Gas Turbine Association

June 6th, 2022

Gas Turbine Association Comments to EPA Document entitled "Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Combustion Turbine Electric Generating Units"

The Gas Turbine Association (GTA) offers the following comment to the EPA Document entitled Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Combustion Turbine Electric Generating Units, here after referred to as the EPA whitepaper.

Introduction: The Gas Turbine Association (GTA) is a membership organization established in 1995 with a goal of communicating the message that gas turbines are, and will continue to be, a vital source of power generation in the United States of America and around the globe. The GTA is comprised of the major gas turbine manufacturers and service providers in the energy market, with US gas power exports of $12B USD per year, with more than 200,000 high paying jobs across the country. See appendix A and the end of these comments for a list of GTA membership.

Gas Turbine Association Mission: The GTA serves as the unified voice for the gas turbine industry. As the world transitions towards carbon neutrality, gas turbine technology will be essential for underpinning and securing a sustainable, clean, efficient, and reliable generation mix. Today, gas turbines produce over one-third of our nation's electricity and power a substantial portion of our nation's pipeline infrastructure, representing an installed base of thousands of operating assets. Gas turbine technology provides the best attributes:

- Variation in offerings from small to large gas turbines – making it suitable for an extraordinarily broad array of applications.
- Operational flexibility – that will provide power security to the growing renewable portfolio.
- Achieve a significantly lower environmental impact when compared to other energy technologies.
- Substantial gain in plant efficiencies in Combined Heat and Power applications.

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Gas Turbines are a cornerstone energy conversion technology, providing electricity and heat for industries and communities, and are essential for ensuring the resiliency of the GRID through the delivery of required ancillary services. Since the late 1970's Gas Turbine technology has evolved with a focus on reducing Green-House Gas (GHG) emissions… they are a critical part of the clean energy solution for today and for tomorrow:

Consistent with the GTA mission to educate and inform, advocate, and promote gas turbine technology, the GTA provides the following comments to the EPA Whitepaper

General Comments: The EPA Whitepaper provides an overview of gas turbine Greenhouse Gas (GHG) emissions and technologies to reduce GHG emissions. The following are general comments to be considered as this EPA whitepaper is used to "provide context for permit development under the prevention of significant deterioration (PSD) program…including in the assessment of best available control technology (BACT)" and as the information may be "useful to EPA in future development of new source performance standards (NSPS).

Plant Efficiency: Power plant design engineers strive to achieve the most efficient plant economically possible. By definition, a more efficient plant burns less fuel per unit of electricity. As a result of burning less fuel, the cost to produce electricity will decrease while also the GHG intensity (GHG emission per unit of electricity) will also decrease. GTA estimates that globally, 1% efficiency gain can save customers $3B in fuel expense. Due to this inherent economic incentive towards improved efficiency and corresponding benefit of reduced CO_2 intensity, plants are currently operated with on objective to reduce CO_2 intensity. As a result, any standard that is established to further reduce CO_2 intensity of an individual plant will not further incentivize towards improved plant efficiency or reduce a plants CO_2 intensity, this is already being done in response to the incentive of saving fuel costs. Further, there is very limited opportunity for efficiency improvements within the plant that have not already been implemented.

Operational Flexibility: Power plants respond to the demands of the grid. Electric demand varies through the day, generally higher during the day, and lower at night. Available renewable energy (wind and solar) is used to satisfy this electric demand. Gas turbine plants are an ideal technology to provide reliable, dispatchable load firming and peaking power to fill the electric demand not satisfied by renewable energy.

As renewable capacity increases, gas turbine plant dispatch is becoming increasingly variable. To respond to this variable dispatch, gas turbine plants are designed to provide more flexible operation (faster starts, lower part load, faster load ramping). As noted above, there is a strong incentive to reduce fuel consumption and fuel costs while starting and operating at reduced loads. As plants are called to start-up/shutdown or operate at part load, the plant is not as efficient, even with continual efficiency improvements during this flexible operation, as when operating at baseload. As a result, a plant with variable dispatch will have higher CO_2 intensity than a steadily base loaded plant.

Increased renewable generation will reduce the CO_2 intensity of the entire electric grid, however, the CO_2 intensity of an individual gas turbine plant may increase in response to the variable demand imposed by renewables. Plant specific CO_2 intensity limits would not change how a plant is designed, as noted in the previous paragraph, however it would have the unintended consequence of limiting the ability of a gas turbine plant to respond to the dispatch requirements demanded from the grid. The operating mission, both current and future, of a gas turbine plant must be considered when developing CO_2 emission standards.

Fuel Flexibility: Gas turbines are capable of firing a broad range of fuels. Hydrogen (H_2) fuel is a notable fuel receiving significant attention today, and a fuel specifically addressed in the EPA Whitepaper. Today's gas turbines have been designed to fire on natural gas as a primary fuel. These turbines, with appropriate modifications to address unique H_2 combustion properties to the gas turbine combustion system and the plant fuel accessary systems, can accommodate varying levels of H_2 fuel blended with natural gas. The specific H_2 blend capabilities are dependent on turbine model and combustion system.

Gas turbine original equipment manufacturers (OEMs) and select full-scope aftermarket providers are investing to increase the volume percentage of H_2 blends that gas turbines can handle. Future gas turbines, and existing units retrofitted with H_2 capable combustion systems, will be prepared to fire H_2 fuels when they become available in sufficient quantities and at an economic cost.

GHG Emission Control Technologies: The EPA whitepaper identifies various GHG Emission Control technologies, notably, carbon capture utilization and storage (CCUS), Oxy-fuel combustion, and Hydrogen combustion. Significant research and investment are being devoted to these technologies. As noted in the EPA Whitepaper, these technologies are in various stages of research, engineering study, development, and demonstration projects, however at the writing of this EPA whitepaper, these technologies are not currently commercially demonstrated at full scale and are not “shovel ready” technologies without compromising plant performance, operability, or cost, for use as either Best System of Emission Reduction (BSER) or Best Available Control Technologies (BACT). As the gas turbine industry strives to meet the challenges of delivering clean, reliable, low-cost electricity with reduced CO_2 intensity, these technologies will be developed, and the technology maturity and full-scale commercial viability will improve. Assessment of these technologies will need to remain current with the development of these technologies as they are considered in regulatory and permitting assessments.

Equipment Efficiency Fuel Heating Value Basis: The efficiency of the fleet of gas turbines have been included in the EPA Whitepaper and shown in Exhibit 5-2 and Exhibit 5-4 of the whitepaper. The efficiency is shown on a fuel higher heating value basis (HHV). It is industry practice to express both gas turbine and combined cycle power plant efficiency on a fuel lower heating value (LHV) basis. The GTA recommends showing efficiency on a LHV basis to be consistent with industry practice. Additionally, the efficiency of combined heat and power (CHP) plants in section 5.0 and reciprocating internal combustion engines (RICE) in section 8.0 are expressed on an LHV basis. The efficiency basis should be consistent throughout the document.

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Andrew Dicke – GTA Environmental Affairs Committee Chair

Appendix A

<u>Gas Turbine Association Current Membership</u>

Camfil Power Systems

GE Gas Power

Mitsubishi Power

Mitsubishi Power Aero LLC

Power Systems Mfg., LLC (PSM)

Pratt & Whitney

Reuter-Stokes

Siemens Energy

Solar Turbines

Strategic Power Systems, Inc.

The Pennsylvania State University

Turbine Logic

University of Central Florida (UCF)

University of Connecticut (UCONN)