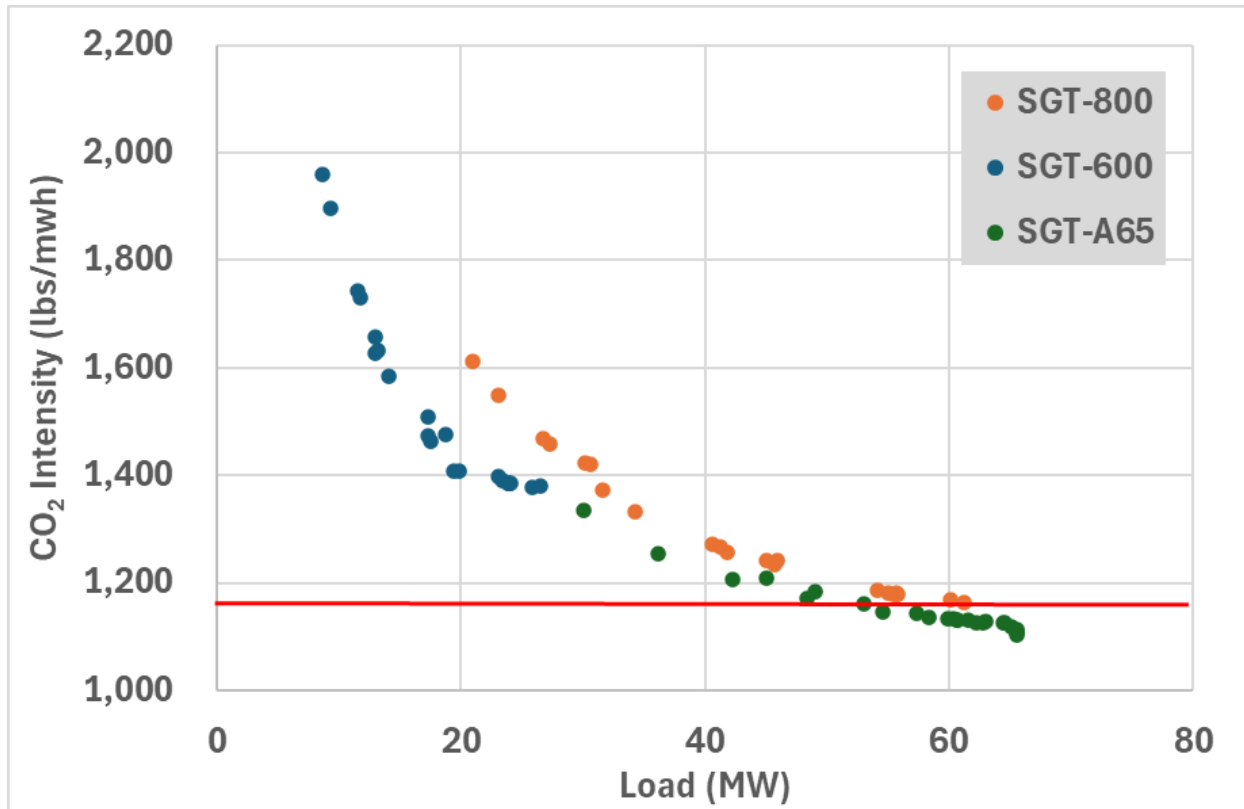
Small industrial and aeroderivative simple-cycle turbines also face significant challenges in meeting the 1,170 lbs. CO<sub>2</sub>/MWh-gross standard when operating at a maximum output under optimal ISO standard conditions. For example, Figure 4 depicts the CO<sub>2</sub> emission rates that are achievable at full load by three models of small turbines manufactured by Siemens Energy.<sup>36</sup> One model is an aeroderivative turbine (SGT-A65) and the other two models are small industrial simple-cycle turbines (SGT 600 and SGT-800). As reflected in Figure 4, none of the three turbines with nameplate capacity levels rated at various sizes below 55 MW or 60 MW can achieve the performance standard even at maximum output under optimal operating conditions.

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<sup>35</sup> New simple-cycle turbines in the A, B, C, D, and E classes (ranging from 40 to 110 MW) face similar difficulties in meeting a performance standard of 1,170 lbs. CO<sub>2</sub>/MWh, particularly at the partial load levels and minimum load conditions. New A-E class simple-cycle turbines have emissions rates at approximately 1,300 lbs. CO<sub>2</sub>/MWh at partial load and 1,400 to 1,500+ lbs. CO<sub>2</sub>/MWh at minimum load.

<sup>36</sup> This graphic on performance levels was prepared and presented to the LPPC membership by GE Verona and Siemens Energy at a LPPC Environmental Task Force meeting in late June 2025.

**Figure 4**  
**Performance Standard Unachievable at Maximum Output**  
**Small Industrial and Aero-derivative Combustion Turbines**



Furthermore, GE Verona’s performance data indicates that many of its aero-derivative turbine models also face major challenges in meeting the 1,170 lbs. CO<sub>2</sub>/MWh-gross limitation at partial and minimum operating load levels. Notable examples include LM6000 rated at around 55 MW and LMS100 rated around 115 MW.<sup>37</sup>

This performance data generated by the turbine manufacturers demonstrates that a significant portion of the affected simple-cycle combustion turbines cannot meet a performance standard set at 1,170 lbs. CO<sub>2</sub>/MWh-gross under recurring, real-world conditions. Setting such a stringent national standard that only a relatively small portion of affected turbines can meet under limited

<sup>37</sup> At partial load and moderate temperatures (59°F), the GE LM6000 and GE LMS100 aero-derivative turbines can only achieve CO<sub>2</sub> emission rates of ~1,250–1,350 lbs. CO<sub>2</sub> /MWh and ~1,200–1,300 lbs. CO<sub>2</sub>/MWh, respectively, due to efficiency losses. At minimum load conditions, the CO<sub>2</sub> emissions rates for these two aero-derivative models increase even further due to efficiency drops in the turbines. The emissions rate for GE LM6000 and GE LMS100 models increase to 1,400+ lbs. CO<sub>2</sub>/MWh.

operating conditions clearly violates the “best system of emissions reduction” (BSER) mandate for EPA to adopt achievable performance standards under CAA section 111.

**C. Actual CO<sub>2</sub> Emission Data Indicates the Unachievability of the Performance Standard for Most Simple-Cycle Combustion Turbines.**

An analysis of recent CAMPD CEMS emissions rate data of simple-cycle combustion turbines further bolsters the technical determination (as described above) that the turbine manufacturers reached on simple-cycle turbines’ inability to achieve 1,170 lbs. CO<sub>2</sub>/MWh-gross standard under a wide range of real-world operating conditions.

One turbine manufacturer has reviewed recent CEMS emissions data for those units installed between 2017-2023. As depicted below in Figure 5 by that turbine manufacturer,<sup>38</sup> only 15% of the existing simple-cycle combustion turbines installed between 2017 and 2023 were able to achieve CO<sub>2</sub> emission rates at or below the applicable 1,170 lbs. CO<sub>2</sub>/MWh-gross standard operating under actual real-world conditions. *The units meeting the standards are not necessarily more efficient; rather, the lower CO<sub>2</sub> emissions rates being achieved simply reflect the fact that the turbine units were generating electricity under more favorable operating conditions.*

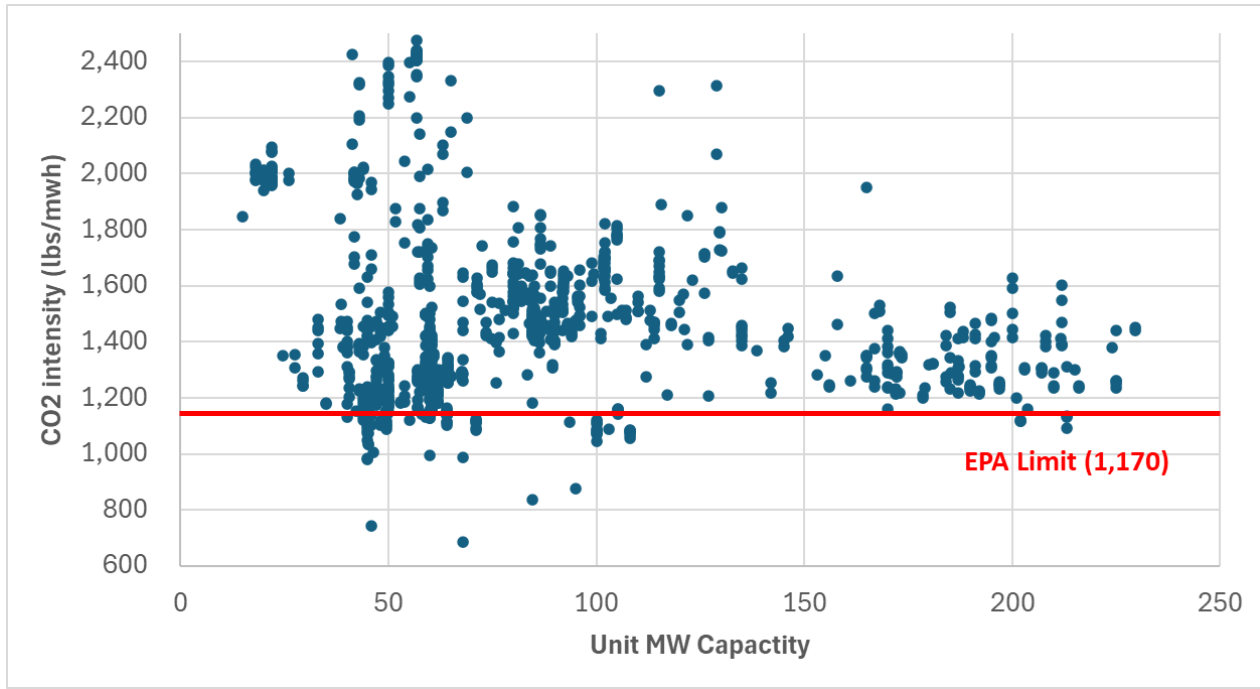
This actual performance data therefore demonstrates the remaining 85% of the existing national reasonably new (installed between 2017-2023) fleet of simple-cycle combustion turbines did not meet the current performance standard for intermediate-load turbines. EPA cannot ignore or discount these CO<sub>2</sub> performance levels achieved by this existing fleet of turbines. No significant major technological advancements to improve simple-cycle turbine performance have occurred that would cause more recent turbines to perform better than turbines installed between 2017-2023. Nor are any major advancements in generating efficiency expected in the foreseeable future.

Setting such a stringent national standard that only a relatively small portion of affected turbines can meet only under optimal operating conditions clearly violates the BSER mandate under CAA section 111 and therefore needs to be revised.

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<sup>38</sup> This graphic was prepared and presented to the LPPC membership by GE Verona and Siemens Energy at a LPPC Environmental Task Force meeting in late June 2025. The CEMS data analyzed included the CO<sub>2</sub> emission rates achieved by those simple-cycle turbines operating in calendar year 2024, of which the data for 127 turbine units had valid data that was included in the analysis.

**Figure 5**  
**2024 Actual Annual CO<sub>2</sub> Performance Levels**  
**Simple-Cycle Combustion Turbines**



Source: EPA CAMPD CEMS Data

**D. The Unachievability of the Performance Standard Poses Substantial Regulatory Risks and Compliance Challenges.**

Substantial regulatory risks are posed by EPA’s imposition of this unachievable CO<sub>2</sub> performance standard. No emissions control technologies exist for controlling CO<sub>2</sub> emissions from intermediate-load, simple-cycle combustion turbines. As EPA itself has confirmed in the CPS, combusting large amounts of hydrogen is not a feasible control option for lowering CO<sub>2</sub> emissions from combustion turbines.<sup>39</sup> Similarly, EPA has determined in the Proposed Rule that carbon capture and storage (CCS) is neither “adequately demonstrated” nor economically feasible, technically, and even if it was, the 90% capture control requirement is not achievable.<sup>40</sup>

Furthermore, the unachievable Phase 1 standard poses major compliance challenges for electric utilities bringing new combustion turbines online. Noncompliance with the applicable standard is not an option for electric utilities. *The only compliance options available are for electric utilities*

<sup>39</sup> 89 Fed. Reg. at 39,805, 39,939-43.

<sup>40</sup> 90 Fed. Reg. at 25,775-77.

*to operate their new combustion turbines in an inflexible manner whereby the performance standards are dictating how electric utilities may operate their turbine units.*

One alternative would force electric utilities to operate their turbine units uneconomically at full loads to maximize their generating efficiencies and thereby achieve the lowest possible CO<sub>2</sub> emissions rates. The other alternative is for the new turbines to limit the annual capacity factors to below 20% so that the units need only to comply with the clean fuel requirements set for the low-load peaking turbines. In capacity markets, artificially limiting new turbine units' production levels to less than 20% will require electric utilities to overbuild their turbine generating capacity to meet projected future demand growth. In energy-only markets, these performance standards could have a chilling effect on the construction of new combustion turbines needed to support growing demand as well as the integration of renewables

Both options would greatly increase costs for consumers and could pose significant challenges for ensuring electric grid reliability.

#### **V. COMBINED-CYCLE TURBINES CANNOT ACHIEVE CO<sub>2</sub> PERFORMANCE STANDARDS FOR BASELOAD TURBINES UNDER REAL-WORLD OPERATING CONDITIONS.**

Many of the new large combustion turbines operated in a combined cycle will struggle to meet the current CO<sub>2</sub> performance standards set for baseload combustion turbines. For many combined-cycle combustion turbines, compliance with an emission rate limitation of 800 lbs. CO<sub>2</sub>/MWh-gross will be possible only under optimal (full-load, steady-state) conditions. As discussed above in Section III, real-world operating conditions (such as reduced and fluctuating load levels, hot ambient temperatures, efficiency degradation and use of duct burners) will likely prevent these new large, combined-cycle facilities from reliably meeting the 800 lbs. CO<sub>2</sub>/MWh-gross annual performance standard.

The smaller combined-cycle facilities also face major challenges in meeting the performance standard even under optimal operating conditions.<sup>41</sup> Even if these combined-cycle turbine models could meet the standards at optimal conditions (which may not be feasible based on OEM performance data), none of these smaller turbine models can reliably achieve the 800 lbs.

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<sup>41</sup> One such example is the Siemens SGT-800 model (with power output from 66 MW up to 163 MW), which OEM performance data indicates that they can achieve only an emissions rate between ranging from 823-889 lbs. CO<sub>2</sub>/MWh at optimal operating conditions. Other borderline cases in meeting the performance standards for baseload combustion turbines are the GE 7F.05, Mitsubishi M501F, and Siemens SGT6-5000F. These three models of combined-cycle turbines have CO<sub>2</sub> emission rates in the range of 750 lbs. to 820 lbs. CO<sub>2</sub>/MWh-gross at optimal baseload.

CO<sub>2</sub>/MWh-gross limitation under recurring, real-world operating conditions, particularly when operation at low-load levels (or cycling on and off) is required, the turbines are at locations with high ambient temperatures, or when duct firing is required to meet sharp spikes in electricity demand.

Support for this determination is provided below with analyses of the GTW performance data, OEM performance data, OEM performance data for specific combined-cycle turbine models, and actual CO<sub>2</sub> emissions levels currently being achieved by the combined-cycle turbine fleet.

**A. GTW Performance Levels Are Not Representative of Combined-Cycle Performance Levels Under Real-World Operating Conditions.**

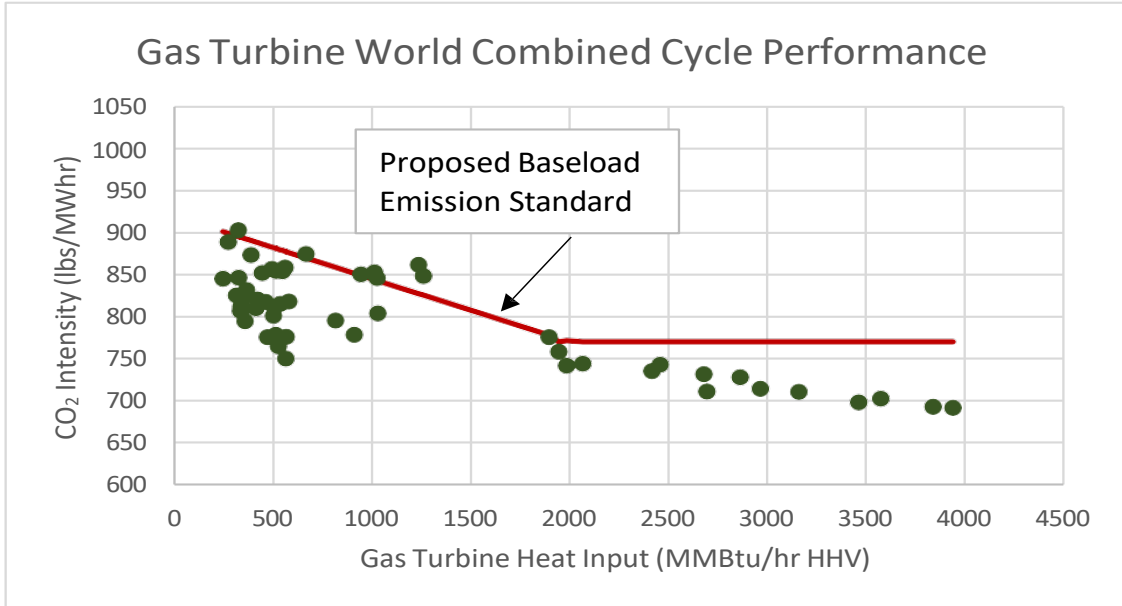
For the same reasons discussed above for simple-cycle combustion turbines under Section IV.A. of these comments, reliance on GTW performance levels is misguided for combined-cycle combustion turbines. The GTW performance data only identifies the performance levels that combined-cycle combustion turbines can achieve at ideal or optimal operating conditions and does not reflect the CO<sub>2</sub> performance levels that the turbines can achieve under typical real-world operating conditions (including reduced and fluctuating loads, high ambient temperatures, and degradation in efficiencies over time).

These differences in performance levels between ideal and typical operating conditions are illustrated below in the following two graphics. Figure 6 depicts what combined-cycle units can achieve at full load levels under “new and clean” conditions with no degradation, while Figure 7 depicts what the same fleet of combined-cycle units can achieve under real-world operating conditions. Both figures were included in comments that the GTA submitted on the 2023 Proposed CPS and reflect the levels achievable as compared to the proposed CO<sub>2</sub> performance standard for new combined-cycle combustion turbines.<sup>42</sup>

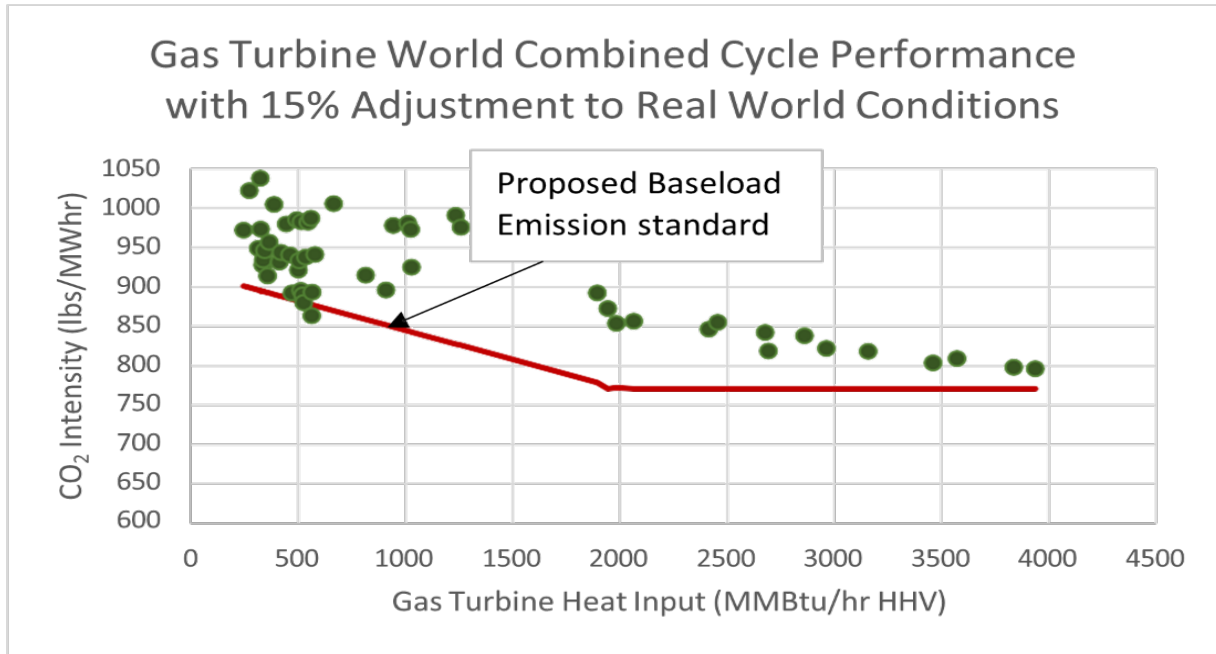
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<sup>42</sup> GTA Comments at 14-15.

**Figure 6**  
**Unadjusted GTW Performance Levels**  
**Performance Standards Achievable by Most Turbines**



**Figure 7**  
**Adjusted GTW Performance Levels**  
**Performance Standards Unachievable by Most Turbines**



As illustrated in the above two figures, many combined-cycle turbine models may be able to achieve the current 800 lbs. CO<sub>2</sub>/MWh-gross performance standard only under ideal operating conditions. By contrast, *virtually all these turbine units would be unable to meet that 800 lbs. CO<sub>2</sub>/MWh-gross standard when they must operate under less-favorable conditions and at reduced or variable load levels.*

**B. OEM Performance Data Indicates That Most Combined-Cycle Turbines Cannot Achieve the Performance Standard.**

Turbine manufacturers also have completed extensive performance testing on the various models of new combined-cycle turbines that they sell to the electric power sector. A review of this performance data clearly indicates that most combined-cycle models face major challenges in meeting the performance standard of 800 lbs. CO<sub>2</sub>/MWh-gross at most load levels and operating conditions.

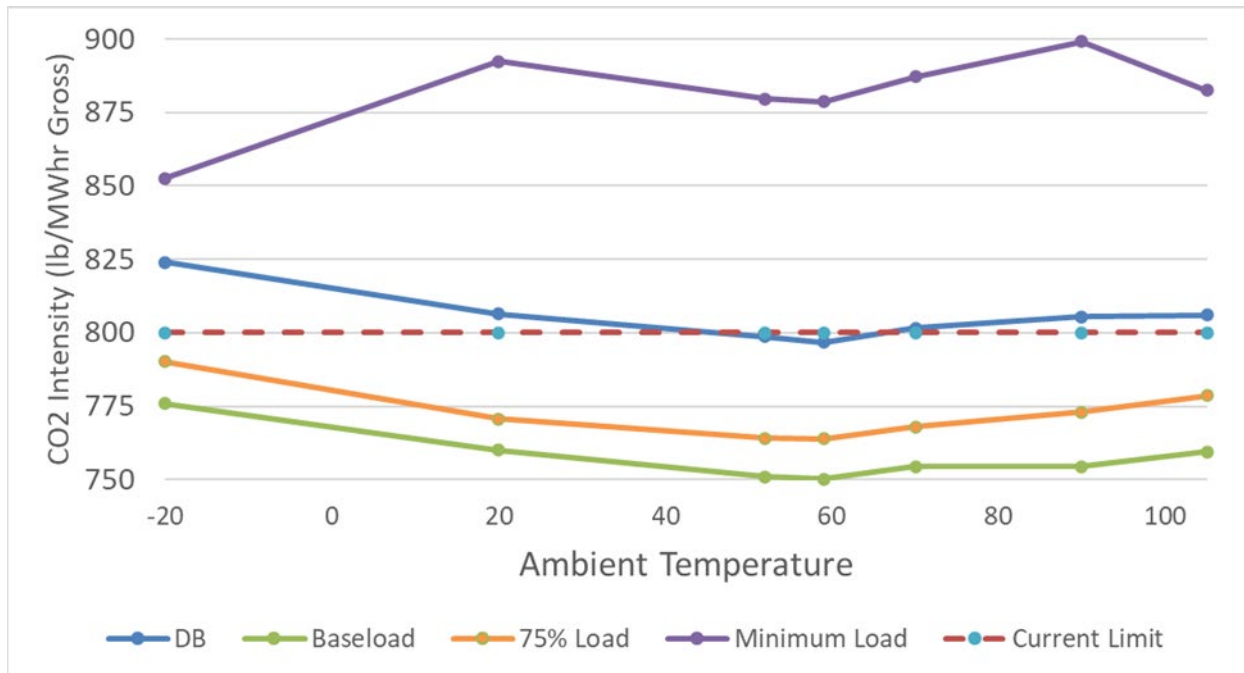
One notable example is performance data depicted in Figure 8 below for GE Verona's H Class combined-cycle combustion turbines, which are among the largest and most heavy-duty combustion turbines—generating output around 700 MW in a one1x1 combined-cycle configuration. Figure 8 illustrates that H Class combined-cycle units cannot meet the 800 lbs. CO<sub>2</sub>/MWh-gross at minimum load levels at all ambient temperature levels or when using duct burners at most of the ambient temperature levels.<sup>43</sup>

While these large H Class combined-cycle turbines can meet the 800 lbs. CO<sub>2</sub>/MWh-gross performance standard when operating at baseload and intermediate (75%) load levels, the units are only minimally below that standard. For example, CO<sub>2</sub> emission rates achievable at baseload levels are in the range of 765-770 lbs. CO<sub>2</sub>/MWh-gross at ambient temperatures above 70°F and in the range of 770-780 lbs. CO<sub>2</sub>/MWh-gross when operating at 75% load.

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<sup>43</sup> This graphic was prepared and presented to the LPPC membership by GE Verona and Siemens Energy at a LPPC Environmental Task Force meeting in late June 2025.

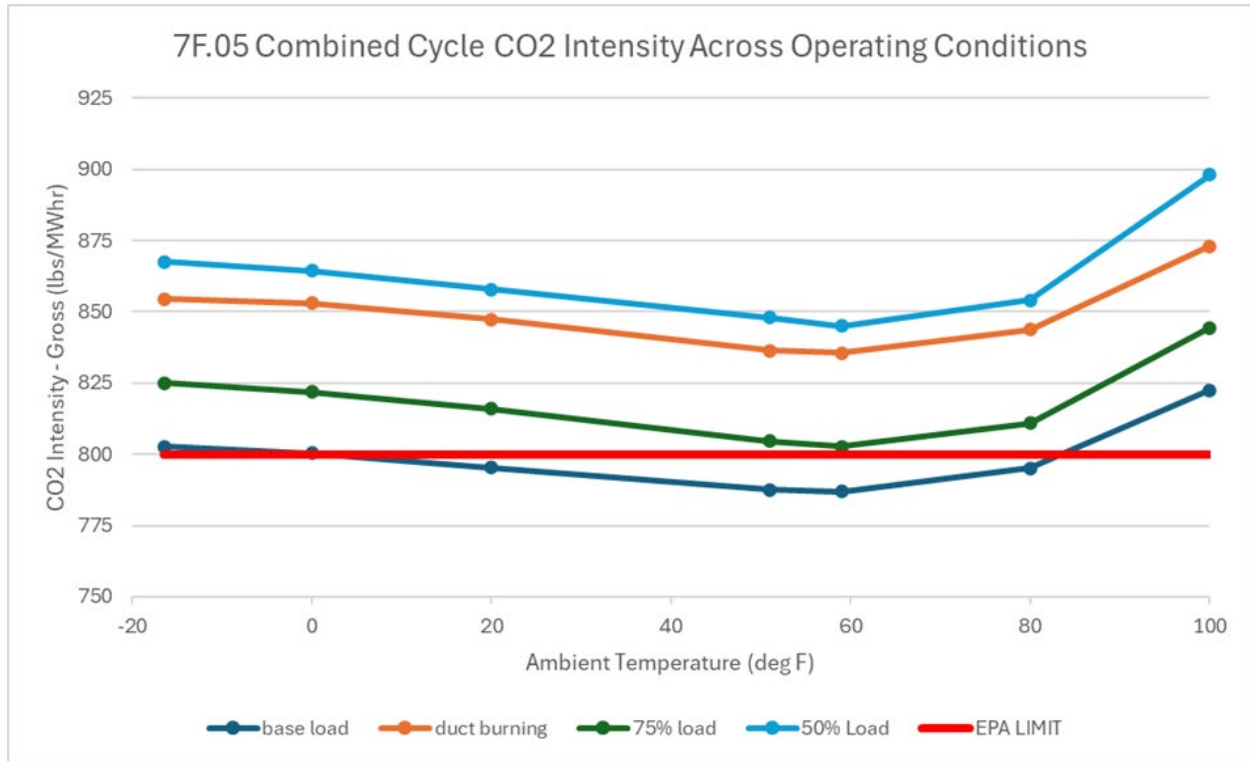
**Figure 8**  
**CO<sub>2</sub> Emissions Rates Achievable at Load Levels**  
**H Class Combined-Cycle Combustion Turbines**



By contrast, these H Class combine-cycle units are in the range of 875-900 lbs. CO<sub>2</sub>/MWh-gross when operating at minimum load levels and above 70°F, significantly more than the 800 lbs. CO<sub>2</sub> performance standard. These emission trends clearly indicate that H Class combined-cycle units dispatched for some periods at minimum-load levels may not be able to offset the proportionately much higher CO<sub>2</sub> emissions, if the units are infrequently dispatched at baseload levels and operate primarily at intermediate load levels.

As depicted below in Figure 9, the inability to comply with the 800 lbs. CO<sub>2</sub> limitation is even more evident in the smaller size GE Verona F Class combustion turbines. (7F and 9F Series turbines have a megawatt size ranging from 201 MW to 288 MW in simple-cycle output and 300 MW to 500 MW as combined-cycle facilities.) Figure 9 below illustrates that F Class units can meet the standard only when operating at baseload (maximum) levels and when the unit operates at mild or moderate ambient temperatures (below approximately 80°F). In all other cases, the F Class units cannot achieve an 800 lbs. CO<sub>2</sub>/MWh-gross limitation under any operating level and ambient temperature, even when the units are operating at 75% and 50% load levels. Failing to revise the 800 lbs. CO<sub>2</sub>/MWh-gross limitation could prevent the electric utilities from deploying and using this size of combustion turbines, which are generally targeted for use by many electric utilities.

**Figure 9**  
**CO<sub>2</sub> Emissions Rates Achievable at Load Levels**  
**F Class Combined-Cycle Combustion Turbines**



**C. Actual CO<sub>2</sub> Emission Data Indicates the Unachievability of the Performance Standard for Most Combined-Cycle Combustion Turbines.**

A preliminary analysis of recent CEMS data of all existing combined-cycle combustion turbines in EPA’s CAMPD database further confirms the inability of combined-cycle turbines to achieve a performance standard of 800 lbs. CO<sub>2</sub>/MWh-gross under a wide range of real-world operating conditions.

This analysis, prepared by one turbine manufacturer,<sup>44</sup> indicates that only 14% of the combined-cycle turbines (almost all H Class or J Class turbines) installed between 2017-2023 were able to meet the 800 lbs. CO<sub>2</sub>/MWh-gross limitation under real-world operating conditions. *The turbine units meeting the standards are not necessarily more efficient but, in some cases, simply reflect more favorable operating conditions.* In contrast, the remaining 86% of these combined-cycle

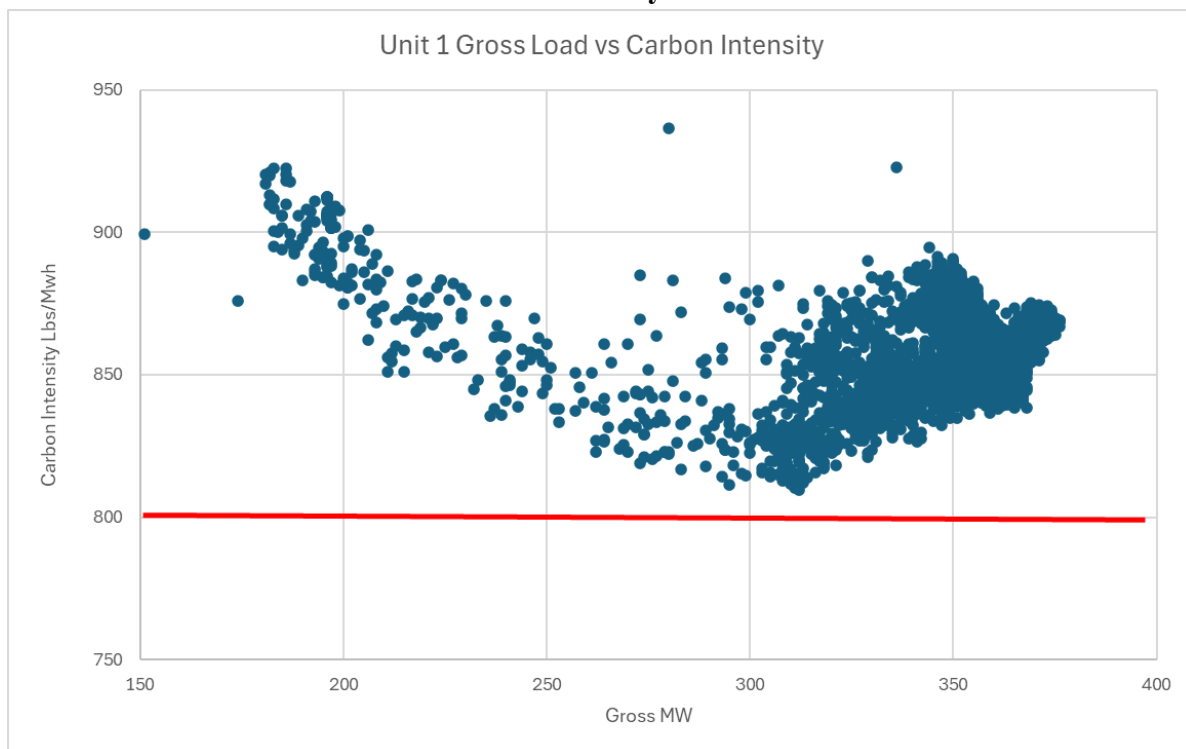
<sup>44</sup> This analysis was presented to the LPPC membership by GE Verona at a LPPC Environmental Task Force meeting in late June 2025.

combustion turbines were unable to meet the current performance standard for baseload combustion turbines under the full range of reasonably foreseeable operating conditions.

Setting such a stringent national standard that only a relatively small percentage of affected combined-cycle turbines can meet clearly violates the BSER mandate under CAA section 111. That statutory mandate—as interpreted by the courts—requires EPA to set a standard that all affected combined-cycle combustion turbines nationwide must be able to achieve in practice under full range of reasonably foreseeable, real-world operating conditions.

The unachievability of the performance standard set is further illustrated by a review of the CO<sub>2</sub> CAMPD CEMS data for a GE Verona 7F combined-cycle combustion turbine. This graphic in Figure 10 below indicates a combined-cycle turbine that operated for 7700 hours in 2024 could not achieve an emissions rate of 800 lbs. CO<sub>2</sub>/MWh for even one hour at any load or operating conditions.<sup>45</sup>

**Figure 10**  
**2024 Actual Annual CO<sub>2</sub> Performance Levels**  
**GE Verona 7F Combined-Cycle Combustion Turbine**



<sup>45</sup> This analysis was presented to the LPPC membership by GE Verona at a LPPC Environmental Task Force meeting in late June 2025.

**D. EPA Must Revise the Performance Standard to Remove the Substantial Regulatory and Compliance Risks Posed by Unachievable Standards.**

The importance of EPA revising this standard cannot be overstated. No emissions control technologies exist for controlling CO<sub>2</sub> emissions from combined-cycle combustion turbines. As discussed above, neither carbon capture and sequestration nor combusting large amounts of hydrogen are technically or economically feasible control options for lowering CO<sub>2</sub> emissions from combustion turbines. Given that noncompliance is not an option, the 800 CO<sub>2</sub> lbs./MWh-gross standards would either greatly increase compliance costs or pose significant challenges for ensuring electric grid reliability.

One compliance option would force electric utilities to operate their combined-cycle facilities at full loads under favorable ambient temperatures to maximize the generating efficiencies and thereby lower CO<sub>2</sub> emissions from the facility. The other option would force electric utilities to over-build their turbine generating capacity to comply with the less-stringent CO<sub>2</sub> performance standards set for intermediate-load and low-load turbines. Such a regulatory outcome is not only an inefficient regulatory solution but also an unnecessary step for minimizing CO<sub>2</sub> emissions from combustion turbines.

Both the turbine manufacturers and electric utilities already have strong economic incentives to design, build, and operate the most efficient combustion turbines with the lowest CO<sub>2</sub> emissions to reduce fuel consumption and lower overall costs of generating electricity. The turbine manufacturers compete in an extremely competitive marketplace and thus are already highly motivated to produce the combustion turbines with the highest generating efficiency. Similarly, electric utilities have strong economic incentives to purchase the most efficient turbines to reduce fuel costs, the largest component of the operating costs for combustion turbines. Very little is gained by imposing a CO<sub>2</sub> performance standard that (at best) is only achievable at ideal operating conditions and prevents the operation of the new combustion turbines at variable load levels and conditions that are needed for supplying dispatchable, firm power to the electricity grid.

**VI. REDUCED AND FLUCTUATING LOADS REQUIRE EPA TO SET HIGHER (LESS STRINGENT) PERFORMANCE STANDARDS FOR BOTH INTERMEDIATE-LOAD AND BASELOAD COMBUSTION TURBINES.**

As discussed above, reduced and fluctuating load levels have the greatest impact on both turbine efficiencies and CO<sub>2</sub> emission rates. The Agency expressly acknowledged this reality in the CPS

when it stated: “Emissions can increase dramatically at lower loads and could impact the ability of an owner/operator to comply with the . . . standard” set for intermediate-load and baseload turbine units.<sup>46</sup> This conclusion is also reiterated throughout the Technical Support Document (TSD) that provides the technical basis upon which EPA set the CO<sub>2</sub> performance standards under the CPS. Notably, the Agency states in the TSD that combustion turbines “operate more efficiently and with a lower CO<sub>2</sub> [lbs. CO<sub>2</sub>/MWh] emission rate [when operating] near their nameplate capacity. . . . Alternatively, a unit that cycles frequently could have a higher 12-operating month capacity factor but have a higher emission rate” because the unit operates at lower hourly average output levels, referred to as the unit’s “duty cycle.”<sup>47</sup>

EPA defines the “duty cycle” as “the average operating capacity factor,” whereby the capacity cycle is a function of “how much an EGU is operated relative to how much it could potentially have been operated.”<sup>48</sup> For example, if an EGU operated on average 75% of the unit’s maximum generating capacity during each hour of operation, the duty cycle would be 75% regardless of whether the unit operated at annual capacity factor of 25% or 75%.<sup>49</sup>

In setting the CO<sub>2</sub> performance standards for both the intermediate-load and baseload combustion turbines under the CPS, EPA failed to adequately account for the growing trend that the many combustion turbines must operate at much lower duty cycles (with higher CO<sub>2</sub> emissions rates) more frequently and for extended periods of time. Rather, the CO<sub>2</sub> performance standards for new combustion turbines were based on the old paradigm on how electric utilities typically ran their combustion turbines in past years. That old paradigm assumes that turbine units are operated in a binary manner, whereby electric utilities operate those units at near or full load for short periods of time (with duty cycles at or above 90%) when additional power is needed and then shut down those turbine units when that additional power is no longer needed. Furthermore, as indicated in the performance data presented above in Sections IV and V, most sizes and types of combustion turbines must operate at those higher loads with 90% duty cycles to comply with the Phase 1 performance standards. If, by contrast, they need to operate at partial

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<sup>46</sup> CPS, 89 Fed. Reg. at 39,946.

<sup>47</sup> EPA, *Simple Cycle Stationary Combustion Turbine EGUs*; Technical Support Document at 13, Docket No. EPA-HQ-OAR-2023-0072 (Apr. 2024) (Simple-Cycle TSD). *See also id.* at 17 (stating that combustion turbines operating at higher hourly load levels “are more efficient” and where the “CO<sub>2</sub> emissions rates are lower”).

<sup>48</sup> CPS, 89 Fed. Reg. at 39,912, n.726.

<sup>49</sup> EPA defines “annual capacity factor” as the ratio between actual heat input to an EGU during a calendar year and the potential heat input to the EGU had it operated for 8,720 hours during a calendar year at the base load rating. 40 C.F.R. § 60.550a.

or minimum load levels (with duty cycles below 90%), those turbines cannot achieve those Phase 1 standards.

The old paradigm, in many cases, is not how electric utilities currently operate their existing combustion turbines. As discussed above in Section III.B., combustion turbines are increasingly operated at a variety of load levels to meet fluctuating electricity demands and serve a variety of important functions for maintaining electric grid stability.<sup>50</sup> Electric utility operators do not have the options of just running their combustion turbines at maximum output levels for short periods to meet peak demands or keeping their units' annual capacity factor below 20% when they operate at duty cycles below 90%. Nor do they typically have the option to operate their combustion turbines as stable baseload units at maximum production levels for extended periods of time with annual duty cycles exceeding 90% when they can optimize efficiencies and minimize their CO<sub>2</sub> emissions rates.

Rather, combustion turbines must be frequently operated at output levels well below their maximum production levels (with optimal turbine efficiencies) to meet fluctuating energy demands and perform these other important functions for maintaining the grid. For many combustion turbines that have annual capacity factors above low-load peaking threshold of 20%, the annual duty cycles can range well below 90% levels necessary to operate at generating efficiencies for achieving the applicable Phase 1 CO<sub>2</sub> performance standards. Given, as even EPA acknowledges, CO<sub>2</sub> emissions rate for each combustion turbine is “a function of duty cycle,”<sup>51</sup> a key factor in setting the CO<sub>2</sub> performance standard will be the hourly operational levels that combustion turbine operates over the annual compliance period.

The overall decline in the maximum hourly output levels is illustrated for two combustion turbine units in Figures 11 and 12 below. Figure 11 shows that Unit 1 at Montgomery County Power Station, a 276 MW combustion turbine with 71% annual capacity factor, had operated in 2024 at below 80% of its maximum generating output for 44% of its annual operating hours. Similarly, Figure 12 shows that Unit 3 at Barney Davis Power Station, a 189.6 MW combustion turbine with a 30% annual capacity factor, had operated in 2024 at below 80% of its maximum generating output for 65% of its annual operating hours. These two figures provide concrete evidence that (contrary to EPA's assumption in the CPS) combustion turbines do not always

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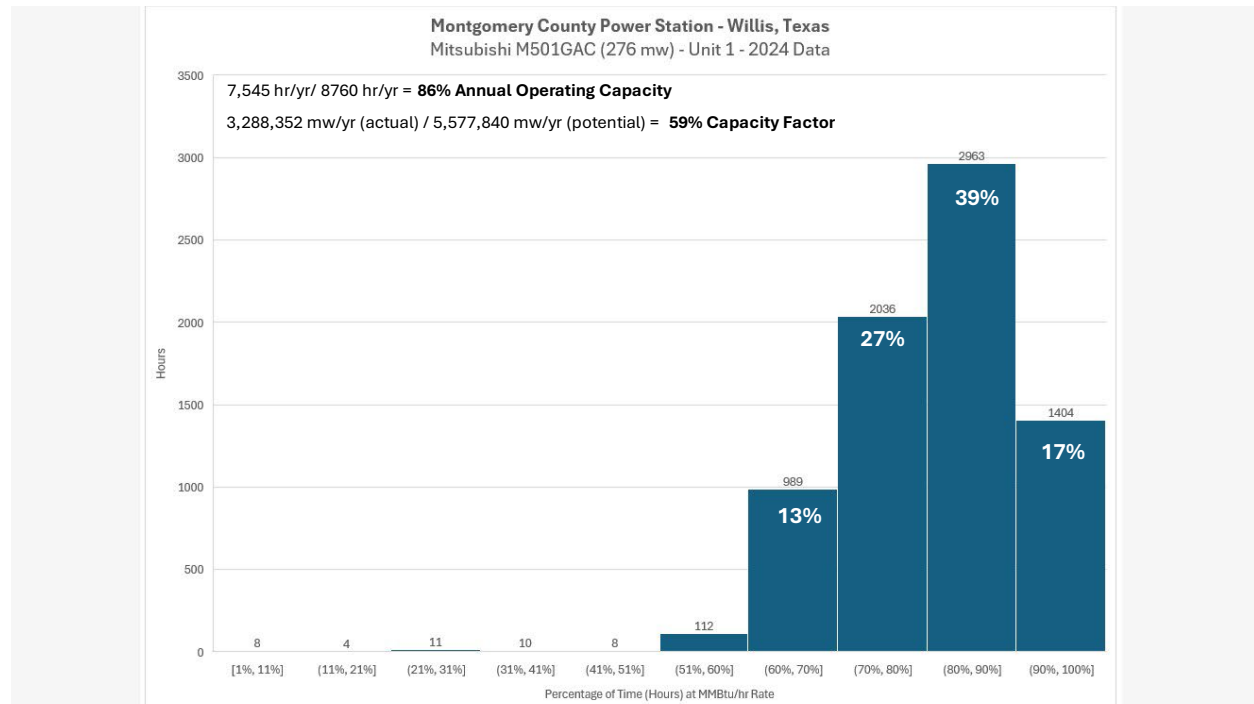
<sup>50</sup> As noted above in great detail, these functions go well beyond the function of meeting short-term peak power demands. They include firming and integrating renewable energy, maintaining grid stability, and performing various ancillary services indispensable for maintaining electric grid stability. Importantly, the turbine operating characteristics for performing these functions are frequently beyond the control of an individual electric utility.

<sup>51</sup> Simple-cycle TSD at 15.

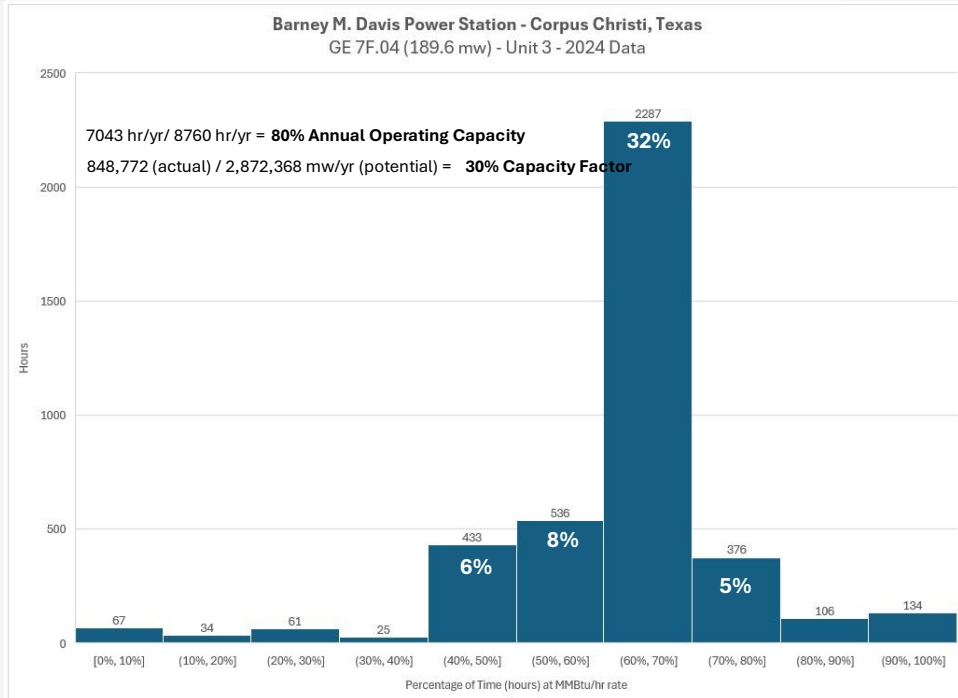
operate at the near- or full-load levels that are necessary for meeting the current Phase 1 CO<sub>2</sub> performance standards for both simple-cycle and combined-cycle units.

The decline in the hourly maximum output for both turbine units is further confirmed by an examination of their annual duty cycle levels in 2024. As noted above, the annual duty cycle for each turbine unit is determined by first calculating the percentage of the unit’s maximum generating capacity during each hour of operation in 2024 and then averaging all the hourly maximum generating capacity levels into one annual average capacity value. The 2024 duty cycles for both turbine units are well below the 90% capacity threshold. Unit 1 at Montgomery County Power Station had a 2024 annual duty cycle of 69% and Unit 3 at the Barney Davis Power Station had a 2024 annual duty cycle of 65%. These low duty cycles, which are far below the full load levels in the range of 90% duty cycle necessary for meeting the Phase 1 standards, underscore the fact that many new combustion turbines will be operated at reduced load levels for extended periods of time and, as a result, will not be able to achieve the current applicable performance standards.

**Figure 11**



**Figure 12**



This current trend on lower hourly output levels and duty cycles is further illustrated in Table 1 below, which depicts the relatively low output levels that 30 combustion turbine units operated above the 20% annual capacity factor set for low-load peaking units<sup>52</sup> (or just below 20% annual capacity factor in the case of two units) during the calendar year 2024 based on EPA’s CAMPD data.

A graphic on hourly operating levels of each combustion turbine listed in Table 1 is provided in Appendix A attached to the LPPC comments. For each listed unit, Table 1 indicates the percentage of hours in 2024 at which the combustion turbine operated below 80% of its maximum output levels on an hourly basis, the annual duty cycles, and other relevant information on the combustion turbine unit.

<sup>52</sup> The annual capacity factor is calculated as the percentage of megawatt hours (MWhs) generated by turbine unit for calendar year 2024, as compared to the total potential MWhs that the unit could generate at maximum for the year (i.e., maximum output for 8,760 hours). Since the maximum potential MWh output level was not available for each unit, the analysis has substituted the highest peak MWh output that the unit achieved during any one-hour period over the same 2024 annual period.

**Table 1  
Combustion Turbine Hourly Operating Levels  
Maximum Output Levels Below 80% for 2024**

<b>Turbine Unit</b>	<b>MW Size (Nominal)</b>	<b>Annual Capacity Factor</b>	<b>% of Hours Below 80% of Maximum Output</b>	<b>Annual Duty Cycle</b>
CPV Towantic Energy Center, Unit 2	290	73%	25%	83%
Montgomery County Power Station, Unit 1	276	71%	44%	69%
Montgomery County Power Station, Unit 2	276	70%	43%	82%
Jack McDonough Power Station, Unit 5A	283	81%	53%	83%
Jack McDonough Power Station, Unit 5B	283	80%	42%	83%
Jack McDonough Power Station, Unit 6A	265	60%	50%	80%
Jack McDonough Power Station, Unit 6B	265	61%	46%	81%
Sacramento, California Campbell Power Plant, Unit 1	261	46%	58%	75%
Basin Electric Deer Creek Station, Unit 1	240	43%	61%	71%
Salem Harbor Station, Unit 1	239	19%	46%	71%
Salem Harbor Station, Unit 2	239	18%	56%	67%
Marshalltown Generating Station, Unit 1	222	59%	22%	85%
Marshalltown Generating Station, Unit 2	222	52%	23%	84%
Harry Allen Power Plant, Unit 5	190	57%	65%	71%
Harry Allen Power Plant, Unit 6	190	57%	63%	72%
Barney Davis Power Station, Unit 3	189.6	30%	94%	64%
Barney Davis Power Station, Unit 4	189.6	26%	91%	65%
Thomas A. Smith Generating Facility, Unit 1	147	68%	63%	73%
Thomas A. Smith Generating Facility, Unit 2	147	69%	62%	73%
Thomas Smith Generating Facility, Unit 3	147	72%	47%	79%
Thomas Smith Generating Facility, Unit 4	147	72%	47%	79%
Beatrice Power Station, Unit 1	80	26%	54%	68%

<b>Turbine Unit</b>	<b>MW Size (Nominal)</b>	<b>Annual Capacity Factor</b>	<b>% of Hours Below 80% of Maximum Output</b>	<b>Annual Duty Cycle</b>
<b>Beatrice Power Station, Unit 2</b>	80	39%	56%	67%
<b>Black Hills Energy, Pueblo Airport Generating Station, Unit 1</b>	100	34%	68%	67%
<b>Black Hills Energy, Pueblo Airport Generating Station, Unit 2</b>	40	46%	79%	52%
<b>Black Hills Energy, Pueblo Airport Generating Station, Unit 4</b>	40	48%	75%	64%
<b>Mesquite Generating Station Unit 2</b>	185	68%	39%	78%
<b>Brandy Branch, Unit 1</b>	173	20%	54%	66%
<b>John S. Rainey Generating Station, Unit 2A</b>	165	49%	42%	74%
<b>John S. Rainey Generating Station, Unit 2B</b>	165	46%	45%	75%

Table 1 provides an overview of key information contained in Appendix A on 30 combustion turbines that operate at low loads more frequently and over extended time periods due to a variety of reasons (such as renewable integration, grid congestion, or other grid situations). The reduced load levels at each of these units reduces their generating efficiencies from optimal levels with duty cycles at 90% or higher, to duty cycles at much lower levels. As reflected in Table 1, those lower duty cycles are well below 90% with some units having duty cycles as low as 52%. These low load levels help to explain why most of the combustion turbine units had annual CO<sub>2</sub> emission rates exceeding the applicable CO<sub>2</sub> performance standards in analyses of the CO<sub>2</sub> emissions levels achievable for simple-cycle turbines and combined-cycle combustion turbines that were presented in Sections IV and V of these comments, respectively.

It is critically important for EPA to adjust the current CO<sub>2</sub> performance standards to enable the efficient deployment of new combustion turbines. It also is mandated by CAA section 111. As discussed above, the statute bars EPA from setting CO<sub>2</sub> emission rate limitations that many of the new combustion turbines cannot achieve because they have low duty cycles, well below 90%. The performance standard must account for the duty cycles matching the operational levels of the entire population of new combustion turbines being deployed by the power sector. As the preceding analysis shows, the Agency did not comply with this statutory requirement because it did not take into consideration the low duty cycles for combustion turbines when setting these standards.

## VII. SETTING A HIGHER (LESS-STRINGENT) PERFORMANCE STANDARD MAY LOWER OVERALL CO<sub>2</sub> EMISSIONS FROM NEW COMBUSTION TURBINES.

Increasing the CO<sub>2</sub> performance standard to a less stringent does not necessarily increase total CO<sub>2</sub> emissions on a mass basis. In fact, *overall CO<sub>2</sub> emissions may decline if reduced turbine output (which increases CO<sub>2</sub> emissions in terms of pounds per hour) is replaced by an increased production from zero-emission renewable sources.*

This outcome occurs for two reasons. First, combustion turbines operating at a reduced load consume less natural gas and thereby emit fewer CO<sub>2</sub> emissions at pounds per hour. Second (and more important) the reduced turbine generation is offset by clean, intermittent renewable energy that has zero emissions for the megawatts generated.

Tables 2-4 illustrate the effect for a 240 MW simple-cycle turbine operating at moderate ambient temperatures (59°F) on an annual basis. In the full-load scenario (Table 2), the combustion turbine operates at a 100% duty cycle, meets the 1,170 lbs. CO<sub>2</sub>/MWh-gross, and emits 1,203,462 tons. In the partial-load scenario (Table 3), renewable generation provides 25% of the total output. Turbine emissions rise to 1,260 lbs. CO<sub>2</sub>/MWh-gross—above the standard—but annual mass emissions drop to 728,133 tpy, a net CO<sub>2</sub> emission reduction of 475,329 tpy. In the minimum-load scenario (Table 4), emissions intensity reaches 1,869 lbs. CO<sub>2</sub>/MWh-gross, yet total CO<sub>2</sub> emissions from the turbine fall to 243,540 tpy—nearly 1 million tpy lower—because renewable generation supplies most of the power to the electric grid.

*An unintended consequence of the current CO<sub>2</sub> performance standard is that it can make it harder for utilities to meet rising electricity demand with a balanced portfolio. By penalizing turbines that operate at reduced and fluctuating loads to accommodate renewables, the rule discourages the flexible, lower-mass-emission operation needed to integrate intermittent resources while ensuring reliability.*

**QUANTIFICATION OF CO<sub>2</sub> EMISSIONS  
LOAD SHIFTING FROM COMBUSTION TURBINE TO RENEWABLE ENERGY**

**Table 2  
Full Load Scenario**

	Hourly Output (MWh)	Annual Duty Cycle	CO <sub>2</sub> Rate (lbs. CO <sub>2</sub> /MWh)	Mass CO <sub>2</sub> Emissions	
				lbs./hour	tpy
<b>Combustion Turbine</b>	236.77	100%	1,160	274,763	1,203,462
<b>Renewable (Solar or wind)</b>	0	--	0	0	0
<b>Total Combined</b>	236.77			274.763	1,203,462

**Table 3  
Partial Load Scenario**

	Hourly Output (MWh)	Annual Duty Cycle	CO <sub>2</sub> Rate (lbs. CO <sub>2</sub> /MWh)	Mass CO <sub>2</sub> Emissions	
				lbs./hour	tons per year
<b>Combustion Turbine</b>	175.9	75%	1,260	175.9	728,133
<b>Renewable (Solar or wind)</b>	60.87	--	0	0	0
<b>Total Combined</b>	236.77			175.9	728,133

**Table 4  
Minimum Load Scenario**

	Hourly Output (MWh)	Annual Duty Cycle	CO <sub>2</sub> Rate (lbs. CO <sub>2</sub> /MWh)	Mass CO <sub>2</sub> Emissions	
				lbs./hour	tons per year
<b>Combustion Turbine</b>	85	35%	1,869	158,839	243,540
<b>Renewable (Solar or wind)</b>	151.77	--	0	0	0
<b>Total Combined</b>	237.77			158,839	243,540

**VIII. THE FINAL RULE SHOULD ADDRESS KEY IMPLEMENTATION PROBLEMS POSED BY THE CURRENT CO<sub>2</sub> PERFORMANCE STANDARDS FOR NEW COMBUSTION TURBINES.**

In addition to revising the CO<sub>2</sub> performance standards for new intermediate-load and baseload combustion turbines, two major regulatory challenges could still potentially impede the prompt deployment of new combustion turbines.

One regulatory challenge relates to setting CO<sub>2</sub> emissions limitations based on “best available control technology” (BACT) under the New Source Review (NSR) program. This challenge stems from the CAA provision that expressly requires permitting authorities to set CO<sub>2</sub> BACT limitations no less stringent than the applicable CO<sub>2</sub> NSPS limitations through the NSR permitting process. This CAA provision effectively requires these unachievable Phase 1 standards to set the minimum CO<sub>2</sub> BACT control levels (or “floor”) so long as the current NSPS limitations remain on the books.

The second regulatory challenge pertains to determining whether the current Phase 1 standards apply to new combustion turbine projects. Those regulations can be interpreted to require that those standards should apply to those projects for which binding contracts already have been executed for the purchase and fabrication of new combustion turbines. Given that many electric utilities are currently entering into such binding contracts for the purchase of combustion turbines to meet projected major increases in electricity demand, those utilities may potentially remain subject to the unachievable Phase 1 standards even if EPA lowers the stringency of those standards pursuant to this or another EPA rulemaking.

The discussion below begins by providing a detailed analysis of these two implementation problems that could impede the deployment of new combustion turbine generation while the Phase 1 performance standards remain in effect. This analysis is then followed by a review of suggested options to address the potential regulatory challenges through the issuance of national guidance.

**A. EPA Should Issue National Guidance on Permissible Options for Setting the CO<sub>2</sub> BACT for New Combustion Turbines.**

One key requirement imposed under the NSR permitting program is that all new combustion turbine facilities must meet stringent BACT emission limitations for all NSR-regulated air pollutants. Permitting authorities must set those BACT limitations on a case-by-case basis for each new combustion turbine and, in so doing, may not set the BACT limitations that are less stringent than the applicable NSPS limitations for the affected facility. In the case of CO<sub>2</sub> emissions, those minimum BACT limitations are the current CO<sub>2</sub> performance standards that EPA established for new combustion turbines in the 2024 CPS so long as they remain in effect.

Many electric utilities are under great pressure to build and bring online new combustion turbines as soon as possible to meet increased demand for electricity. These pressing needs for additional dispatchable generation are requiring electric utilities to obtain as soon as possible NSR permits authorizing the construction of new combustion turbines; they cannot wait until after EPA completes this rulemaking to initiate the process for obtaining their NSR permits.

In effect, timing is the problem. So long as the 2024 CPS performance standards remain in effect, the CAA expressly requires that the CO<sub>2</sub> BACT limitations for new baseload turbines in 2032 not be less stringent than 90% capture through CCS. Similarly, the CO<sub>2</sub> BACT limitations upon immediate startup of the new combustion turbines must not be less stringent than the currently unachievable Phase 1 CO<sub>2</sub> performance standards. Those Phase 1 standards are 800 lbs. CO<sub>2</sub>/MWh-gross for baseload turbines and 1,170 lbs. CO<sub>2</sub>/MWh-gross for intermediate-load turbines. As discussed above, EPA set those limitations based on highly efficient combustion turbines operated under optimal full-load conditions that are practically unrealistic for most, if not all, new combustion turbines to meet over an annual operating period.

Solutions to the CO<sub>2</sub> BACT Permitting Problem. Two options exist for EPA to address the CO<sub>2</sub> BACT problem and thereby remove a major potential regulatory barrier to the permitting of new baseload and intermediate-load combustion turbines. As discussed below, both options entail EPA issuing national guidance that clarifies how permitting authorities may set alternative CO<sub>2</sub>

BACT limitations that would apply in the interim period before EPA revises the current, unachievable CO<sub>2</sub> performance standards set under the CPS.

*Multiple Provisional BACT Limitations.* The overall objective of this first approach would be to allow the establishment of one CO<sub>2</sub> BACT limitation based on the traditional “top-down” BACT analysis used for evaluating the technical and economic feasibility of all available CO<sub>2</sub> control technologies and measures. In effect, this BACT limitation cannot set a CO<sub>2</sub> emission limitation that is less stringent than the current Subpart TTTTa performance standards established under the CPS. To assure compliance with the CAA requirement that the BACT requirement is not less stringent than the applicable NSPS limitations, the NSR permit also would contain a provision requiring that the NSR CO<sub>2</sub> limitation shall not exceed one of following potentially applicable NSPS limitations for new combustion turbines—

- The 2024 Subpart TTTTa limitations, which establishes CO<sub>2</sub> performance standards and currently applies to new combustion turbines,
- The prior 2015 Subpart TTTT limitations, which applied to new combustion turbines prior to the adoption of the more stringent 2024 performance standards and could apply again if EPA were to repeal the 2024 NSPS limitations and revert to the prior 2015 NSPS limitations, or
- Any new CO<sub>2</sub> NSPS limitations that EPA may adopt pursuant to this rulemaking.

In support of this approach, EPA could refer to its 1979 guidance that allowed for the establishment of multiple provisional BACT limitations for sulfur dioxide (SO<sub>2</sub>) due to a similar uncertainty on the numeric limit of a future SO<sub>2</sub> NSPS that would apply in the future.<sup>53</sup> This approach would effectively set only one BACT analysis with a cross-reference to the two potentially applicable NSPS limitations.

*Setting Multiple BACT Limitations for Different Alternative Operating Scenarios.* Under this alternative approach, EPA would issue national guidance confirming that the existing NSR regulations allow permitting authorities to set two CO<sub>2</sub> BACT limitations for new combustion turbine facilities under the two alternative operating scenarios (AOS). The use of AOS permit conditions is a well-established process that EPA has incorporated into the Title V operating

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<sup>53</sup> See Memorandum from W.C. Barber, Director, EPA Office of Air Quality Planning and Standards, “BACT Determinations for Power Plants Subject to Revised NSPS” (Jan. 10, 1979).

permit program for providing operating flexibility in implementing the applicable regulatory requirements.<sup>54</sup> A description of this AOS BACT approach is briefly outlined below.

One BACT limitation under the permit's first AOS would apply to the planned, new combined-cycle combustion turbine or simple-cycle turbine operating as a baseload unit above a 40% annual capacity factor under the following limited operating scenario—namely, the condition that EPA revises or repeals the current CO<sub>2</sub> performance standards. Under this AOS permit provision, the CO<sub>2</sub> BACT limitation would be set based on reasonably achievable efficiency control measures that are economically and technically feasible, instead of the unachievable CCS limitation based on 90% CO<sub>2</sub> capture by 2032. In addition, it would avoid imposing the extremely stringent 800 lbs. CO<sub>2</sub>/MWh-gross limit immediately upon startup of the new baseload combined-cycle unit. The CO<sub>2</sub> BACT limitation set in the permit would be based on reasonably achievable efficiency control levels.

The alternative BACT limitation under the permit's second AOS condition would set the CO<sub>2</sub> BACT limitation based on the current CO<sub>2</sub> Phase 1 performance standards so long as the NSPS Subpart TTTT<sub>a</sub> regulations remain in effect. In this case, this second BACT limitation would be based on the CO<sub>2</sub> control levels that would apply to combustion turbines at intermediate-load levels (between 20 and 40% annual capacity factors) given the fact that the current CO<sub>2</sub> NSPS regulations remain in place without change. Under this operating scenario, the CO<sub>2</sub> BACT limitation would set emission control levels that the current CO<sub>2</sub> NSPS regulations have established for intermediate-load combustion turbine facilities set at 1170 lbs. CO<sub>2</sub>/MWh-gross based on highly efficient simple-cycle generation technology under the current NSPS regulations. If EPA ultimately repeals the current CO<sub>2</sub> NSPS, the new combustion turbine would no longer be regulated under this AOS permit condition but instead be subject to the CO<sub>2</sub> BACT limitation established for a baseload unit under the first AOS permit condition. As described above, the first AOS permit condition would allow the new combustion turbine to operate as a

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<sup>54</sup> The EPA regulations under the Title V program define an AOS as a scenario authorized in a permit that involves a change at a source for a particular emissions unit, resulting in (1) the unit being subject to different applicable requirements, or (2) rendering inapplicable one or more requirements previously applicable to the unit. The primary purpose of an AOS is to provide operational flexibility while ensuring compliance with air quality regulations. To establish an AOS, the designated AOS must be written into the facility's permit and approved by regulators before operations begin. Those AOS permit conditions must clearly specify which compliance options a source may utilize under an AOS.

baseload unit without having to comply with the excessively stringent CCS and efficiency limitations imposed by the current CO<sub>2</sub> NSPS.

To summarize, this proposed permitting approach would require the state permitting authority to establish two CO<sub>2</sub> BACT limitations under NSR permits. Each BACT limitation would apply to the new combined-cycle combustion turbine only under specific conditions set forth in the AOS permit conditions outlined above. In so doing, it would insulate the NSR permit from legal challenges because the CO<sub>2</sub> BACT limitation under the first AOS permit condition would authorize the combined-cycle unit to operate at baseload levels not less stringent than the 2015 Subpart TTTT CO<sub>2</sub> performance standards only if EPA were to repeal the current CO<sub>2</sub> NSPS regulations. By contrast, the second AOS permit condition would ensure compliance with the current CO<sub>2</sub> NSPS while that rule remains in effect. It would do so by authorizing the new combined-cycle turbine unit to operate at intermediate levels (between 20 and 40% annual capacity factors) not less stringent than the 2024 Subpart TTTTa standards so long as those current CO<sub>2</sub> NSPS regulations continue to apply to the units.

**B. EPA Should Issue Durable National Guidance Clarifying That the Phase 1 Standards Do Not Apply to All New Combustion Turbine Projects.**

The second regulatory challenge is an implementation problem that results from current NSPS regulations for determining the applicability of newly adopted NSPS limitations. Those regulations could be interpreted to require that the current 2024 performance standards should apply to those turbine projects even if EPA lowers the stringency of those performance standards to achievable control levels pursuant to this rulemaking. If EPA lowers the standards, these facilities continue to be subject to a limitation that is unachievable.

*Current Rules for Determining NSPS Applicability.* The current EPA regulations generally require that the newly adopted CO<sub>2</sub> performance standards (with the CO<sub>2</sub> limitations) would only apply to those affected combustion turbine projects that “commenced construction” after the issuance of the proposed performance standards. Under those EPA regulations, the term “commence construction” is not limited to onsite construction but also includes those projects where the owner or operator of new affected source executes binding contracts with substantial liquidated damages for cancellation. This means that all new combustion turbines that commenced construction on or prior to the date of the proposed CPS rule (May 23, 2025) will be subject to the current, more stringent, NSPS Subpart TTTTa limitations that impose the CCS and the overly stringent efficiency standards noted above. Given that many electric utilities have already executed binding contracts with liquidated damages for the fabrication and purchase of new combustion turbines, these utilities may be subject to those stringent Subpart TTTTa

standards and thereby not get the benefit of the relief provided by new upcoming CO<sub>2</sub> performance standards.

*Proposed Solution.* EPA must take measures to ensure that the current, unachievable CO<sub>2</sub> NSPS limitations do not apply to those turbine projects for which binding contracts have been executed for the purchase and fabrication of new combustion turbines. The solution to this problem will most likely require either rulemaking action or Agency guidance clarifying how the NSPS applicability rules will apply to new combustion turbines for which electric utilities have executed binding turbine contracts prior to EPA's issuance of the revised CO<sub>2</sub> performance standards for new combustion turbines. LPPC looks forward to working with EPA in the development of such workable guidance that removes the potential impediment to the permitting and deployment of new combustion turbines.

## **IX. CONCLUSION**

LPPC appreciates the opportunity to submit the preceding comments on the achievability of the current CO<sub>2</sub> performance standards that EPA established for new combustion turbines under the CPS. These comments have focused on technical shortfalls that require EPA to replace the performance standards with new standards that are achievable by all combustion turbines nationwide under the reduced and fluctuating load levels as well as other real-world operating conditions typically recurring for new combustion turbines.

In addition, the LPPC comments have sought to address several related technical regulatory matters that are intended to assist in ensuring the workability and effective implementation of those standards. It is critically important to address these concerns to improve the CAA regulatory framework for controlling CO<sub>2</sub> emissions from the EGU source category under section 111 of the CAA. Furthermore, addressing these technical concerns is necessary for removing potential regulatory constraints that may hamper LPPC members' efforts to achieve their clean energy goals in an efficient manner.

LPPC members are supportive of the transformation of the electric grid to cleaner sources of energy. They are proactively doing so in a manner that reflects varying resource mixes across diverse regions of the country as well as differing energy policy priorities and goals in those diverse regions. The overarching objective of these comments is to support the achievement of these efforts.



Should you have any questions about these comments, please do not hesitate to contact me at (970) 266-7906 or [woodC@prpa.org](mailto:woodC@prpa.org).

Respectfully Submitted,

A handwritten signature in black ink that reads 'Chris Wood'.

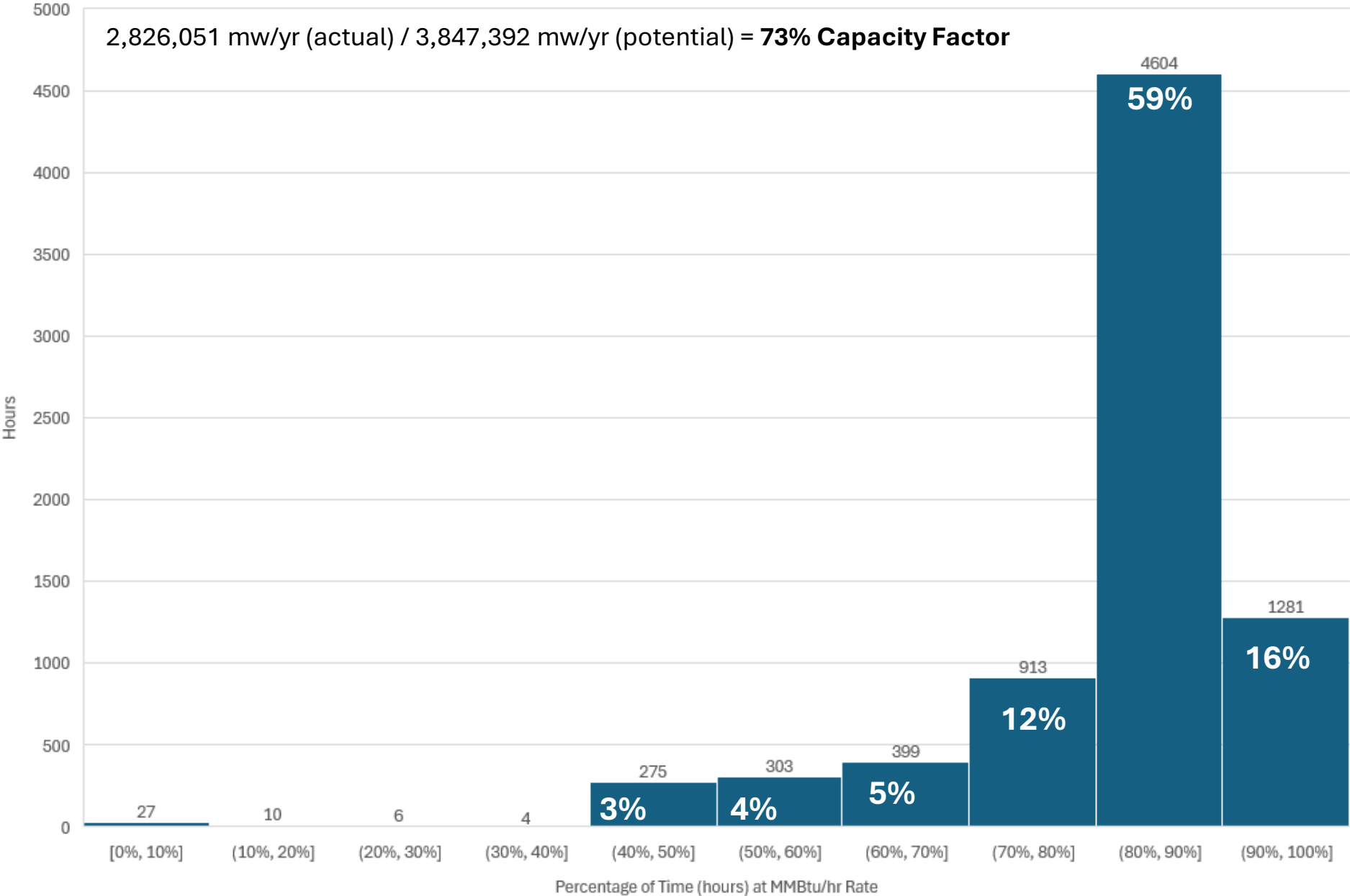
Christopher Wood  
Senior Manager, Environmental Compliance  
Platte River Power Authority  
Chair, LPPC Environmental Task Force

## **APPENDIX A**

### **Combustion Turbine Hourly Operating Levels**

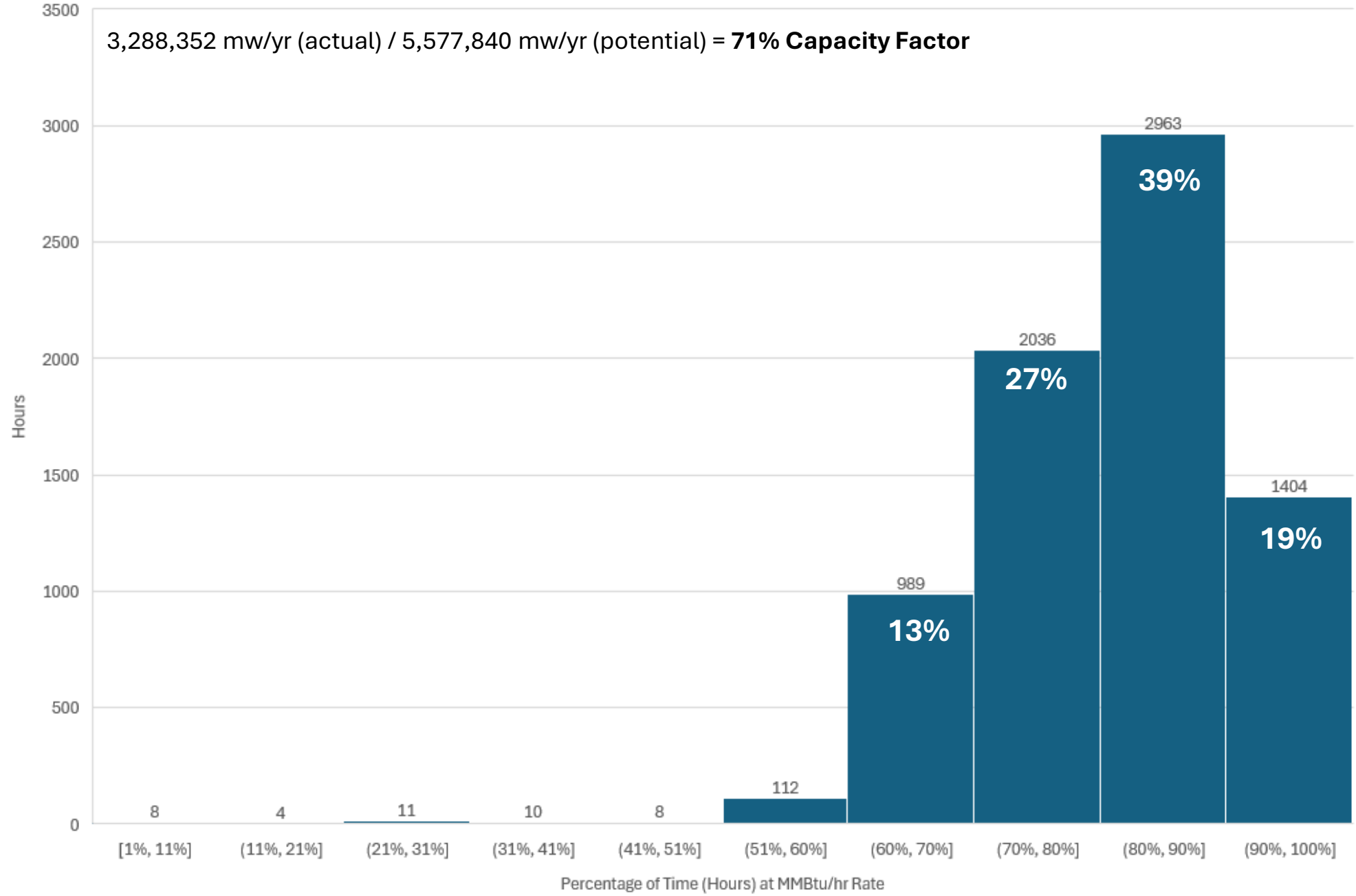
# CPV Towantic Energy Center - Oxford, CT

GE 7HA.01 (290 mw) - Unit 2 - 2024 Data

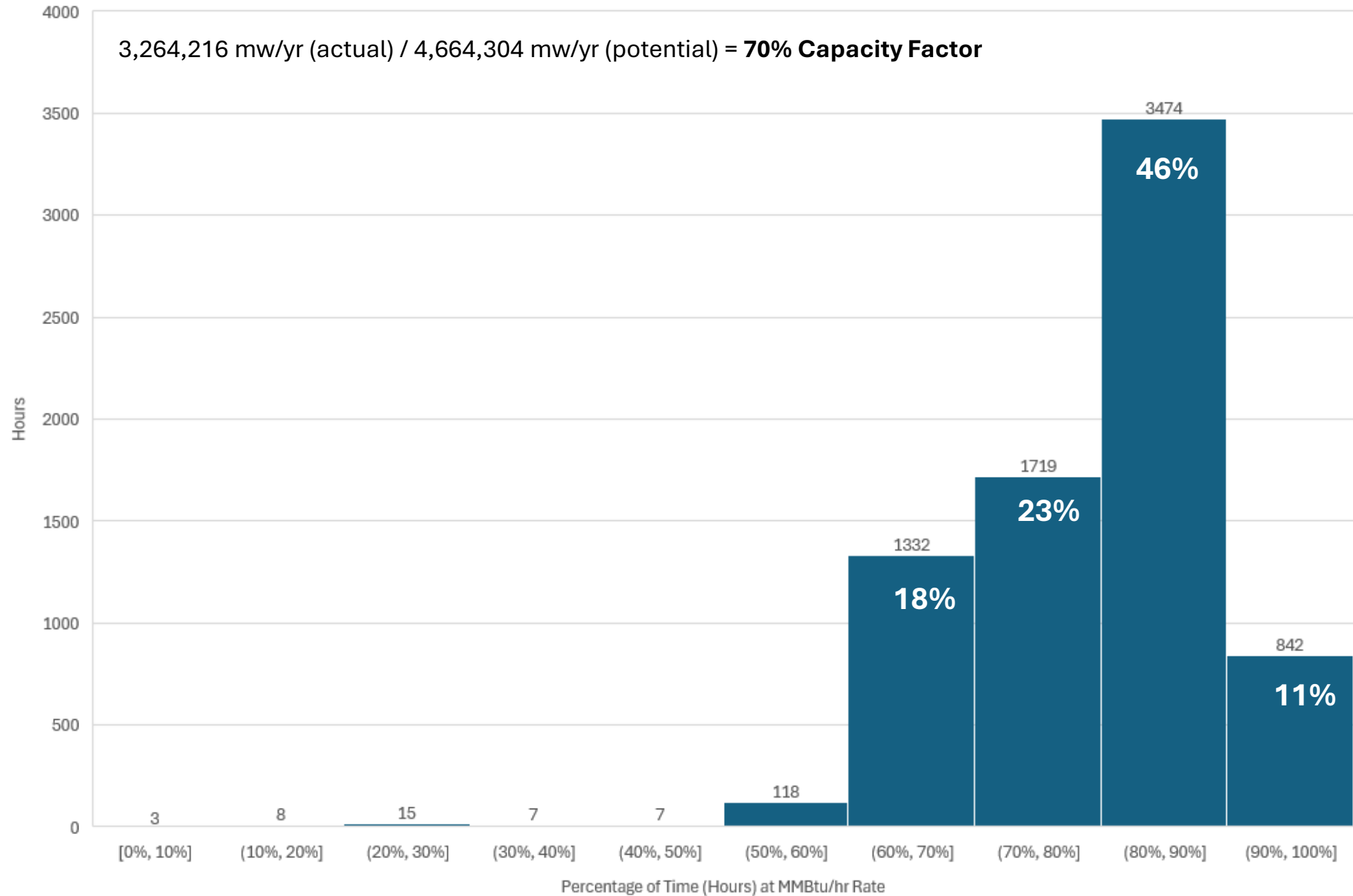


# Montgomery County Power Station - Willis, Texas

## Mitsubishi M501GAC (276 mw) - Unit 1 - 2024 Data

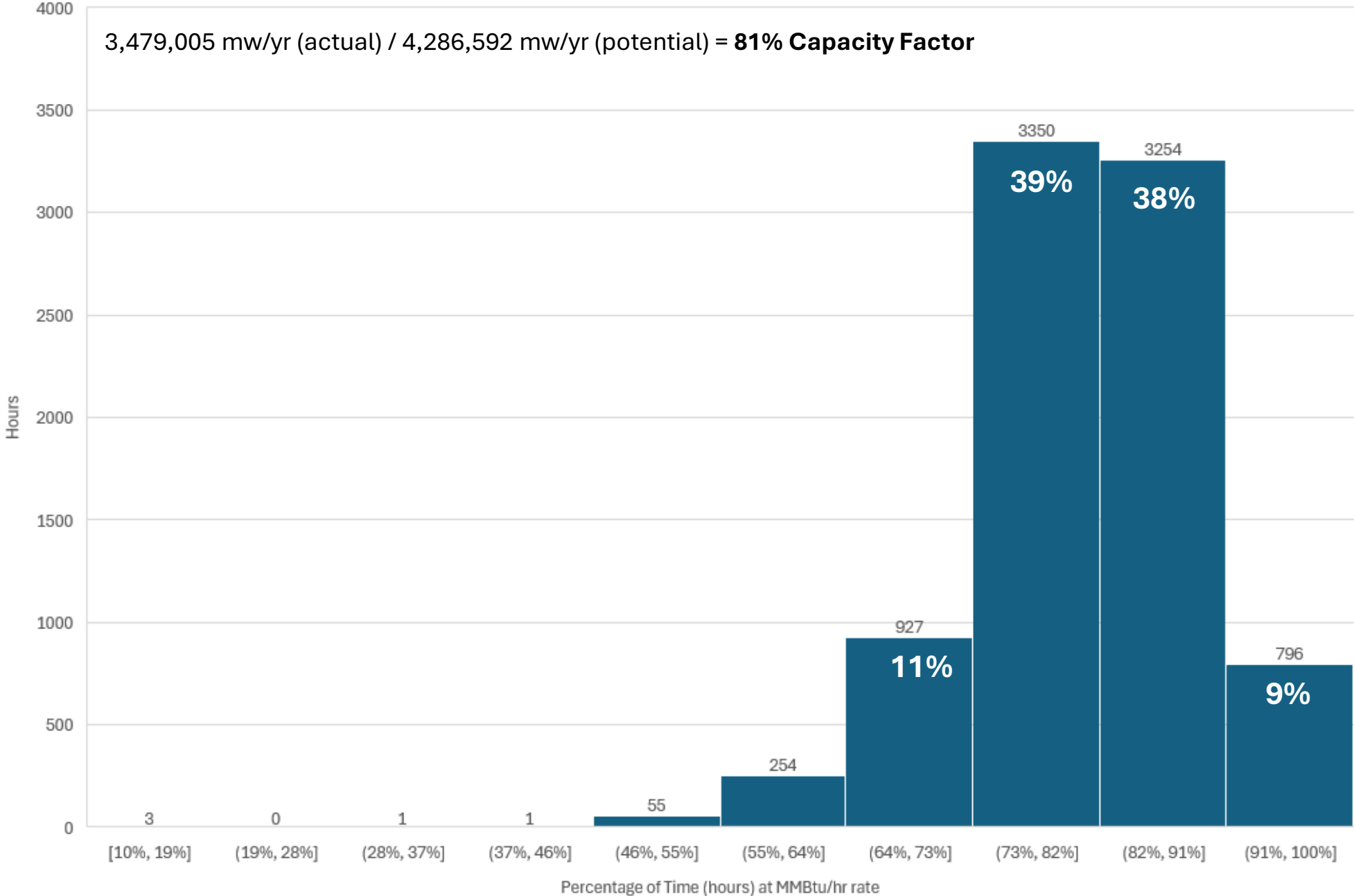


Montgomery County Power Station - Willis, Texas  
Mitsubishi M501GAC (276 mw) - Unit 2 - 2024 Data

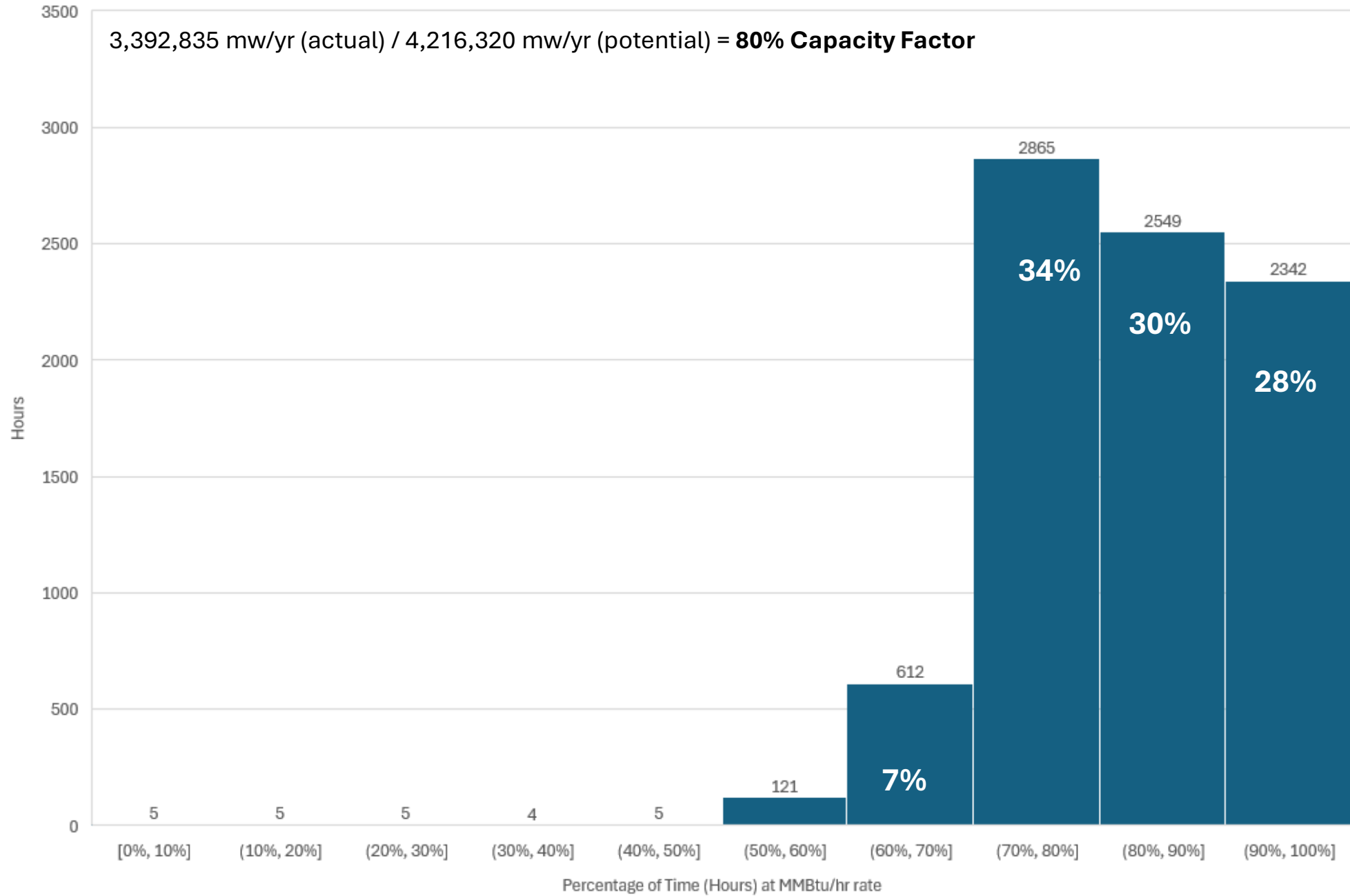


**Jack McDonough Power Station - Smyrna, Georgia**  
Mitsubishi M501GAC (283 MW) - Unit 5A - 2024 Data

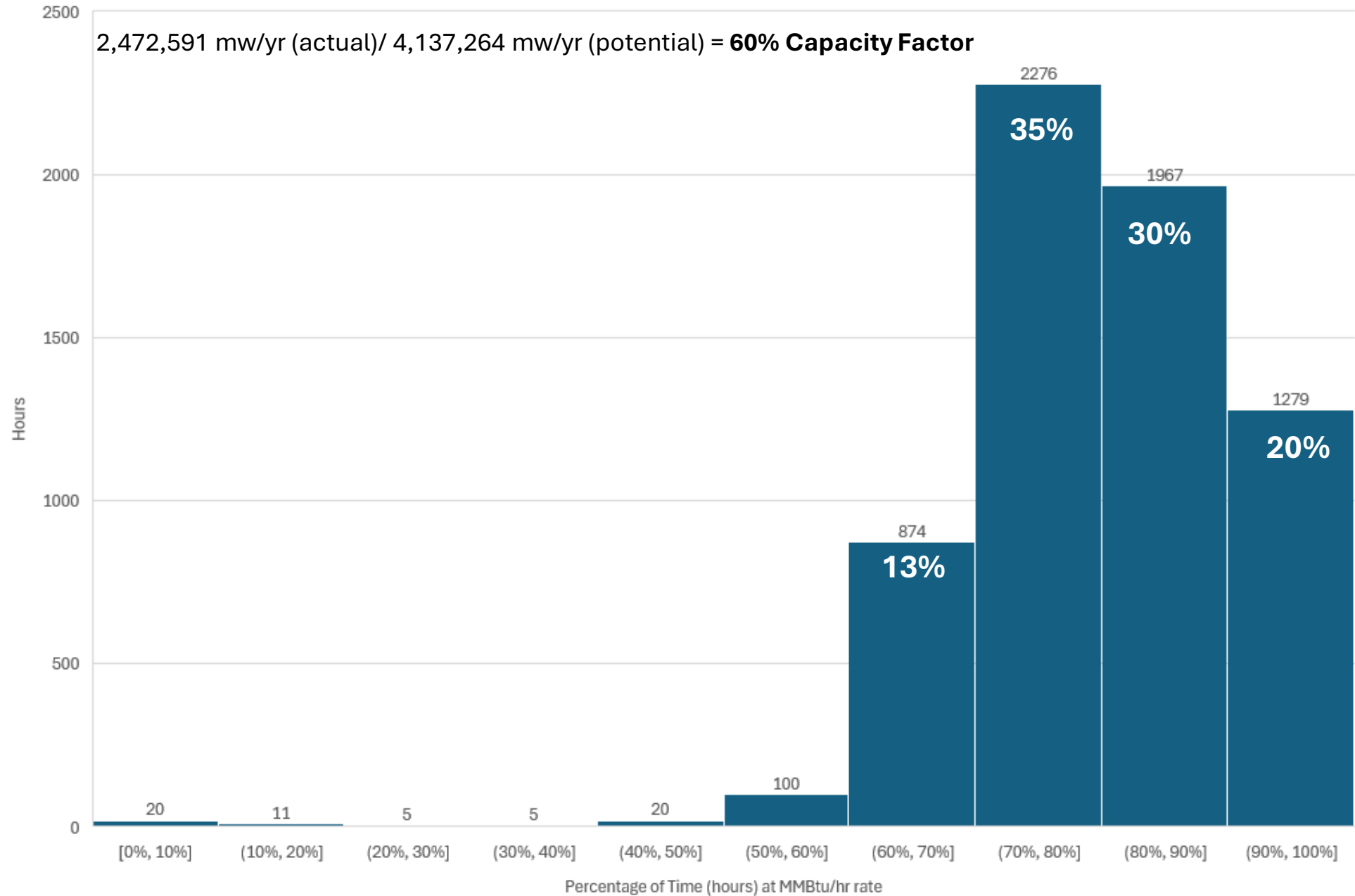
3,479,005 mw/yr (actual) / 4,286,592 mw/yr (potential) = **81% Capacity Factor**



3,392,835 mw/yr (actual) / 4,216,320 mw/yr (potential) = **80% Capacity Factor**

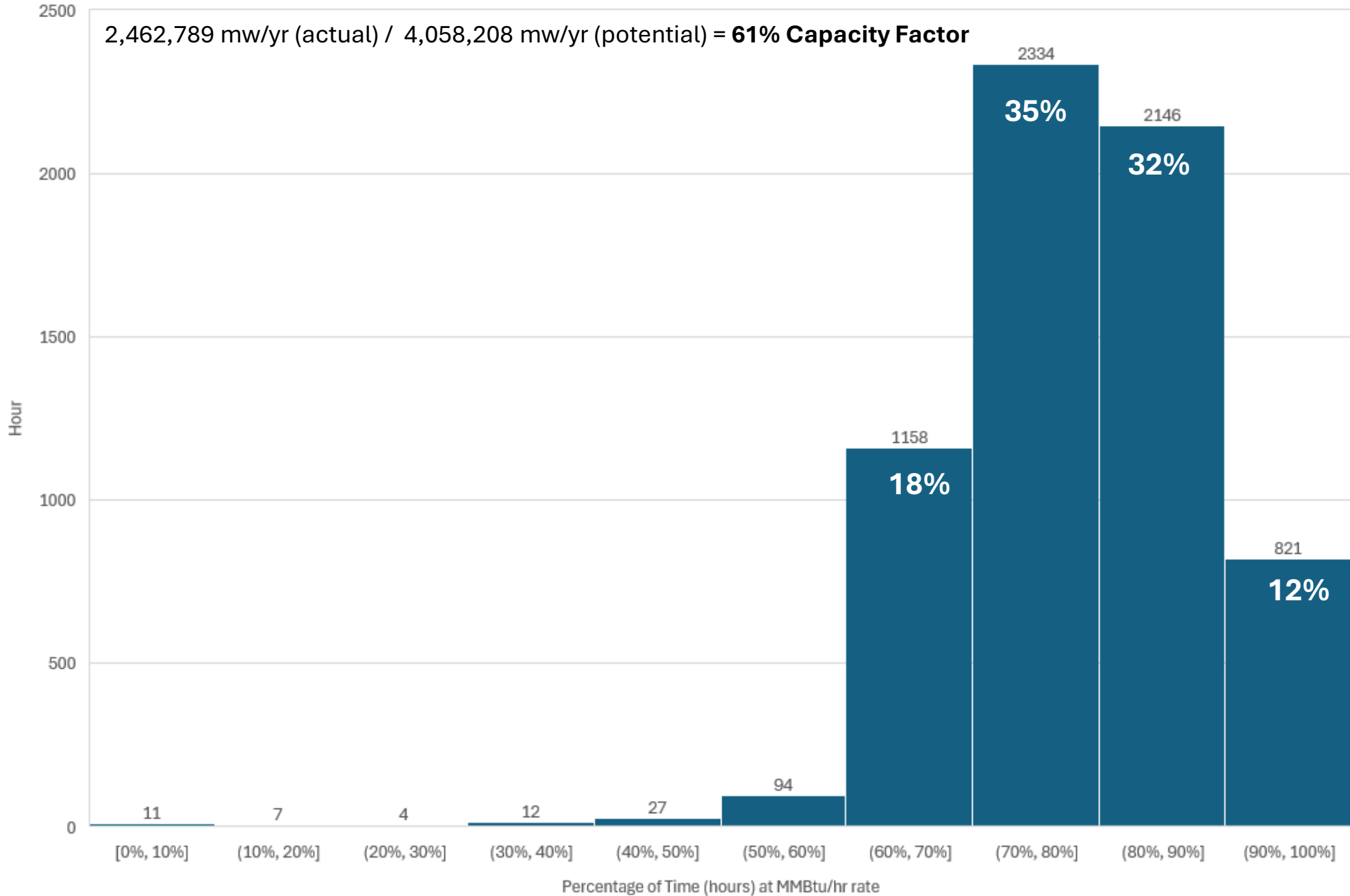


Jack McDonough Power Station - Smyrna, Georgia  
Mitsubishi M501GAC (265 mw) - Unit 6A - 2024 Data



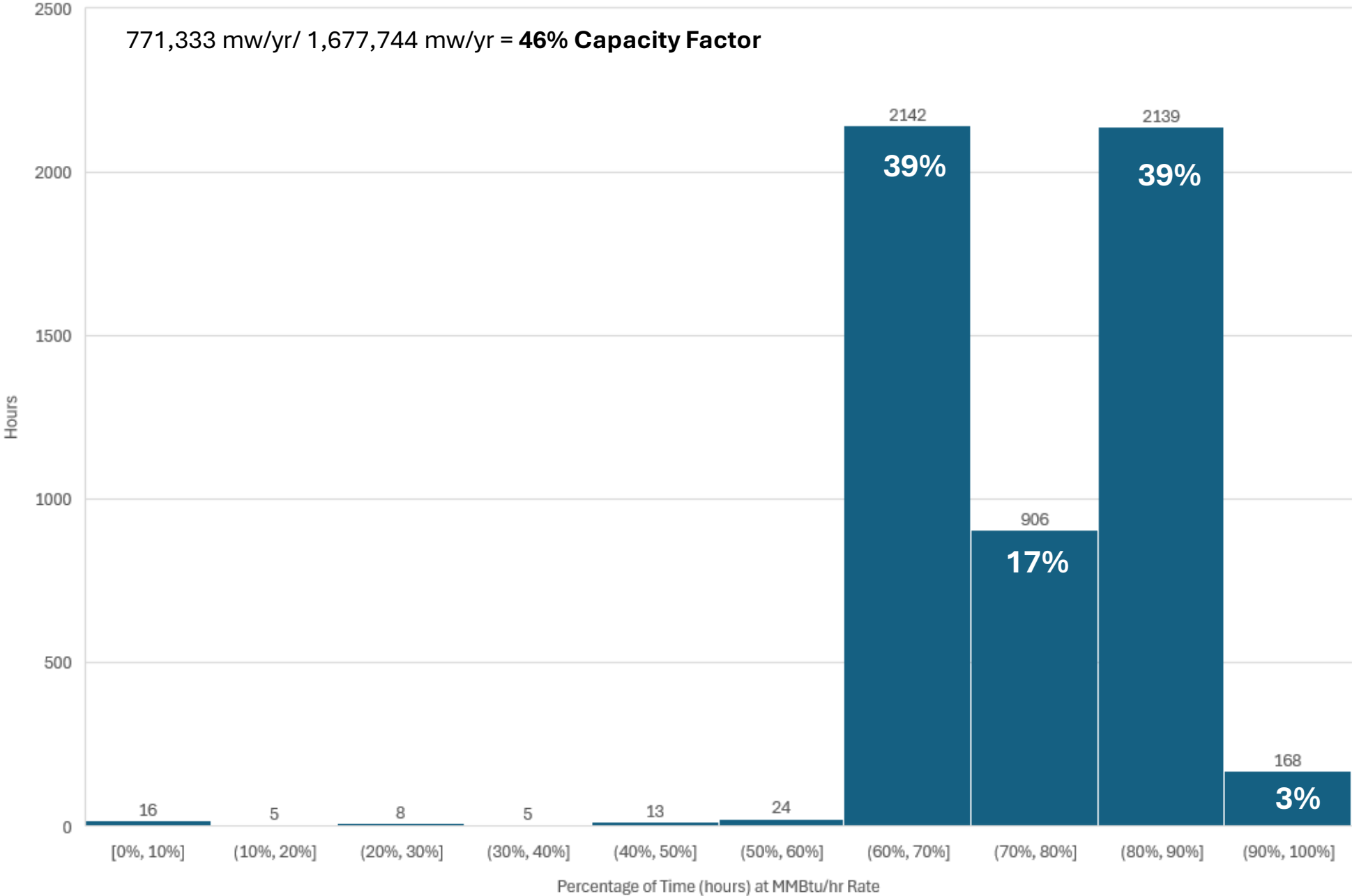
# Jack McDonough Power Station - Smyrna, Georgia

## Mitsubishi M501GAC (265 mw) - Unit 6B - 2024 Data



# Campbell Power Plant - Sacramento, California

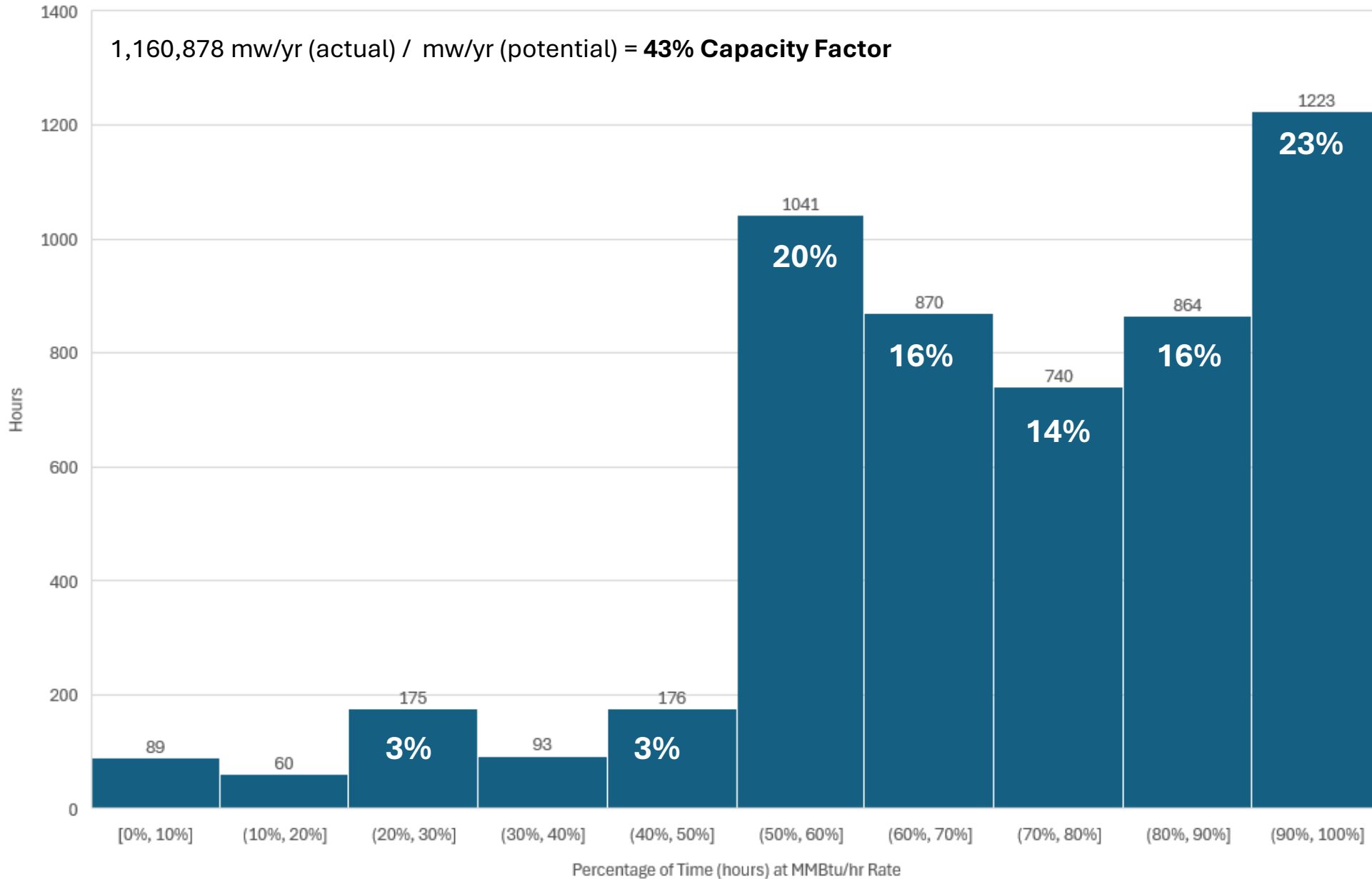
(261 mw) - Unit 1 - 2024 data



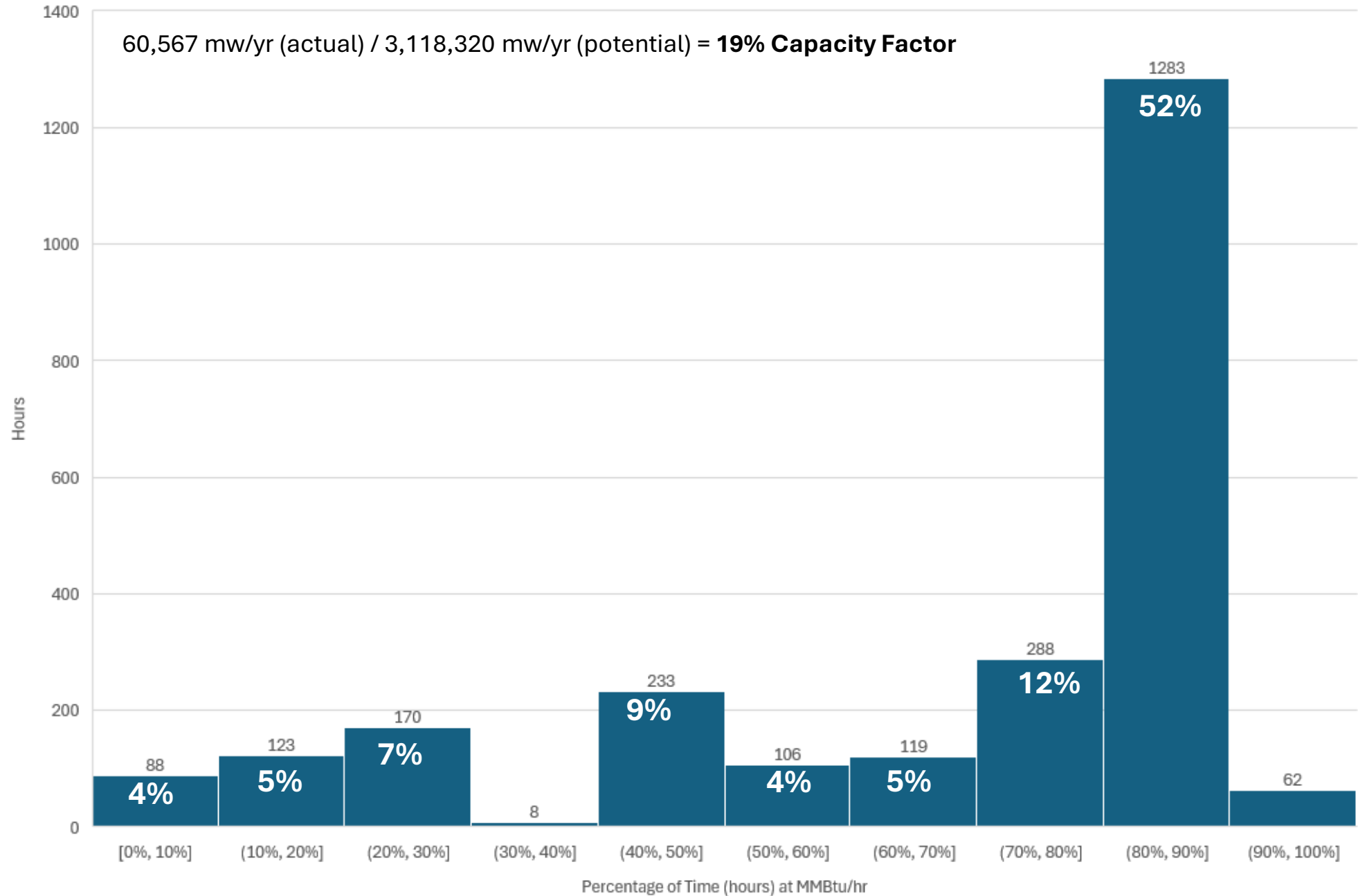
# Basin Electric Deer Creek Station - White, South Dakota

GE 7FA (240 MW) - Unit 1 - 2024 data

1,160,878 mw/yr (actual) / mw/yr (potential) = **43% Capacity Factor**

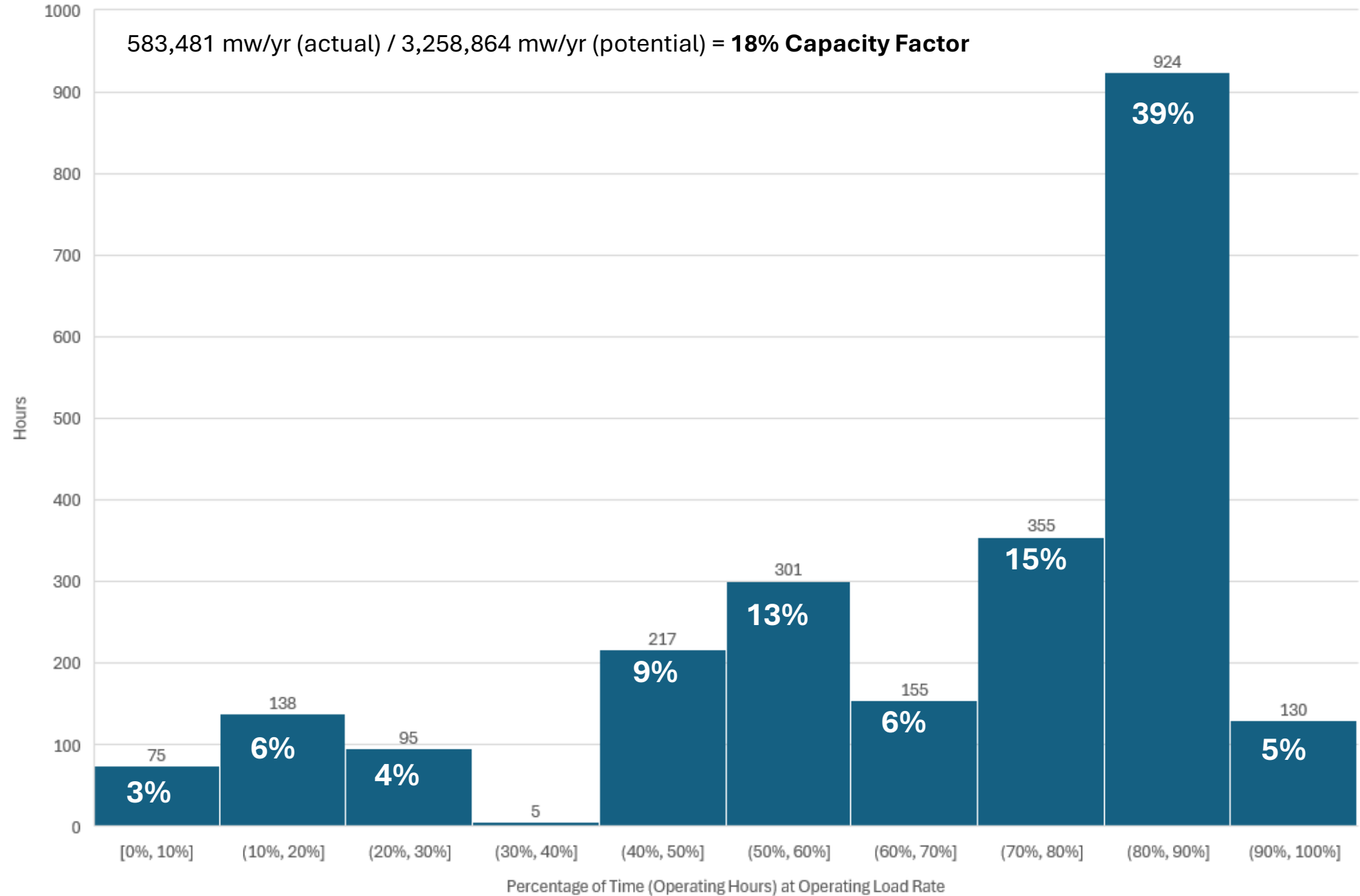


Salem Harbor - Salem, MA  
GE 7F.05 (239 MW) - Unit 1 - 2024 data



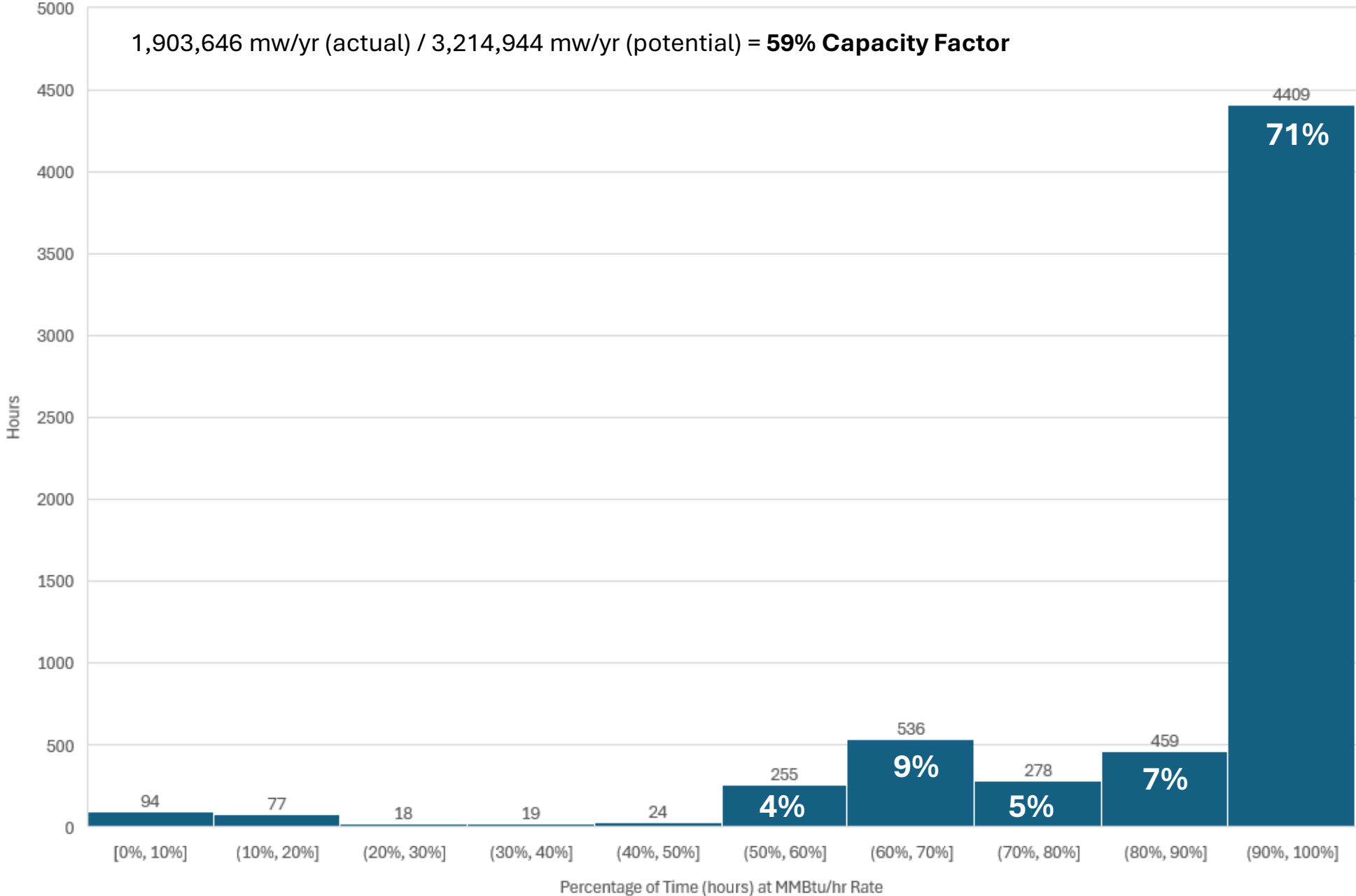
# Salem Harbor Power Station - Salem, MA

GE 7F.05 (239 mw) - Unit 2 - 2024

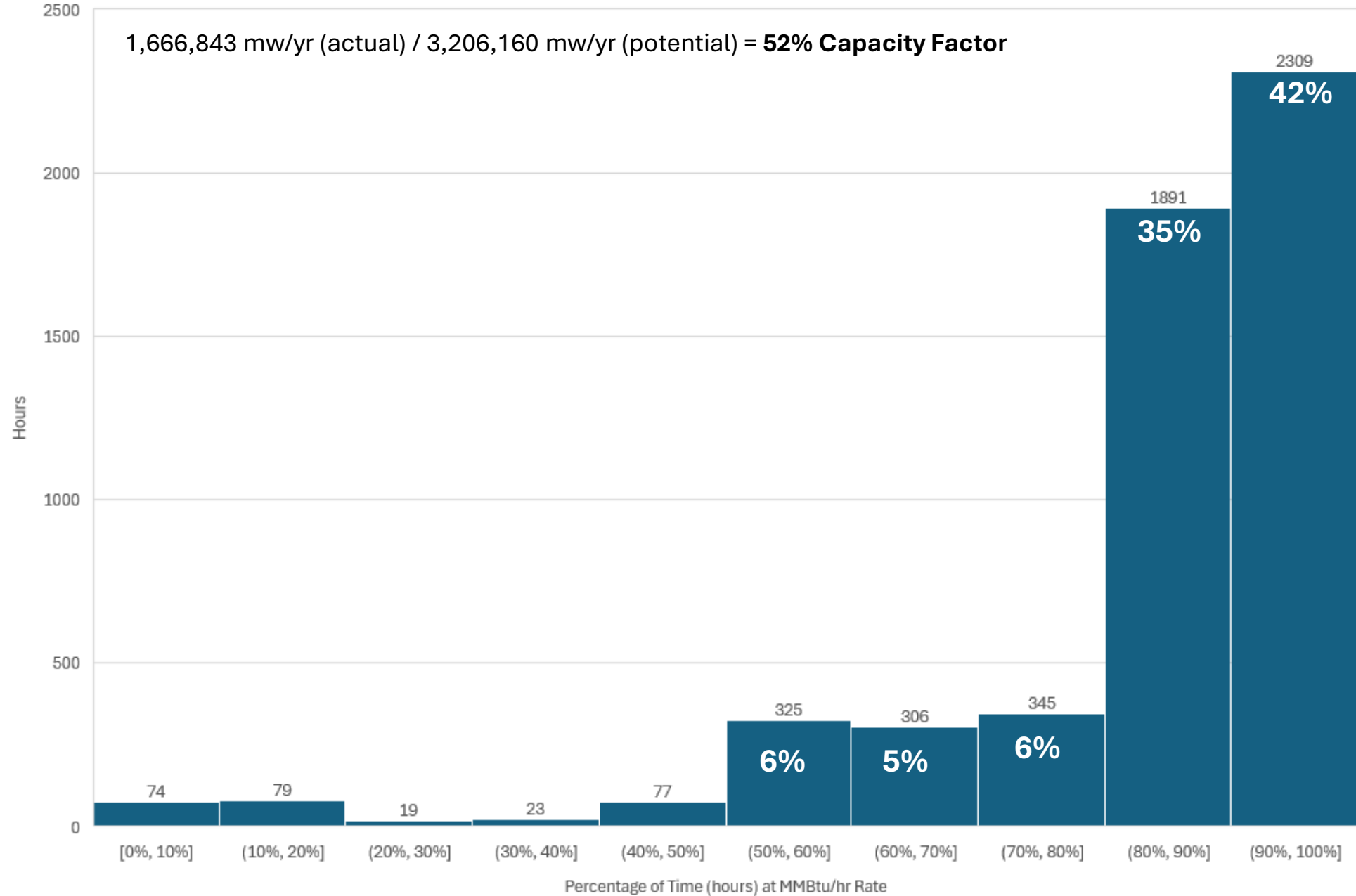


# Marshalltown Generating Station - Marshalltown, Iowa

Siemens SGT6-5000F5 (222 mw) - Unit 1 - 2024

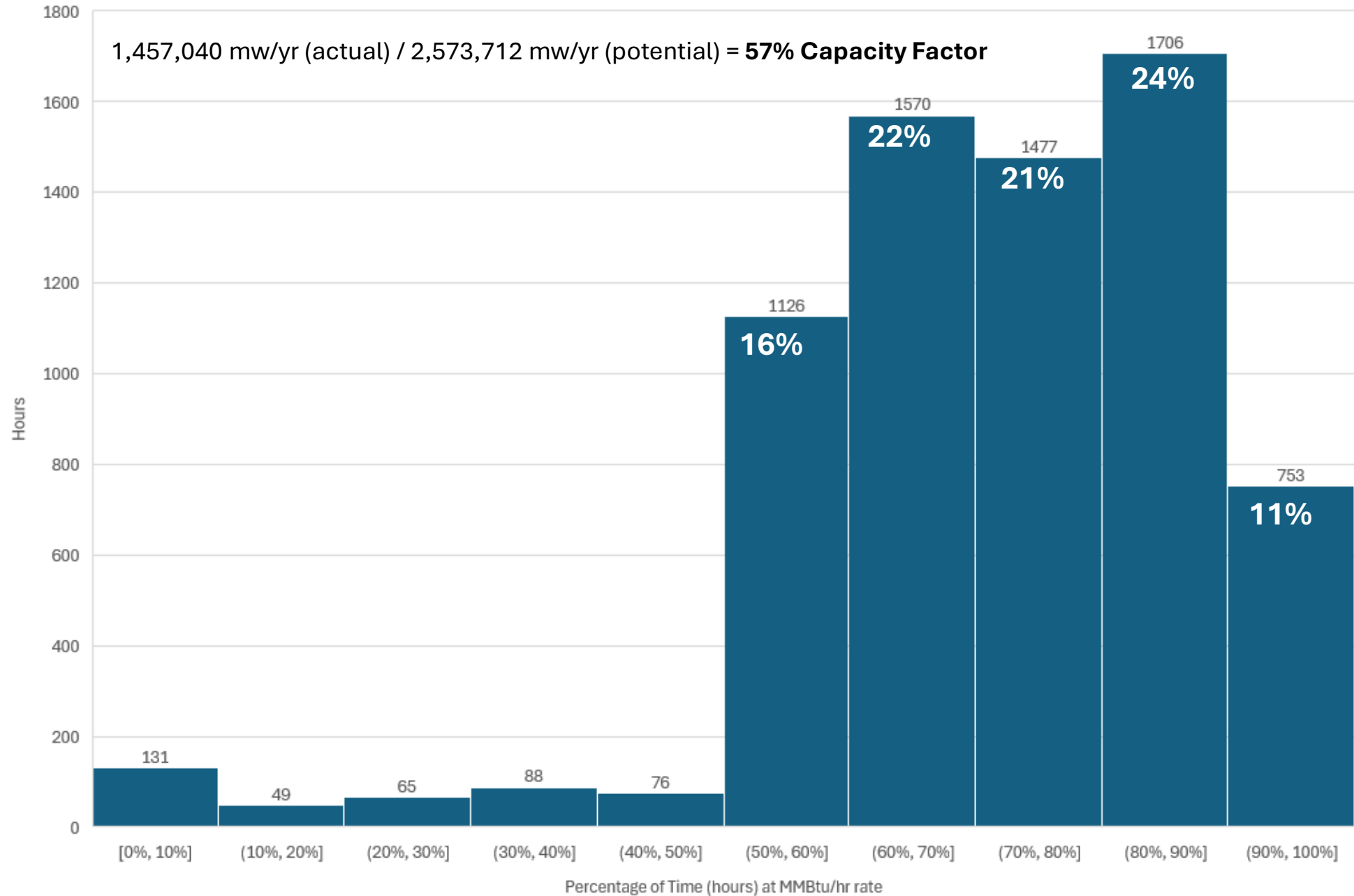


Marshalltown Generating Station - Marshalltown, Iowa  
Siemens SGT6-5000F5 (222 mw) - Unit 2 - 2024



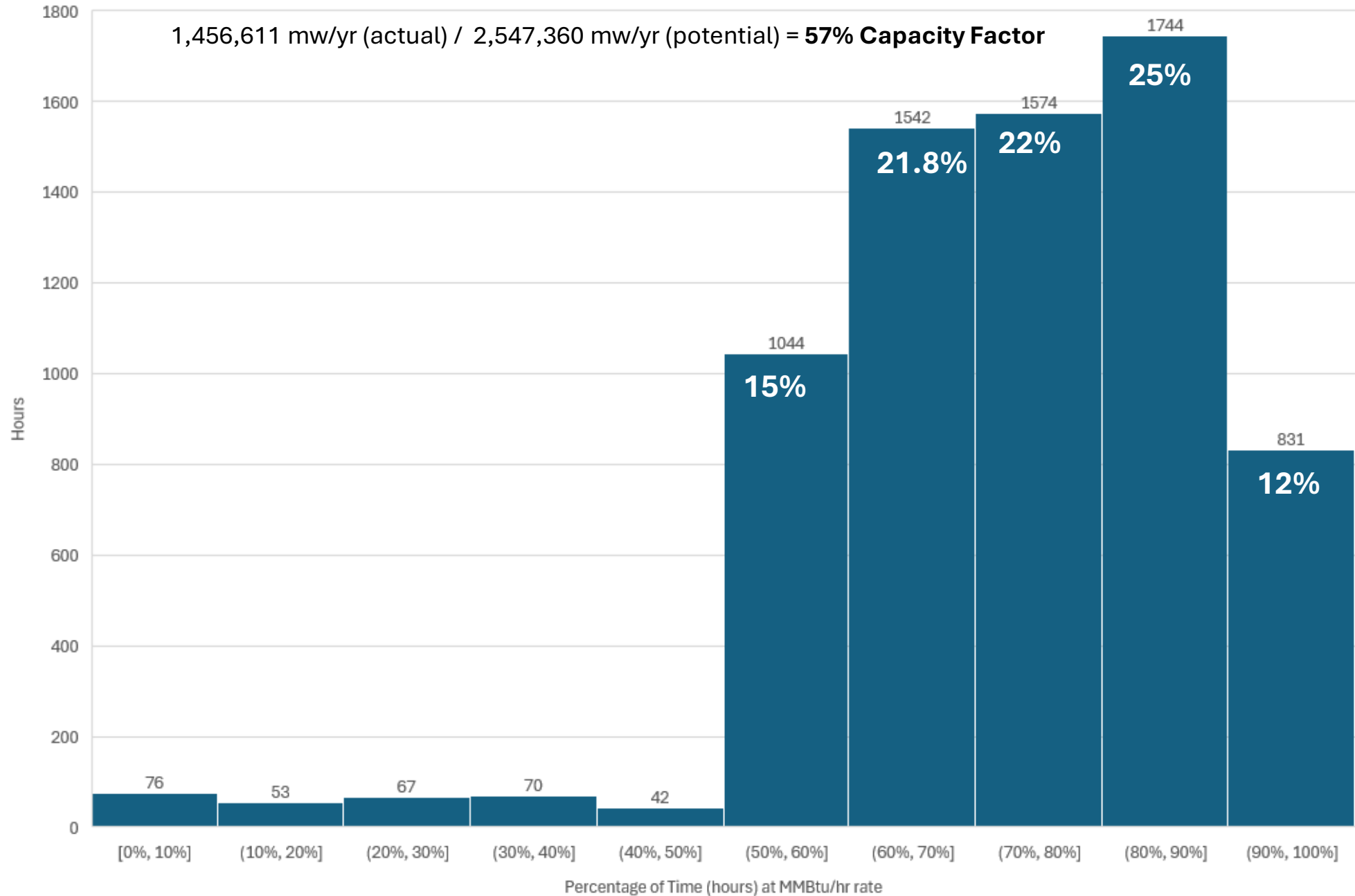
# Harry Allen Power Plant - Las Vegas, NV

GE 7FA+e (190 MW) - Unit 5 - 2024 data



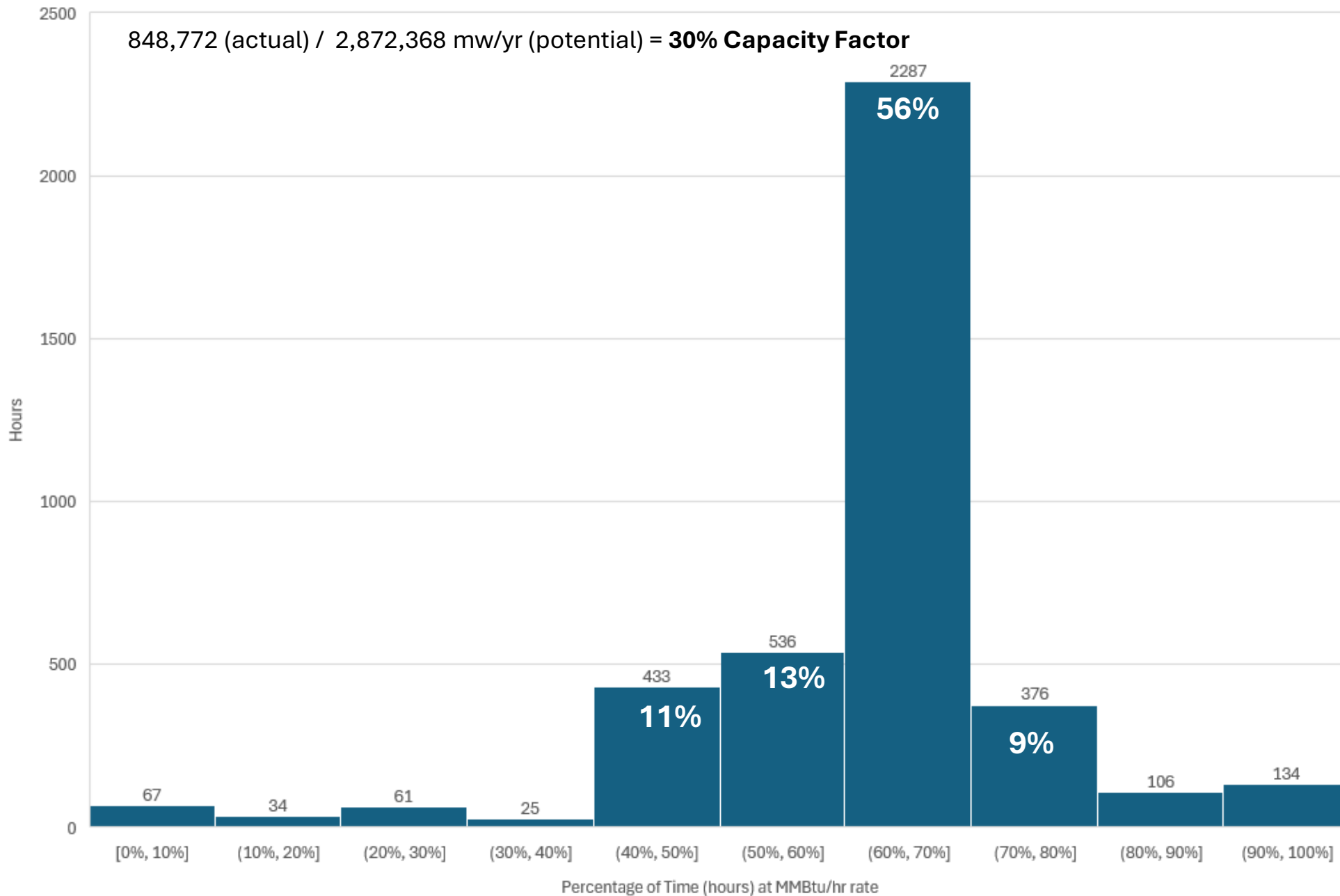
# Harry Allen Power Plant - Las Vegas, NV

GE 7FA+e (190 MW) - Unit 6 - 2024 data



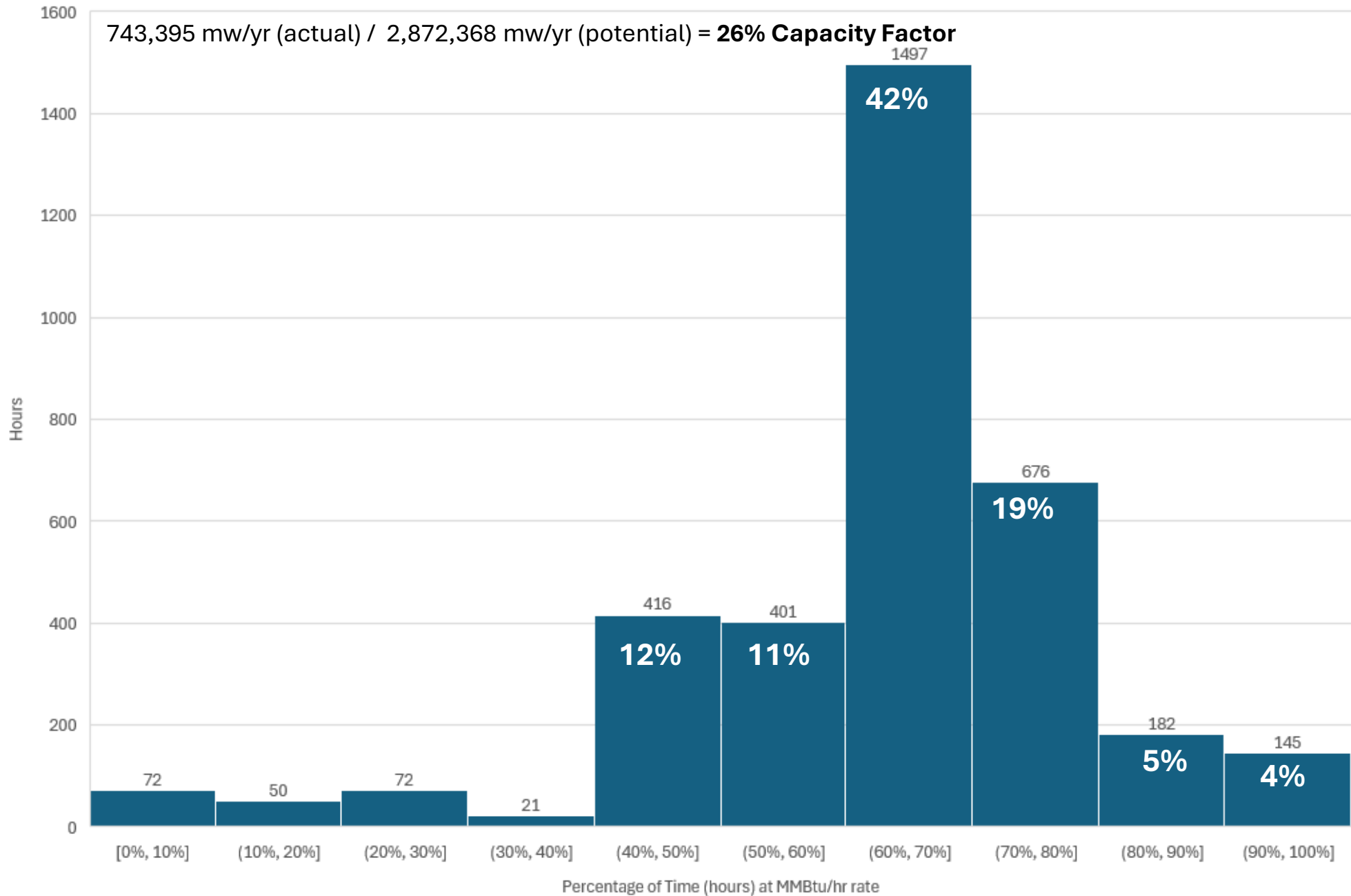
# Barney M. Davis Power Station - Corpus Christi, Texas

GE 7F.04 (189.6 mw) - Unit 3 - 2024 Data



# Barney M. Davis Power Station - Corpus Christi, Texas

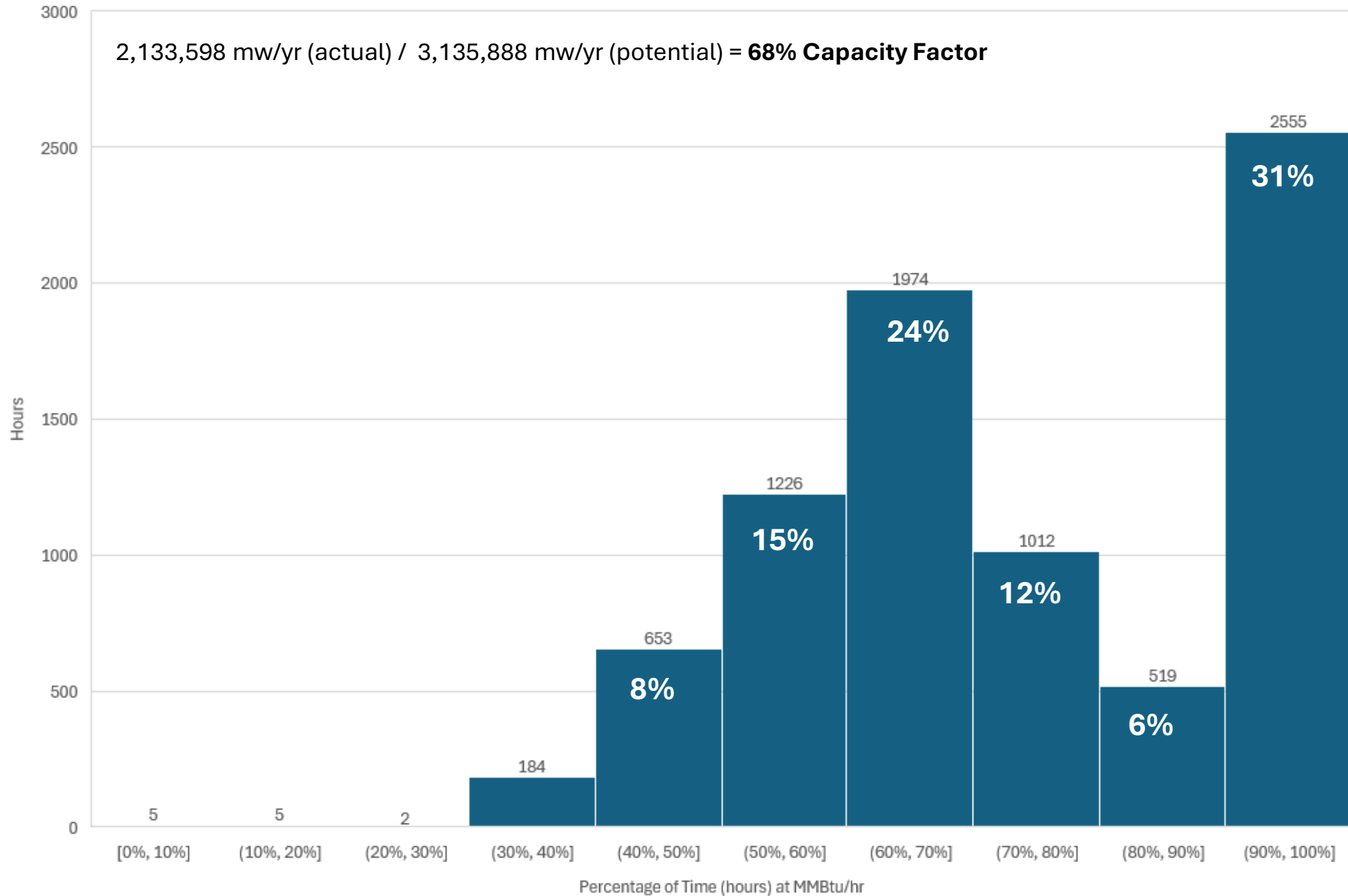
GE 7F.04 (189.6 mw) - Unit 4 - 2024 Data



# Thomas A. Smith Generating Facility - Dalton, Georgia

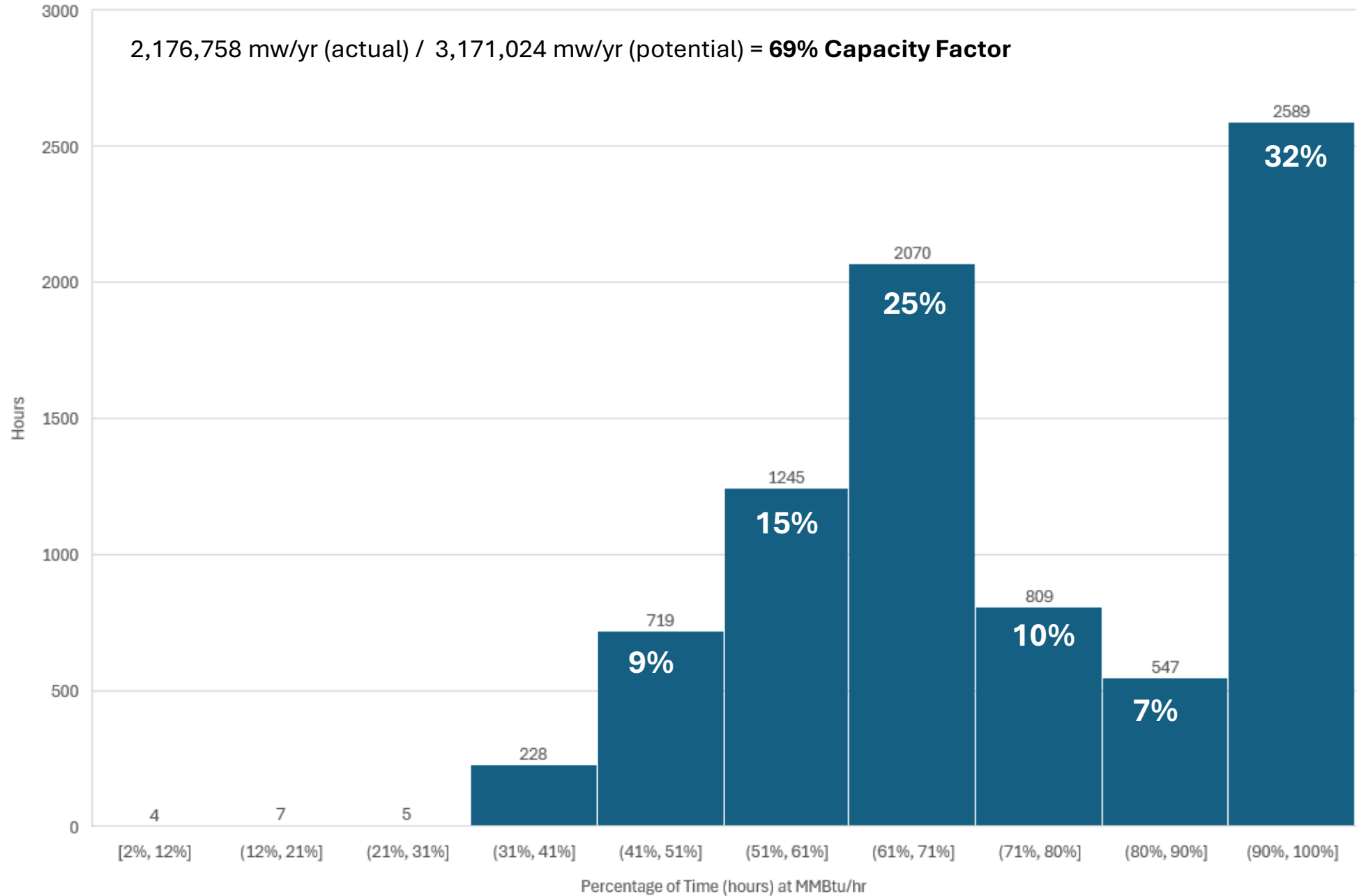
GE 7F.04 (147 MW) - Unit 1 - 2024 data

2,133,598 mw/yr (actual) / 3,135,888 mw/yr (potential) = **68% Capacity Factor**



# Thomas A. Smith Generating Facility - Dalton, Georgia

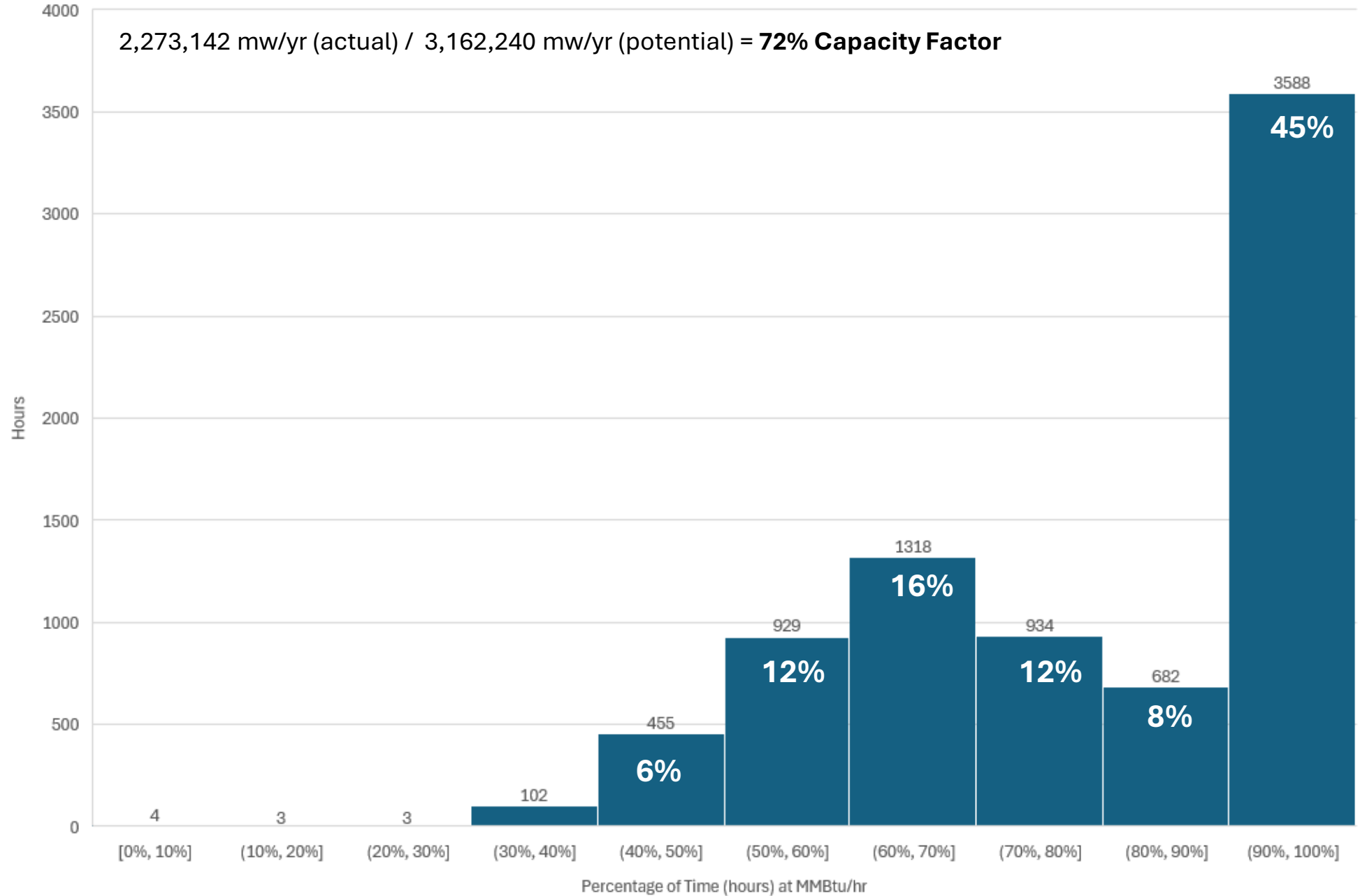
GE 7F.04 (147 MW) - Unit 2 - 2024 data



# Thomas A. Smith Generating Facility - Dalton Georgia

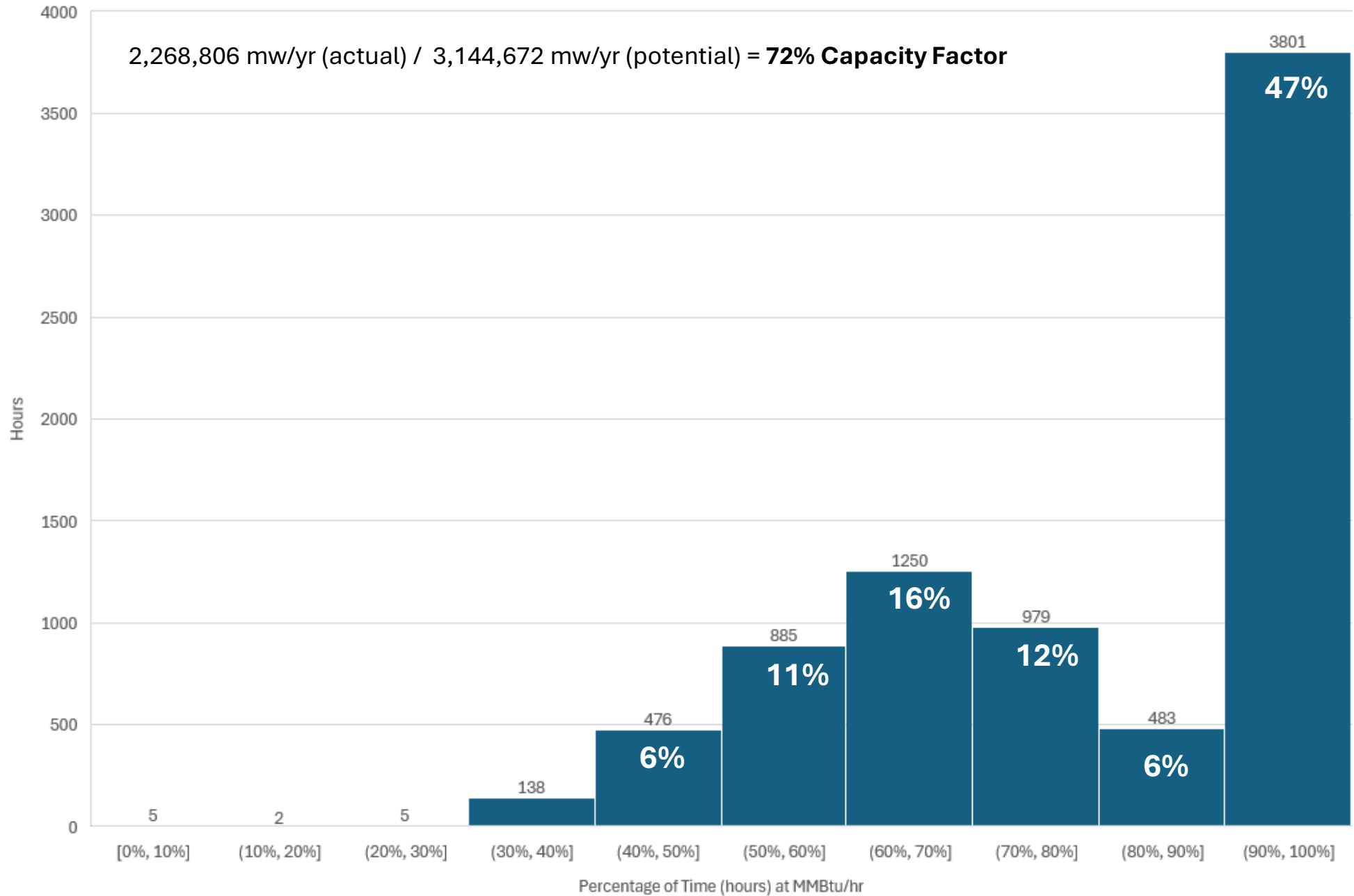
GE 7F.04 147 MW - Unit 3 - 2024 data

2,273,142 mw/yr (actual) / 3,162,240 mw/yr (potential) = **72% Capacity Factor**



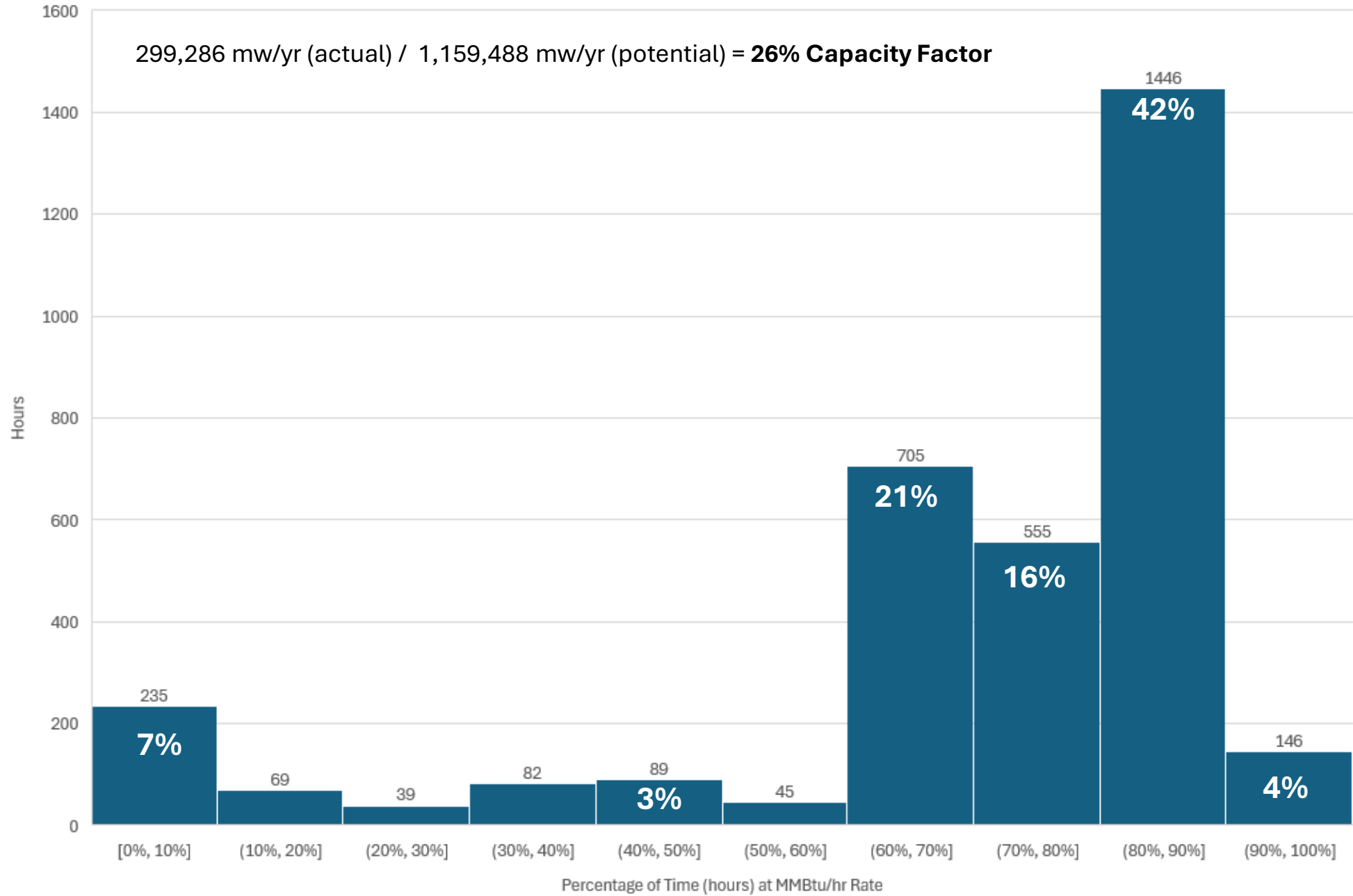
# Thomas A. Smith Energy Facility - Dalton, Georgia

GE 7F.04 147 mw - Unit 4 - 2024 data



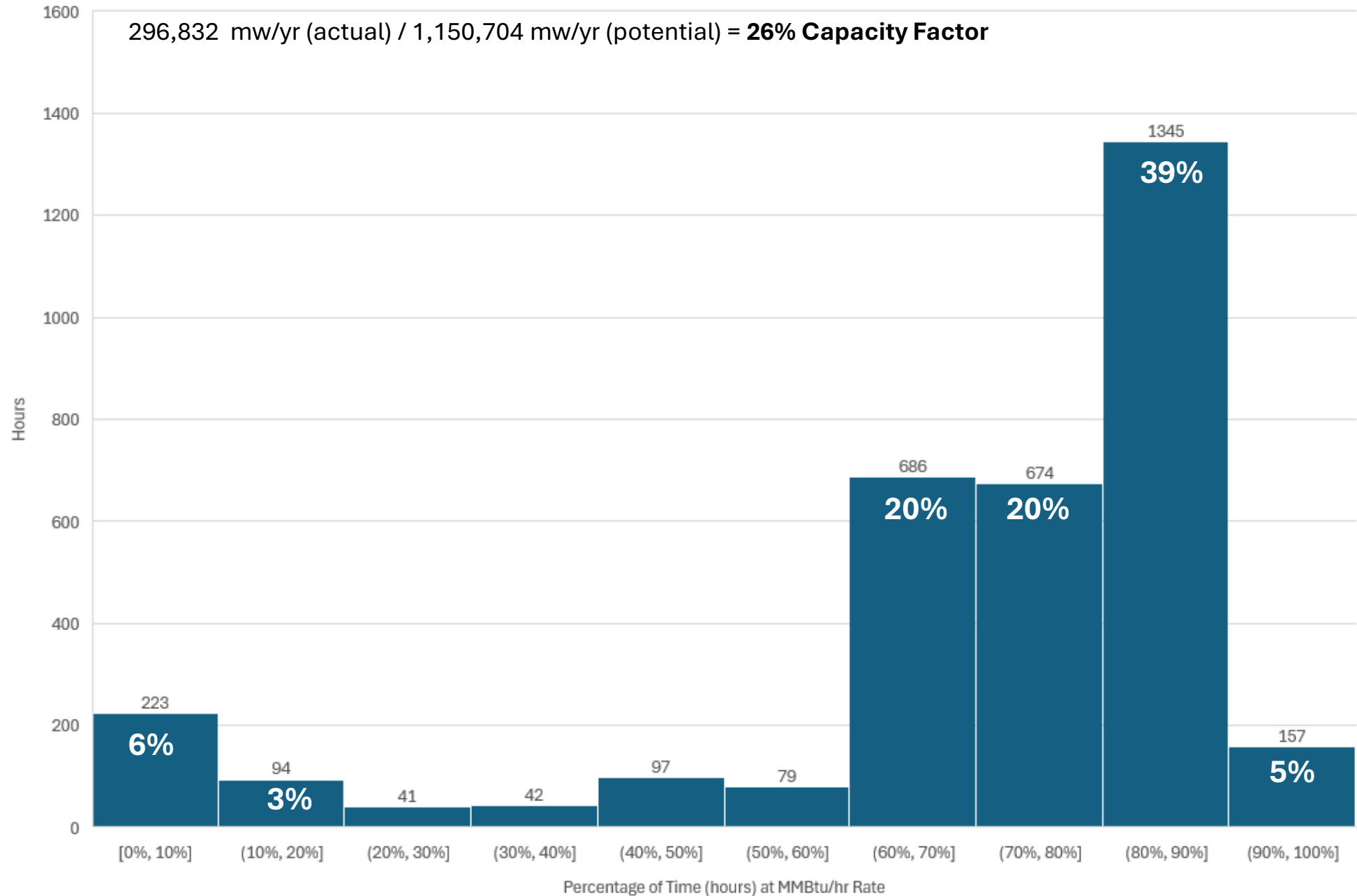
# NPPD Beatrice Power Station - Beatrice, NE

GE 7EA (80 mw) - Unit 1 - 2023 Data

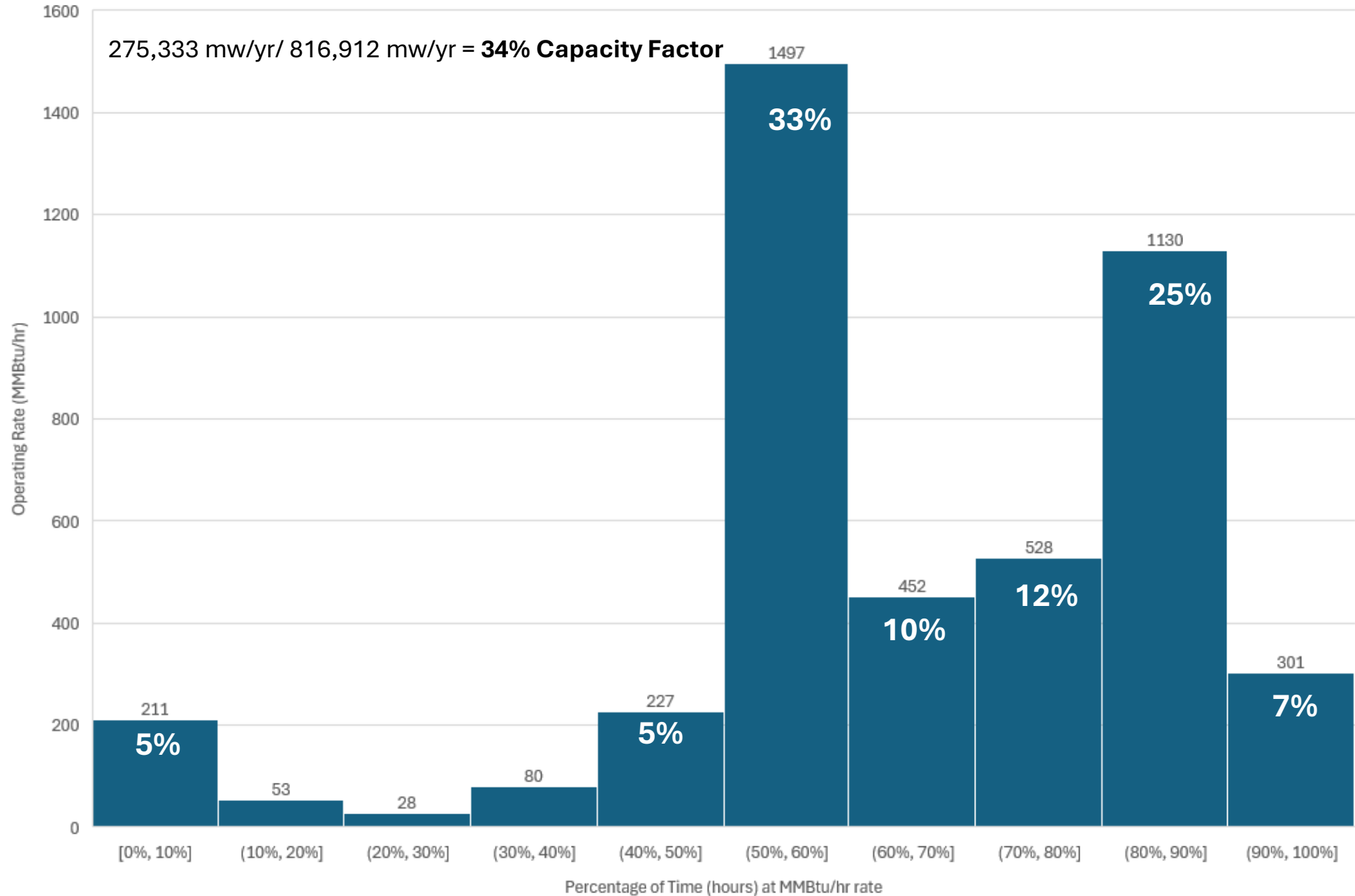


# NPPS Beatrice Power Station - Beatrice, NE

GE 7EA (80mw) - Unit 2 - 2023 data

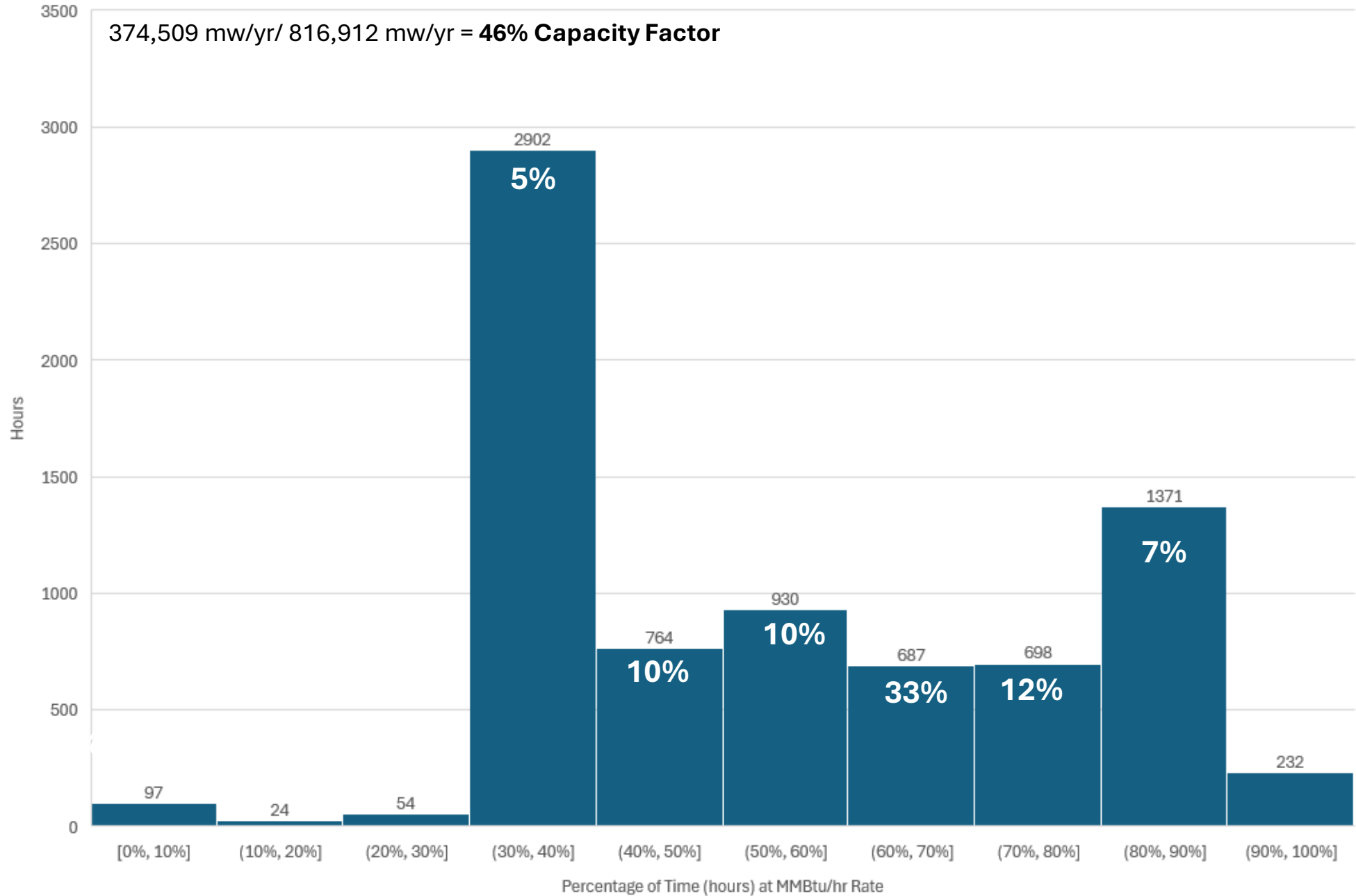


**Black Hills Energy (PAGS) - Pueblo, CO**  
LMS100 (100 mw) - Unit 1 - 2024 Data



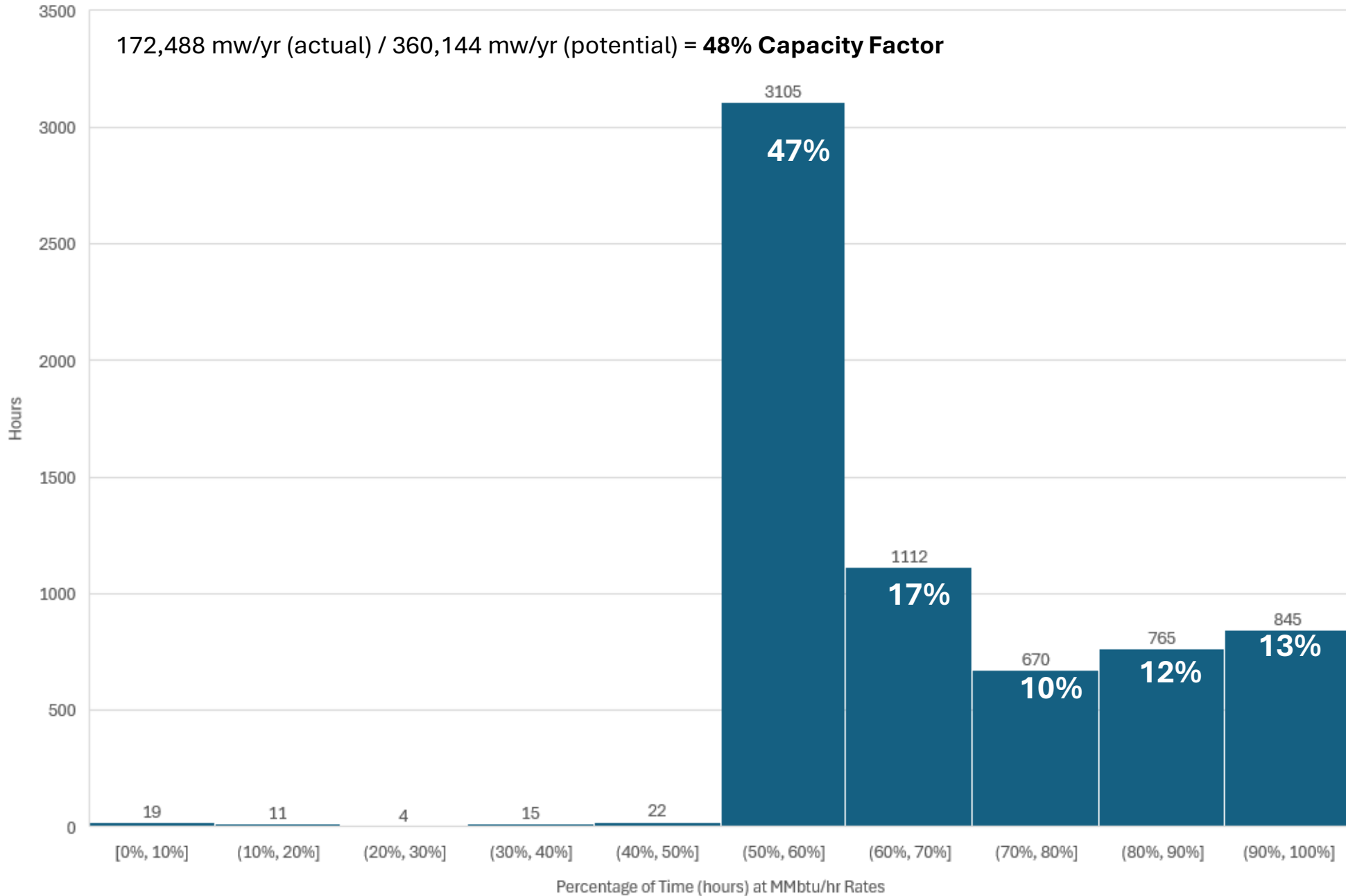
# Black Hills Energy (PAGS) - Pueblo, CO

LMS100 (100 mw) - Unit 2 - 2024 Data



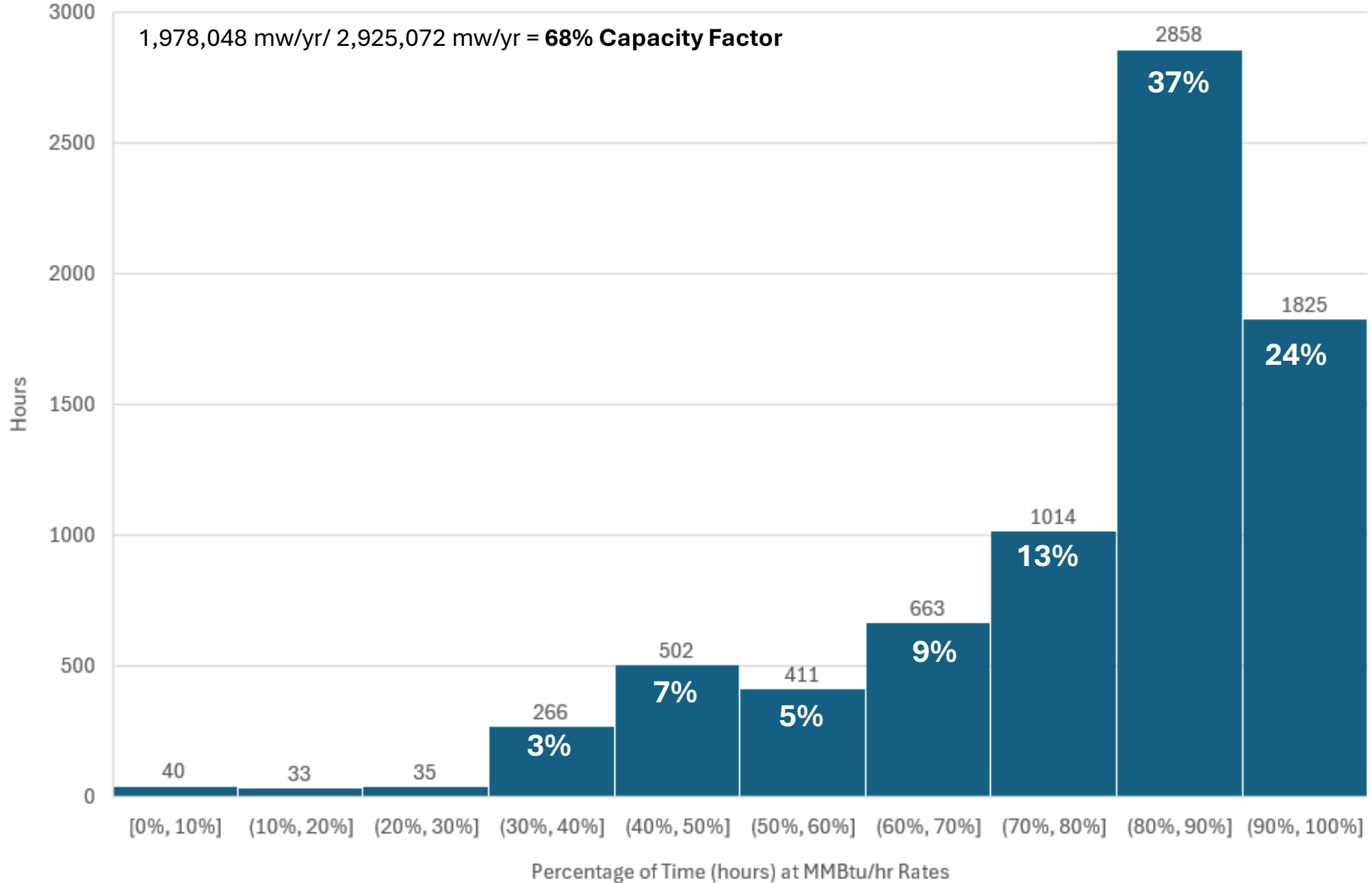
# Black Hills Energy (PAGS) - Pueblo, CO

GE LM6000 (40 mw) Unit 4 - 2024 Data



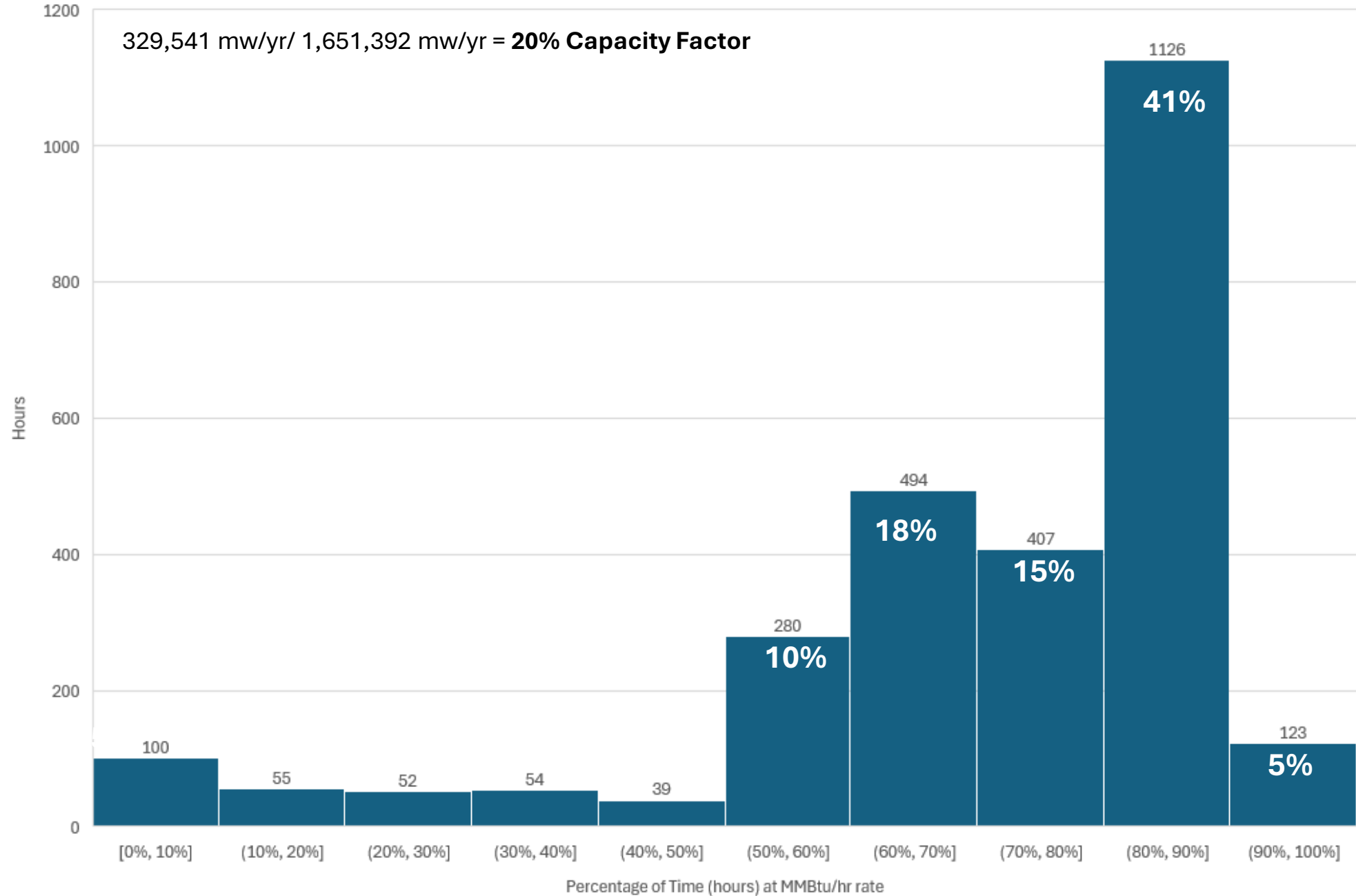
# Mesquite Power Plant - Arlington, AZ

## GE 7F.04 (185.3 mw) - Unit 1 - 2024 data



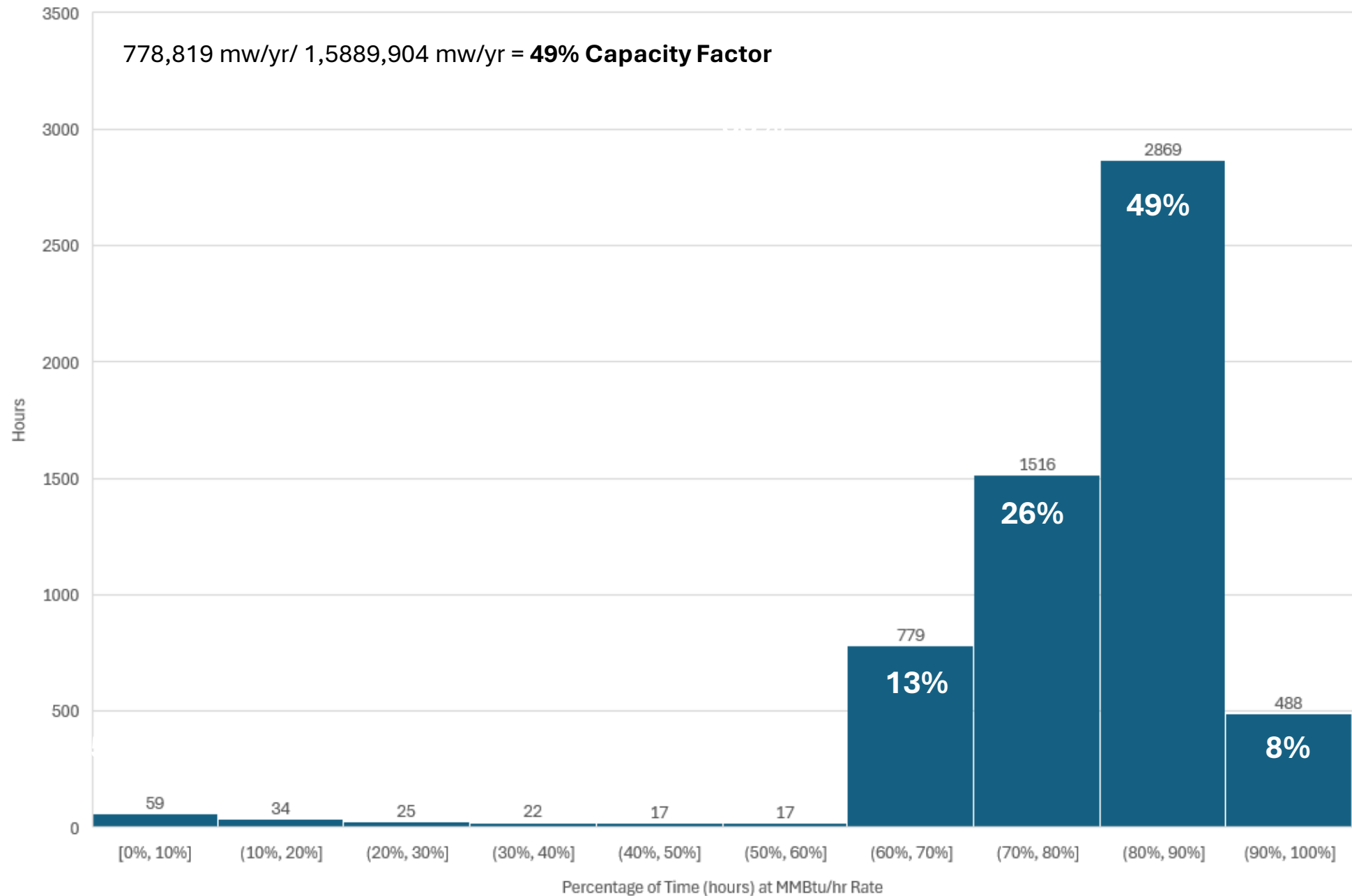
# Brandy Branch Power Plant - Jacksonville, Florida

GE 7F.04 (173 mw) -Unit 1 - 2024 data



# John S. Rainey Generating Station - Anderson, South Carolina

GE 7F.04 (165 mw) -Unit 2A - 2024 data



# John S. Rainey Generating Station - Anderson, South Carolina

GE 7F.04 (165 mw) - Unit 2B - 2024 data

