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Via Electronic Filing and Email

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Attention: Docket ID No. EPA-HQ-OAR-2011-0660

Re: *Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units*, 77 *Fed. Reg.* 22,392 (Apr. 13, 2012)

Dear Mr. Fellner and Dr. Hutson:

The General Electric Company (GE) appreciates the opportunity to comment on the proposed *Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units.* We look forward to working with the Agency as it moves toward promulgation of a final rule.

Please contact me at larry.boggs@ge.com or (202) 637-4126 with any questions regarding these comments.

Sincerely,

/s/

Larry A. Boggs

COMMENTS OF THE GENERAL ELECTRIC COMPANY

PROPOSED STANDARDS OF PERFORMANCE FOR GREENHOUSE GAS EMISSIONS FOR NEW STATIONARY SOURCES: ELECTRIC UTILITY GENERATING UNITS

77 Federal Register 22,392
(April 13, 2012)

SUBMITTED ON JUNE 25, 2012

TABLE OF CONTENTS

Page

INTRODUCTION AND EXECUTIVE SUMMARY 1

THE PROPOSAL APPROPRIATELY RECOGNIZES THE IMPORTANCE OF GAS BUT ALSO MUST PROVIDE A ROLE FOR CLEAN COAL 2

THE FINAL RULE MUST PROVIDE CERTAINTY TO ALLOW FOR INVESTMENT IN CLEANER FUELS AND TECHNOLOGIES 3

I. THE PROPOSED RULE APPROPRIATELY RECOGNIZES THE INCREASE ROLE OF NATURAL GAS IN U.S. ELECTRICITY PRODUCTION 4

II. NATURAL GAS TURBINES PLAY A VITAL ROLE IN U.S. ELECTRICITY PRODUCTION 5

A. Natural Gas Turbines Provide Critical Operational Flexibility to Today's Electricity Generation and Distribution Systems, While Allowing More Efficient Response to Demand Fluctuations 5

B. Natural Gas Turbines Are Uniquely Able to Support Renewable Generation 6

C. By Facilitating the Use of Renewable Generation, Gas Turbine Technologies Reduce System-Wide Emissions 6

III. STANDARD OF NO LESS THAN 1,100 lb/MWh IS NECESSARY TO ACCOUNT FOR ACTUAL OPERATING CONDITIONS AND SITE-TO-SITE VARIATIONS 7

A. Section 111 of the Act Requires EPA to Take Into Account the Expected Operating Performance in Actual Conditions Over the Life of the Unit 7

B. EPA's 5% Allowance to Address Partial Load Situations is Insufficient and Not supported by the Record 9

C. Failure to Establish an Achievable Standard will Lead to Higher Overall GHG Emissions 12

D. If a 1,000 lb/MWh Standard Is Issued, Alternative Compliance 111's Requirements 12

IV. THE PROPOSED SIMPLE CYCLE COMBUSTION TURBINE EXEMPTION, WHICH IS BOTH REASONABLE AND NECESSARY TO ENSURE RELIABILITY OF THE ELECTRICAL GRID, MUST BE MAINTAINED IN THE FINAL RULE 13

A. GE Supports Issuance of a Specific Simple Cycle Turbine Definition and Exemption 13

B. Simple Cycle Gas Turbines Are an Essential Part of the Power Generation Portfolio in That They Provide: Highly Flexible Power Generation, the Ability to Manage Contingencies in the Electrical Grid, and Necessary Backup Power 14

TABLE OF CONTENTS (cont'd)

Page

C. NGCC Installations, while Flexible, Cannot Substitute for Simple Cycle 14

D. The Importance of Maintaining the Broad Simple Cycle Exclusion from the Rule is Underscored by the Fact that the Proposed EGU Definition Exempting Units that Supply Less than 2,900 Hours to the Grid is Insufficient to Address Simple Cycle Units 15

E. The Proposed Range of 950 to 1,100 lb/MWh Does Not Reflect BSER for Simple Cycle Turbines 16

F. The Simple Cycle Turbine Exemption Does Not Provide an Incentive to Install Simple Cycle in Place of NGCC 17

G. The Simple Cycle Exemption Will Not Delay the Installation of the Heat Recovery Steam Generator Portion of NGCC 18

H. NGCC Plants with a By-Pass Stack Must Not be Subject to the Standard When Operated in Simple Cycle Mode..... 18

V. WHILE CARBON *CAPTURE* IS ACHIEVABLE NOW, EPA SHOULD PROVIDE FLEXIBLE COMPLIANCE PERIODS TO REDUCE UNCERTAINTIES RELATED TO SEQUESTRATION THAT MAY PREVENT INVESTMENT AND TECHNOLOGY ADVANCEMENT..... 19

VI. EPA SHOULD AMEND THE KEY PROVISIONS OF THE RULE TO ENSURE THAT IGCC CAN BE USED UNDER THE ALTERNATIVE COMPLIANCE OPTION 20

A. EPA Should Clarify the Definition of Integrated Gasification Combined Cycle Electric Generating Unit to Include the Heat Recovery Steam Generator..... 20

B. EPA Should Also Amend the Applicability Requirements for the Alternative Compliance Option Under Proposed § 60.5220(b) to Specifically Allow IGCC Units as They are Defined in the Rule to Qualify 21

VII. THE FINAL RULE SHOULD INCLUDE A CUMULATIVE ROLLING SUM THAT WILL ACCURATELY REPRESENT EMISSIONS AND PROPORTIONATELY WEIGH PERIODS OF HIGH EMISSIONS AND LOW GENERATION..... 22

VIII. A GROSS OUTPUT STANDARD SHOULD BE ADOPTED OVER A NET OUTPUT STANDARD..... .23

IX. BECAUSE FUEL MONITORING MEETS CLEAN AIR ACT COMPLIANCE REQUIREMENTS AND DOES NOT INVOLVE THE MEASUREMENT UNCERTAINTIES AND COSTS OF CONTINUOUS EMISSION MONITORS, THE RULE SHOULD ADOPT FUEL SAMPLING AS AN INDEPENDENT COMPLIANCE METHOD..... 23

TABLE OF CONTENTS (cont'd)

Page

X. EPA SHOULD ADOPT AN EXEMPTION FOR COMBUSTION OF WASTE FUELS SUCH AS BLAST FURNACE GAS AND REFINERY FUEL GAS 25

XI. EPA SHOULD PROVIDE FOR COMPLIANCE CALCULATED AS AN AVERAGE OF ALL NEW ELECTRIC GENERATING UNITS AT A SINGLE PLANT 26

XII. COMBINED HEAT AND POWER FACILITIES WHERE USEFUL THERMAL OUTPUT ACCOUNTS FOR 20 PERCENT OF THE TOTAL USEFUL OUTPUT SHOULD BE EXCLUDED FROM THIS RULE 26

XIII. THE POLLUTION CONTROL PROJECT EXCLUSION SHOULD NOT BE ELIMINATED 26

XIV. THE PROPOSED RULE SHOULD BE REVISED TO INCLUDE LANGUAGE CLARIFYING THAT THE FINAL STANDARD INCLUDED IN THIS RULE FOR NGCC DOES NOT APPLY TO PSD PERMITS FOR SIMPLE CYCLE UNITS 27

XV. EPA SHOULD INCLUDE EXPLICIT REGULATORY LANGUAGE IN PART 52 PSD REGUATIONS TO CLARIFY THAT REGULATION OF CO2 UNDER SECTION 111 TRIGGERS THE TAILORING RULE GHG EMISSION THRESHOLDS..... .27

CONCLUSION..... 28

Introduction and Executive Summary

General Electric Company (GE) submits the following comments on the Proposed *Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units,* 77 Fed. Reg. 22,392 (April 13, 2012). GE is a diversified services, technology, and manufacturing company with a commitment to achieving customer success, innovation, and worldwide leadership in each of its businesses. GE operates in more than 100 countries and employs more than 300,000 people worldwide.

The proposed rule would regulate products manufactured by GE, such as gas turbines, and services that it offers, such as methods for improving the efficiency of electricity generation. In addition, GE both invests in and operates power plants in the United States.

GE supports EPA's overall efforts to move the country towards more efficient power generation using natural gas and where it can meet appropriate standards, coal. GE manufactures products that are designed to meet stringent emissions standards and that are extremely efficient. We are able to deploy these products quickly to provide reliable power to the nation. Our detailed comments provide a series of recommendations aimed at promoting the proposed rule's goals of efficient and reliable power generation, including the following:

- ✓ EPA should promote use of natural gas-fired power, which is both efficient and reliable;
- ✓ The standard should be set to allow natural gas combined cycle (NGCC) turbines to meet the standard during the full range of operating conditions and environments and to play a vital role in supporting deployment of renewable energy sources like wind and solar power; this standard should be no lower than 1,100 lb/MWh based on a 12 month rolling sum;
- ✓ EPA should maintain the proposed exclusion of simple cycle gas turbines for several reasons, including, among others, the critical role they play in delivery of electricity across the country;
- ✓ EPA should recognize that integrated gasification combined cycle (IGCC) is a proven technology and that the carbon capture aspect of carbon capture and sequestration (CCS) is available now, but EPA should also provide flexible compliance periods to reduce uncertainties related to sequestration;
- ✓ EPA should adopt a gross output standard over a net output standard.

GE's Products and Services Are Reliable and Promote Energy Efficiency: GE's wide array of service and product offerings are designed to meet world demand for abundant, reliable, and efficient energy. GE's power

generation equipment is among the most environmentally clean equipment available in the marketplace. GE Energy manufactures gas turbines ranging in size from 5 MW up to some 300 MW. These clean-running combustion turbines are the most efficient means of generating electricity from fossil fuels commercially available. GE Energy provides solutions—from air-cooled heat exchangers to wind turbines—that address utilities' and industrial facilities' toughest challenges. In addition, GE conducts extensive research and development to produce technological advances in energy efficiency, reliability, and other key operational parameters.

GE Energy is the only company in the world that develops and deploys a full portfolio of energy technologies and solutions to ensure efficient and reliable power generation, transmission, distribution, and utilization regardless of fuel choice and customer location. GE's Power Generation business develops and deploys highly efficient power generation systems capable of meeting extremely aggressive environmental performance standards. These products include gas and steam turbines for multiple applications, generators, coal-powered IGCC systems with precombustion CO_2 capture capability, reciprocating gas engines and aeroderivative gas turbines for natural gas and alternative fuels, wind, solar and nuclear power.

With more than 100,000 employees in over 100 countries, GE Energy's diverse portfolio of product and service solutions and deep industry expertise help customers solve their challenges locally. We serve the energy sector with technologies in such areas as natural gas, oil, coal and nuclear energy; wind, solar, biogas and water processing; energy management; and grid modernization. We also offer integrated solutions to serve energy- and water-intensive industries such as mining, metals, marine, petrochemical, food and beverage and unconventional fuels.

GE Energy Financial Services (EFS) invests globally across the capital spectrum in essential, long-lived, and capital-intensive energy assets that meet the world's energy needs. In the United States, GE EFS owns a controlling interest in five power plants (four natural gas-fired plants and one coal-fired plant), and has invested preferred equity, lease equity or debt in over 100 other power plants, including fossil-fuel-fired plants and renewable energy plants. Based in Stamford, Connecticut, GE EFS helps its customers and GE grow through new investments, strong partnerships and optimization of its $20 billion portfolio of energy assets. EFS has investment commitments totaling over $8 billion in renewable energy projects, including wind, solar, hydroelectric, landfill gas, and other renewable energy technologies.[1]

The Proposal Appropriately Recognizes the Importance of Gas But Also Must Provide a Role for Clean Coal: The proposed rule appropriately recognizes the increasing role that natural gas will play in the nation's electricity

[1] For more information on GE EFS, visit www.geenergyfinancialservices.com.

production. Not only is natural gas a reliable, versatile, economical, and clean source of energy, but it is also in abundant supply, helping to assure long-term price stability. The full array of natural gas-fired generation technologies that exists also helps promote competitive price levels for power from all available fuels. The environmental benefits of gas, including lower greenhouse gas (GHG) and criteria pollutant emissions and reduced solid waste generation combined with the factors above, make it a natural selection for the next generation of power equipment installations.

At the same time, it is important for EPA to recognize that coal remains an abundant natural resource, and it can be utilized in an environmentally acceptable manner. For example, GE has invested in bringing IGCC to commercial reality. IGCC is well suited to carbon capture as has been proven in 19 commercial facilities that are using GE gasification technology to capture carbon generated from coal and petroleum coke. With respect to this rule, GE is ready to offer IGCC commercially at carbon capture efficiencies that will meet the proposed standard today. Cleaner coal technologies are being refined not only to reduce or store CO_2 but also to use it beneficially. CO_2 is being increasingly recognized as a valuable byproduct of fossil fuel consumption, and coal will serve as the primary source to obtain adequate supplies for carbon capture utilization and storage (CCUS). The primary application of CO_2 utilization is enhanced oil recovery. This rule—if crafted to provide flexibility, certainty, and stability that permits the beneficial use of coal—can catalyze the continued development and deployment of CCUS. Coal can thus serve as an option for a diverse energy infrastructure that is tolerant to future upsets in supply and price fluctuations in both coal and gas.

The Final Rule Must Provide Certainty to Allow for Investment in Cleaner Fuels and Technologies: Notwithstanding the benefits of lower emitting fuels and technologies, investment in new equipment by utilities requires a stable regulatory environment—one in which the regulations provide an achievable level of emissions control and are simultaneously not significantly vulnerable to legal challenge in the courts. The overarching objective of any CO_2 regulation must be the most efficient generation and use of energy while maintaining a stable regulatory framework such that market participants believe investments will result in a reasonable payback period and not risk the possibility of unknown control requirements at the time of investment.

Accordingly, as EPA is considering its options for this rulemaking, the Agency should take into account the significant comments filed and try to accommodate the commenters' concerns the extent to which doing so will prevent perpetuation of uncertainty. Indeed, increasing certainty is critical because uncertainty tends to limit investment in new technologies. Specifically, EPA should consider ways in which the rule can be written to minimize the risks of litigation while also meeting statutory requirements and promoting use of natural gas, consistent with current trends towards increased natural gas usage

for power generation. Promoting certainty for the energy generating sector will assist EPA in achieving the proposal's environmental objectives. By bolstering the legal analysis supporting this proposed standard, EPA will promote a rule that is more likely to be perceived by regulated entities as likely to survive legal challenge, thereby helping to foster investment in clean, efficient energy during an appeal period that could last several years.

I. The Proposed Rule Appropriately Recognizes the Increased Role of Natural Gas in U.S. Electricity Production.

The proposed rule correctly predicts that natural gas-fired electric generating units (EGUs) will be the "facilities of choice" for the foreseeable future due to the low cost of natural gas, the increase in domestic natural gas supplies, and the higher cost of coal-fired EGUs. Given recent discoveries of natural gas and new technologies to mine gas more efficiently, the U.S. possesses natural gas supplies sufficient to power electricity production, while continuing to serve manufacturing and residential needs. As illustrated in the figure below, for the past two decades, natural gas turbines have dominated capacity additions in U.S. electricity production. The abundance of natural gas in the U.S. and the availability of highly efficient, reliable, and operationally flexible natural gas-fired turbines will assure that natural gas-fired EGUs will be the predominant fossil fuel fired technology for the foreseeable future.

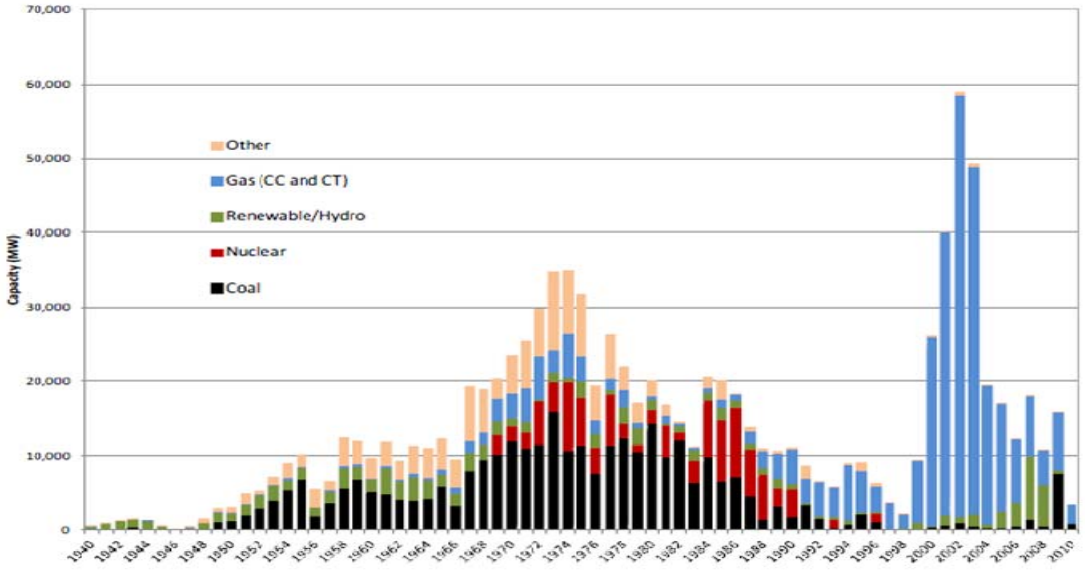

Figure 5-1. Historical U.S. Power Plant Capacity Additions, by Technology
Source: National Electric Energy Data System (NEEDS) v4.10_PTox

In addition to making economic and energy sense, gas turbines are also a better environmental choice for electricity generation. They produce lower overall emissions of CO_2, criteria pollutants, and hazardous air pollutants than other fuels. Compared to the coal-fired fleet, on average, natural gas-fired combined cycle generation results in a 50% reduction in CO_2 emissions, about a

65% reduction in NOx, and 99% less SOx for the same electricity output[2] Similarly, natural gas combined cycle generation does not produce the metals and other hazardous air pollutants associated with coal-fired generation. Moreover, the solid waste byproducts of coal-fired units are eliminated with natural gas firing.

Natural gas and the wide array of technologies developed to put this resource to productive use will also help fulfill the President's goal to ensure that by 2050, 80 percent of U.S. electricity will come from a diverse set of clean energy sources, including wind, solar, biomass, hydropower, nuclear, efficient natural gas, and clean coal.[3]

II. Natural Gas Turbines Play a Vital Role in U.S. Electricity Production.

Because natural gas turbine electricity production is versatile, dependable, economical, and clean, a wide array of technologies has been developed in this area. Gas turbines provide competitive output and efficiency when compared with coal and nuclear energy for both intermediate and base-load generation. As discussed further below, they also provide the additional benefit of affording significant operational flexibility to assure electric reliability and support for renewable generation.

A. Natural gas turbines provide critical operational flexibility to today's electricity generation and distribution systems, while allowing for more efficient response to demand fluctuations.

Gas turbine technology plays an important role within the overall electricity generation and distribution system. Electricity demand in any region varies significantly each day and across the seasons. Typical electric demand peaks during the day when a majority of people and industries are most active and reaches a minimum at night. Seasonal peak power demands most commonly occur on hot days with increased air conditioning demand and on cold days in regions with significant electric heating. As a result, electricity generation must be modulated across the electrical supply grid to coincide with this variation in demand. While the highly variable daily and seasonal electrical demand may be generally predictable, contingencies and errors in prediction mean that operational flexibility and quick responses in production are essential. Such operational flexibility and rapid response can generally *only* be achieved with highly flexible gas turbines. As a result, gas turbines play a key role in maintaining grid reliability by providing a flexible power supply that can be reliably dispatched when power is needed quickly.

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[2] US EPA, "Clean Energy" web page, http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html.

[3] *See Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units; Proposed Rule,* 77 Fed. Reg. 22,392, 22,396 (Apr. 13, 2012).

B. Natural gas turbines are uniquely able to support renewable generation.

While the need for operational flexibility is already significant, it will grow significantly with the increased use of renewable energy. The use of non-hydroelectric renewable generation has increased considerably in many states over the past decade. To date, 30 states, plus the District of Columbia, have established Renewable Portfolio Standards (RPS) that require a minimum share of electrical generation to be produced from renewable generation. As a result of the increased deployment of renewable generation, the short term variability in the electrical supply has also increased. Renewable power, especially from wind and solar, will be expected to fluctuate hourly and even minute-to-minute with changes in wind speed, cloud cover, and other environmental factors. With this generation mix, electric supply must be available to *quickly* compensate for the combined variability of demand and fluctuation in the renewable supply. When this highly variable renewable energy supply is overlaid on existing already-variable electric demand, the importance of increased operational flexibility for each electric generating unit on the grid becomes apparent.

Gas turbine technology is uniquely capable of providing this operational flexibility, especially when compared to nuclear and coal-fired generation technologies. An electric supply grid composed of nuclear, coal, gas turbine and renewable technologies has traditionally relied on nuclear and coal plants to provide relatively steady base load power. The grid, however, will accept all available renewable energy from hydro, wind, or solar generation. Because the energy from these sources is variable, the grid operator fluctuates generation from gas turbine plants to match the variations in renewable generation supply and electrical demand. In response to the increased deployment of renewables, gas turbine installations are now required to start and stop more often and with greater speed in order to supply energy to the grid as quickly as possible to compensate for these rapidly changing loads. In this role, the flexible operating capability of gas turbines has become an increasingly critical attribute. This capability enables the increased deployment of renewables while maintaining safe and reliable grid operation.

C. By facilitating the use of renewable generation, gas turbine technologies reduce system-wide emissions.

Energy generation from renewable sources like wind and solar have zero emissions and very low variable cost of generation. However, if flexible generation assets, such as gas turbines, are not available, these renewable technologies will not be deployed. In other words, gas turbines are an essential component of renewable energy sources' ability to penetrate the market. Failure of renewable energy source deployment will result in increased CO_2 emissions. Any CO_2 emission limitations that EPA establishes in this rulemaking, therefore, must consider the important role of gas turbine technologies in reducing system-

wide emissions. Emission limitations that discourage the use of these technologies will adversely impact reliability, renewable deployment, and emissions.

III. A Standard of No Less Than 1,100 lb/MWh Is Necessary to Account for Actual Operating Conditions and Site-to-Site Variations.

EPA proposes a CO_2 emission limit of 1,000 lb/MWh-hr[4] based on the operation of an efficient natural gas combined cycle plant, but requests comments on an emission range from 950 to 1,100 lb/MWh-hr.[5] Although the proposed limit may be achievable by new NGCC units at optimum load under optimal operating conditions, it is unlikely to be achievable over the full range of operating conditions for the full life of a unit. Therefore, any standard issued must be set no lower than 1,100 lb/MWh on a 12-month rolling basis. Any lower standard would present technological challenges, particularly given partial load operation, degradation over time, startup and shutdown emissions, diversity of location, operating conditions and practices, and geographical and other factors. Moreover, to the extent utilities perceive compliance risk, they will be less likely to install new NGCC units, thus perpetuating the operation of existing higher-emitting units.[6] EPA should design its standard to meet the statutory requirements but also to encourage deployment and market penetration of lower-emitting technologies. Otherwise, any emission benefits obtained by a tighter standard will likely be offset by the negative impact of reduced investment in new NGCC which would be unable to meet the standard.

A. Section 111 of the Act requires EPA to take into account the expected operating performance in actual conditions over the life of the unit.

While GE's fleet of gas turbine products when newly installed in a combined cycle plant are capable of achieving the proposed emission limitation on a standard day in a newly installed (not-yet-degraded) condition (*i.e.,* initial unit performance conditions at original installation prior to any performance degradation due to operating hours or startup and shutdown cycles), operating scenarios exist for which the combined cycle plant would not be able to achieve the 1,000 lb/MWh limit. Most notably, during periods of frequent startup and shutdown, periods of low load operation, and periods operated on a backup fuel, emissions can be expected to exceed 1,000 lb/MWh. Often plants do not operate consistently at peak load, such as units that are parked at low load overnight to reduce production during times of low demand. Many plants deploy supplemental firing (also referred to as duct firing) to boost steam turbine

[4] 77 Fed. Reg. at 22,436 (Proposed Rule 40 C.F.R. § 60.5520(a)).
[5] 77 Fed. Reg. at 22,414.
[6] The proposed emission limit is based on a 12-month rolling average and will encompass all potential operating scenarios including base load operation, start-up and shutdown, range of load operation, and frequent load fluctuation.

generation during periods of peak demand. This supplemental firing to provide peak generation often reduces overall plant efficiency with a resulting increase in CO_2 emissions per megawatt-hour. In addition, plants with water restrictions often must implement less efficient cooling technologies to reduce water consumption. These real life operating scenarios must be considered when establishing the emission limit. In addition, any standard must reflect the fact that a NGCC's performance degrades over its useful life.

As stated previously, operational flexibility is an essential attribute and requirement for gas turbine-based electrical generating installations. Unfortunately, the proposed emission level of 1,000 lb/MWh would have the unintended consequence of limiting operational flexibility essential to the continued reliable deployment of renewable electricity generation; this will result in additional electric generating units needing to be added to meet existing demand. When plant owner/operators bid on opportunities to provide power generation to grid operators, they must include min-load and max-load levels as well as other various cost components. When a plant owner/operator's bid is successful, the grid operator will comply with the bid's minimum and maximum load specifications. If the proposed 1,000 lb/MWh limit is promulgated, plant operators will need to bid a *narrower* range of load to ensure that compliance is maintained. As a result, additional capacity will need to be built or less efficient capacity will be used that is not subject to the rule because the more efficient capacity is not available due to load restrictions. The impact will be additional capacity, increased variable electricity cost, and higher total CO_2 emissions. Moreover, a critical market for NGCC, supporting renewables will be lost because, at a 1,000 lb/MWh standard, the load restrictions that would be required will not be workable for NGCC to support renewable installations like wind and solar.

Section 111(a)(1) defines the term "standard of performance" as:

> (1) The term "standard of performance" means a standard for emissions of air pollutants which reflects the degree of emission limitation *achievable* through the application of the best system of emission reduction which (*taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements*) the Administrator determines has been *adequately demonstrated*.[7]

Thus, NSPS must be "achievable" and "adequately demonstrated." Unfortunately, the proposed standard is not achievable for NGCC when there is significant load fluctuation and several startup and shutdown events unless, as noted above, significant restrictions on the range of load operation and starts/stops are imposed. CO_2 emissions during startup are higher because there are periods of fuel burn while no energy (MW) is being produced or where

[7] 42 U.S.C. § 7411(a)(1) (emphasis added).

a relatively low level of energy is being dispatched to the grid. Start emissions are highly variable depending on the temperature of the equipment at the initiation of the start. As an example a plant that has shutdown overnight can start in generally less than an hour because the equipment is still warm from previous operation. If that same plant has been down for a week, a start may take upwards of 3 hours to allow the equipment to achieve full operating temperature without inducing significant thermal stresses to the equipment. For each plant start, the facility must operate for 3 to as much as 8 hours at baseload condition to ensure the average value for that operating period is below a 1,000 lb/MWh limit.

By setting the limit at the upper end of EPA's proposed range, *i.e.,* at 1,100 lb/MWh, EPA will not only take into account the demonstrated achievable limitation for NGCC but will also increase the probability of overall CO_2 reduction. EPA will further enable the development of *zero-emission* renewable yet variable energy sources like wind and solar power, since NGCC are utilized to support those applications. NGCC units supporting renewable energy generation service require an 1,100 lb/MWh limit, and if EPA finalizes a lower limit, the result that should be expected is that fewer renewable power units will be installed.

In sum, if EPA appropriately takes into account the Section 111 factors, it will adopt a 1,100 lb/MWh limit. EPA *must* consider the overall impacts in its evaluation of the complete range of NSPS factors in determining the best system of emission reduction.

B. EPA's 5% allowance to address partial load situations is insufficient and not supported by the record.

EPA's efforts at addressing the partial load situation understate the impacts. The April 2012 Memorandum regarding Design Data for New Combined Cycle Facilities actually acknowledges that at below 80% load, the actual heat rate increases significantly and concludes that a 5% heat rate increase would be appropriate to account for part-load conditions:

> Operational load is one of the primary factors in the actual operating efficiency and CO_2 emissions rate of a combined cycle power plant. Combined cycle power plants are most efficient when operating at full load. At 80 percent load, the actual heat rate only increases by approximately 1 percent relative to the design basis heat rate. However, below 80 percent load, the heat rate begins to increase at a more significant pace. At 60 percent load, the actual heat rate increases by approximately 10 percent above the design rate. Even though most combined cycle power plants are intended to operate at high loads, part-load operation is inevitable with

> variable demand. We selected a 5 percent heat rate increase relative to the design rate to account for part-load conditions.[8]

The 5% allowance is simply insufficient to accommodate the operating realities of NGCC plants.

EPA's Design Data Memo outlines the methodology by which the proposed CO_2 emission limit was derived based on NGCC. In evaluating the Design Data Memo, GE observes that a number of elements of the analysis clearly indicate that a 5% allowance is insufficient and that even the 10% efficiency lapse EPA discusses in the Design Data Memo may be insufficient to represent NGCC unit performance in real world operating environments over the life of a unit.

The Design Data Memo states that a NGCC plant's performance (efficiency) will lapse as much as 10% at part load and adjusts the values by 5% to account for the range of annual operation. New generations of the gas turbine fleet are designed to turn down farther in response to customer and electric grid demands. At these lower turn down rates, the performance lapse would be closer to 15% at those load points. The actual correction factor to account for part load operation is highly dependent on the operating requirements of the plant. The plant will operate in response to grid requirements, and accordingly the plant operator does not fully control the plant operational profile. To account for variable and unpredictable operating requirements, the rule should provide at least a 10% allowance as compared with the 5% EPA indicates is built into the proposed rule.

While EPA adjusts its predicted emissions level by 1% for annual range of ambient temperatures, variation across ambient can be as much as 3% in very warm or very cold climates. While the 1% value may well be representative of an annual average for many locations, for others that experience consistent temperature extremes, it is likely too low.[9] In addition, the assumptions in the Design Data Memo for plant operational factors do not account for the range of variability to be expected. The annual emission rate *must* consider startup/shutdown, supplemental duct firing operation, and back-up fuel operation. While these parameters are difficult to quantify, they are real and must be considered in the evaluation of annual emissions. A separate 5% adjustment to account for these operational conditions is needed.

The Design Data Memo also concludes that combined cycle plant efficiencies can be improved by installing more efficient HRSGs and that it is therefore reasonable to impose a 1,000 lb/MWh standard. While the Design

[8] Memorandum from OAQPS to Docket, *Design Data for New Combined Cycle Facilities*, EPA-HQ-OAR-2011-0660-0068 (Design Data Memo).

[9] The assumptions of 5% for degradation, and 125 BTU/KWh for SCR/CO Catalyst are reasonable.

Data Memo is unclear on this point, it appears that this statement is intended to indicate a more efficient steam turbine bottoming cycle, which includes the steam generation by the HRSG, the steam turbine design, and condenser type. The Design Data Memo incorrectly concludes that such improvements are readily feasible for most or all plant designs and that "selection of combustion turbine engine designs would not be affected by this standard."[10] The bottoming cycle is matched to the gas turbine to optimize the overall cycle. While it is true that a triple pressure steam turbine with reheat will be significantly more efficient than a single pressure steam turbine with no reheat, it is not true that it would be relatively simple to install a more efficient steam turbine on many of the gas turbine plant designs. The *Gas Turbine World* performance values would typically include the highest efficiency bottoming cycle that is available for that specific turbine model *but would not represent the range of expected designs*. Certain gas turbine models simply do not have sufficient exhaust thermal energy to gain any advantage by installing a more complex steam turbine. Accordingly, higher efficiency steam turbine bottoming cycle would not be feasible.

Further, using EPA's calculation spread sheet and *assumptions*, EPA is correct that 90% of available NGCC designs can achieve the proposed emission limit. The problem is that if the assumptions are not sufficiently representative (as we explain above), the achievability of the limit is dramatically affected. Indeed, if the assumptions are adjusted by 2% to account for non-optimal site designs, such as the use of a lower water usage condenser technology, like an Air Cooled Condenser (ACC) in arid climates, then ***less than 50%*** of the new combined cycle designs would be able to satisfy the proposed standard of 1,000 lbs/MWh. Moreover, when an additional 5% is included to account for starts, stops, duct firing, and other factors ***less than 35% of the turbines can meet the standard***.

This evaluation further bolsters GE's recommendation that the emission limit should be increased to 1,100 lb/MWh and compels the conclusion that the 1,000 lb/MWh proposed standard is not achievable or demonstrated as required under Section 111. It is at the 1,100 lb/MWh level (not the 1,000 level), that approximately 97% of new combined cycle designs would be able to achieve compliance in light of "real life" plantsite constraints and operational requirements (all of which the statute requires the Agency to consider in setting the emissions limit). *Gas Turbine World* supports this conclusion given that *Gas Turbine World* performance values represent the *best* a plant can achieve newly installed and without degradation.[11] As discussed above, the Design Data Memo's

[10] *Id.*

[11] *Gas Turbine World* data was used as the performance basis for the plants. For this discussion plant performance is specifically referring to plant efficiency. Plant efficiency, heat rate, and CO_2 emissions in lbs/MWh are proportional to one another. While these data are representative of achievable performance for NGCC facilities based on optimal performance configurations, many facilities have less favorable configurations. For example, the *Gas Turbine World* performance values are based on steam turbine condenser capabilities with once through cooling. The use of an air cooled condenser in place of once through cooling (or a cooling tower) significantly reduces

supposition that the 1,000 lb/MWh level can be achieved through higher efficiency HRSGs is simply not true. In sum, to account for all of the above factors, the tolerance must be increased by 10% to account for site and design requirements in the final rule and the limit raised.

C. Failure to establish an achievable standard will lead to higher overall GHG emissions.

Even if this were a close call, which it is not, the Agency should strongly consider establishing a workable limit for these units because when they operate at baseload, they provide significant opportunity for emissions improvement as compared with other technologies. If the emission limits are not considered achievable, however, NGCC will not be installed and higher emitting plants will continue in operation. Section 111(a)(1) explicitly provides for the Administrator's consideration of any nonair quality health and environmental impact and energy requirements in establishing a standard of performance and the environmental impact of relying on established, higher emitting generation is one that should be taken into consideration.

D. If a 1,000 lb/MWh standard is issued, alternative compliance options or exemptions must be provided to satisfy section 111's requirements.

If EPA implements the proposed 1,000 lb/MWh standard it must provide an alternative compliance option for periods in which plants operate at part-load conditions. For example, operations on loads of less than 50% of capacity should not be included in the compliance calculations.

We note that historically, NGCC (along with nuclear and coal technologies) provided power to satisfy baseload demand, while simple cycle gas turbines provided the operational flexibility desired in the grid to counter variations in load forecasts and contingencies. In light of the increased development of renewables, however, NGCCs–with their preferable efficiency levels–are increasingly used for balancing renewables and providing flexibility. NGCCs also have become more flexible as a result, although a combined cycle is inherently not capable of maintaining the same extreme level of flexibility as a simple cycle gas turbine, both economically and operationally. EPA should therefore increase the limit for NGCCs or provide other appropriate alternative compliance options to encourage their use in this manner (with the CO_2 reduction benefits they bring) while also adopting the simple cycle exemption as discussed in detail below.

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water usage in arid climates, at the tradeoff of approximately 1.5% percent degradation in site performance. This degradation varies with ambient and would be higher in hotter climates. Moreover, NGCC plants are moderately less efficient at higher altitudes. A plant installed in Denver (mile high) would have a performance lapse of approximately 0.5% compared to a plant located at sea level.

IV. The Proposed Simple Cycle Combustion Turbine Exemption, Which Is Both Reasonable and Necessary to Ensure Reliability of the Electrical Grid, Must Be Maintained in the Final Rule.

EPA recognizes that because simple cycle turbines do not recover waste heat, have frequent startup and shutdown, frequent partial load operation, high altitude operation, air (as compared with water) cooling, and degradation, simple cycle turbines cannot meet limits in the proposed range.[12] Accordingly, EPA is not including these units under the proposed standards. It is worth noting that without such a provision, there would likely have to be *several* emission limits issued, geared to the different types, classes, and sizes of units as required by Section 111 to provide a standard that is adequately demonstrated, higher than 1,100 lb/MWh, and some *significantly higher than 1,100 lb/MWh*.

A. GE supports issuance of a specific simple cycle turbine definition and exemption.

The proposed rule includes a specific exemption for simple cycle combustion turbines[13] but seeks comment on whether that exemption should be maintained. The rule defines simple cycle combustion turbine as follows:

> Simple cycle combustion turbine means a stationary combustion turbine that which *[sic]* does not recover heat from the combustion turbine exhaust gases for purposes other than enhancing the performance of the combustion turbine itself.[14]

Simple cycle combustion turbine installations must be excluded as EPA has proposed because, as discussed in detail below, the proposed emission limit is not achievable with adequately demonstrated technology given the operating modes required for such turbines. Even the most efficient simple cycle gas turbine, GE's LMS100, is only capable of meeting the proposed limit in a newly installed and non-degraded condition and under optimal operating conditions. Requiring simple cycle gas turbines to meet the NGCC-based limits under normal operating conditions would inhibit their installation and could severely disrupt grid operation and electricity markets. Reduced use of simple cycle turbines could also lead to curtailment of renewable energy and increase net CO_2 emissions. Indeed, if simple cycle turbines were to be covered by this NSPS, a separate emission limit would need to be established to satisfy Section 111's requirements for a standard that has been demonstrated to be achievable in practice. A 1,000 lb/MWhr (or GE's recommended 1,100 lb/MWh) limit does not meet those statutory criteria.

[12] *See* 77 Fed. Reg. at 22,411, 22,431-32, 22,440.
[13] 77 Fed. Reg. at 22,437 (Proposed 40 C.F.R. § 60.5520(d)).
[14] 77 Fed. Reg. 22,440 (Proposed 40 C.F.R. § 60.5580).

Excluding simple cycle turbines is also consistent with the existing regulatory framework. Reciprocating engines (RICE) are currently regulated under NSPS Subparts IIII and JJJJ. Thus they do not fall under the regulatory framework being used for CO_2 for gas turbines, and this would create an unintended consequence.

B. Simple cycle gas turbines are an essential part of the power generation portfolio in that they provide: highly flexible power generation, the ability to manage contingencies in the electrical grid, and necessary backup power.

Simple cycle gas turbine installations are an essential technology solution within the overall electrical generation portfolio. Simple cycle gas turbines have been used for renewable integration and ensuring grid reliability for several decades. These units are highly flexible and capable of: rapid starts and stops; multiple start and stop cycles per day; ramping up and down with load to maintain frequency of the electrical grid; providing voltage regulation service by participating in ancillary services; and providing electricity to the grid within a few minutes. In addition, these units can be installed in a much shorter timeframe than NGCC units to meet newly arising demand increases or replace plant retirements.

Simple cycle plants operate under a different maintenance philosophy that is highly valued by operators of flexible units. Due to their enhanced flexibility, they are used to maintain grid frequency and voltage in addition to providing contingency power when there is loss of generating units. For these reasons, simple cycle gas turbines are widely used throughout the country to ensure reliability of the electrical grid.

C. NGCC Installations, while flexible, cannot substitute for simple cycle.

While NGCC installations are also capable of rapid start and deployment, they are not nearly as agile as simple cycle units. Because of the added complexity of the associated steam cycle, a combined cycle plant is unable to respond as quickly and flexibly as a simple cycle turbine. Further, while many simple cycle units are capable of multiple start and stop cycles per day, frequent start and stop cycles of NGCC facilities also induce significant thermal stress and associated operational cost and reliability tradeoffs which must be considered in the plant operation.

Simple cycle gas turbines are critical to grid stability by supporting highly volatile, intra-day or minute-to-minute peaking scenarios, resulting from errors in forecasting, integration of an increased amount of zero emissions renewables, and unanticipated events resulting from loss in generation or load. In addition, these gas turbines are used to maintain the quality of electricity generation

through voltage, frequency regulation, and backup generation which are used to meet stringent North American Electric Reliability Corporation (NERC) and Independent System Operator (ISO) guidelines. GE has continually invested in technology improvement to reduce the carbon footprint by achieving best-in-class efficiencies. Utilization of these simple cycle gas turbines enhances the reliability of the electric grid, promotes the integration of an increased amount of renewables, and reduces the total amount of CO_2 emissions generated by the replacement of low efficiency assets with higher efficiency, natural gas burning gas turbines.

The increased flexibility of simple cycle units in comparison with NGCC units is reflected in the operation of the power market. NGCC units typically bid in the previous day for generation on the following day, while simple cycle units can bid on the same day—a mere hour ahead of the demand. In contrast, it would be prohibitively expensive for traditional NGCC to bid on the same day. In short, NGCC plants are able to respond to grid variability demands, while simple cycle units can provide another layer of flexibility for rapid starts, stops, and grid fluctuations on a smaller scale than NGCC can provide. This means that any final rule needs to ensure that simple cycle turbines can continue to play the vital role they currently play in the power generation portfolio.

In sum, both NGCC *and* simple cycle gas turbines are essential with simple cycle units being critical to provide grid stability and balancing power to enable the continued deployment of renewable electric generation. The best technology deployment at specific electric generating installations must be dictated by the electric grid requirements for that installation, not by regulatory limitations that could prove disruptive.

D. The importance of maintaining the broad simple cycle exclusion from the rule is underscored by the fact that the proposed EGU definition exempting units that supply less than 2,900 hours to the grid is insufficient to address simple cycle units.

The proposed rule exempts any EGU that supplies less than one-third of its potential electric output capacity (2,900 hours) to the grid.[15] EPA requests comment on whether this output requirement in the definition would make the simple cycle exemption unnecessary:

> The potential electric output requirement in the definition of electric generating unit would already exclude facilities with [a] permit restricting *[sic]* limiting operation to less than 1⁄3 of their potential electric output, approximately 2,900 hours of full load operation annually. The peaking season is generally considered to be less than 2,500 hours annually, and we are requesting comment on if

[15] 77 Fed. Reg. at 22,439 (Proposed *Electric generating unit definition at* 40 C.F.R. § 60.5580).

the capacity factor exemption is sufficient such that specifically exempting simple cycle turbine is unnecessary.[16]

EPA justifies the simple cycle gas turbine exemption in part by stating that most simple cycle turbines operate in a peaking capacity and as a result would not generate power in excess of one-third of its potential electric output capacity (less than 2,900 hours in any year). While it is true that a majority of simple cycle turbines do not operate in excess of one-third of their annual capacity, there are likely to be specific installations and operating periods in which a plant would require the flexibility to operate for annual hours in excess of one-third of its potential electric output capacity. Simple cycle units are typically permitted for more hours than the expected operating scenario in order to address precisely those uncertainties for which they are installed. This may be especially true when simple cycle units are increasingly used to support renewable generation. As a result, it is likely that utilities will simply forgo ordering many simple cycle gas turbines because accepting a permit restriction of 2,900 hours would not fit with operational plans and cost needs. The final rule should include both the simple cycle definition and the specific simple cycle exemption in order to ensure that new simple cycle units can provide the needed operational flexibility.

E. The proposed range of 950 to 1,100 lb/MWh does not reflect BSER for simple cycle turbines.

As noted above, the simple cycle exemption is essential because of the critical role these units play in electric grid reliability. In addition, EPA faces significant legal constraints in defining simple cycle units as affected units. Section 111 of the Clean Air Act requires EPA to develop a "standard of performance" that reflects the degree of emission limitation achievable through the application of BSER, taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements that the Administrator determines has been "adequately demonstrated".[17] In developing the standard, EPA reviewed several natural gas- and coal-fired technologies and controls, including NGCC, supercritical coal-fired boilers, and CCS.[18] EPA did not evaluate, nor has it found that this proposed standard is adequately demonstrated by, simple cycle turbines.[19]

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[16] 77 Fed. Reg. at 22,431-32.
[17] Clean Air Act §111(a)(1)
[18] 77 Fed. Reg. at 22,417 -18.
[19] One example of a unit that would be adversely affected is a unit being installed to meet anticipated electricity demand growth in Florida. GE EFS Shady Hills is developing a 400 MW expansion project at adjacent to the Shady Hills power plant that will utilize two new GE 7FA.05 simple cycle combustion turbines. EFS Shady Hills was issued a PSD permit on April 6, 2012, and the company is in the process of applying to EPA Region IV for a GHG BACT determination. EFS Shady Hills expects to receive a GHG BACT determination by Q2 2013 or sooner, and could potentially start construction on the expansion project as early as Q4 2013.

Although the proposed standard may be achievable by some of the most efficient simple cycle turbines under optimum load and ISO conditions, a variety of real world operating factors make the standard unachievable. Simple cycle turbines critical role as peak and back up power units mean they often operate at reduced loads and are called upon to quickly ramp up and down production. Operation at reduced loads is less efficient for any unit. For example, while a full load can achieve 43 percent efficiency, operation at 50 percent load can reduce efficiency to 39 percent and increase carbon emissions by 10 percent. Similarly, load cycling can also lead to inefficiencies. The performance of simple cycle units is also decreased when they operate on backup oil during times when natural gas is unavailable.

If EPA were to remove the simple cycle turbine exemption or impose an operating hour restriction, EPA would be required to establish a separate standard for simple cycle units that reflects day-to-day in-use performance of an array of simple cycle units.

F. The simple cycle turbine exemption does not provide an incentive to install simple cycle in place of NGCC.

The proposal also requests comment on whether the simple cycle exemption would provide a "perverse incentive" to build simple cycle units in lieu of NGCC:

> We are also requesting comment on whether the exemption would provide a perverse incentive to build less efficient simple cycle combustion turbines in order to avoid applicability with the proposed rule. While few existing simple cycle turbines presently generate greater than 1/3 of their potential electric output for sale, we are requesting comment on whether the exemption for simple cycle turbines would result in the greater use of simple cycle turbines for intermediate load applications when more efficient combined cycle facilities would have otherwise been built.[20]

There is no reasonable basis to conclude that the exemption for simple cycle turbines would incentivize parties to install simple cycle turbines in place of NGCC. Grid demands and energy market needs will dictate the technology choice. There are a range of factors that influence specific gas turbine technology choice, including, but certainly not limited to, overall energy demand, demand load profile, demand variability (seasonal, daily, and instantaneous variability), renewable penetrations, fuel availability, transmission constraints, and siting constraints. NGCC units are more efficient and will remain the technology of choice for intermediate and base load applications. In contrast, simple cycle units used to support renewable and to provide needed operational flexibility to the grid will fulfill an important role that cannot be cost-effectively met

[20] 77 Fed. Reg. at 22,432.

with NGCC. As a result, a reasonable and achievable emission requirement for NGCC will not provide a disincentive for NGCC plant installation or an incentive for simple cycle installation.[21]

G. The simple cycle exemption will not delay the installation of the heat recovery steam generator portion of NGCC.

The proposed rule also seeks comment on whether exempting simple cycle units will encourage plant owners to delay installing the heat recovery generator to their NGCC units:

> In addition, it is our understanding that combined cycle facilities are sometimes built in stages with the combustion turbine engine installation occurring first and the heat recovery steam generator being installed in later years as electricity demand increases. We are requesting comment on whether the exemption would potentially delay the installation of the heat recovery steam generator portion of new combined cycle facilities.[22]

The simple cycle exemption should not delay the installation of the heat recovery generator. The real value of NGCC is the fuel savings and efficiency realized when compared to electricity produced from simple cycle units. In the daily operation of electric generating plants, this is a sufficiently significant incentive to ensure use of NGCC whenever a fuel savings and higher efficiency can be realized in electricity production. Given the significant advantages of NGCC in saving fuel and lowering costs, the simple cycle exemption will not delay the installation of the heat recovery steam generator. This is especially true if EPA sets a appropriate emission level for NGCC units of 1,100 lbs/MWh that reflects the daily operational conditions of NGCC units. A tighter standard may have the perverse effect of encouraging greater use of simple cycle which would increase CO_2 emissions overall.

H. NGCC plants with a by-pass stack must not be subject to the standard when operated in simple cycle mode.

The proposal defines simple cycle and combined cycle units but does not recognize that units may be installed with bypass stacks that are capable of operating in either simple or combined cycle mode. Operation in simple cycle mode may be dictated by electric generation demands for flexible power generation or to allow gas turbine operation during periods while the steam

[21] For today's combined cycle with a bypass stack, simple cycle operation is much less economical to operate in steady state mode and facilities tend to operate in combined cycle mode with the simple cycle mode as an option for increased flexibility when demanded and increased reliability in the event the steam cycle is not available Permitting scenarios are unlikely to permit unlimited operation of a combined cycle unit in simple cycle mode (*e.g.,* the same amount of fuel would be required to generate 120 MW in simple cycle mode that could generate 180 MW).
[22] 77 Fed. Reg. at 22,432.

turbine bottoming cycle is unable to operate, such as during maintenance operations. Periods in which a plant with a bypass stack operates in simple cycle mode (when the gas turbine exhaust gas bypasses the heat recovery steam generator), must be treated as simple cycle operation and be exempt from the emission standard. EPA could implement this recommendation by amending the definition of "simple cycle turbine" as follows:

> Simple cycle combustion turbine means a stationary combustion turbine that which *[sic]* does not recover heat from the combustion turbine exhaust gases for purposes other than enhancing the performance of the combustion turbine itself. A combined cycle turbine shall be considered a simple cycle turbine when operating in simple cycle mode by bypassing the heat recovery steam generated through use of a bypass stack.

V. While Carbon *Capture* Is Achievable Now, EPA Should Provide Flexible Compliance Periods to Reduce Uncertainties Related to Sequestration That May Prevent Investment and Technology Advancement.

As carbon sequestration technologies are being developed, flexibility in the annual compliance period should be provided to assist units in dealing with fluctuations in market demand for CO_2. The proposed rule provides a 30-year compliance period for sources which will utilize a CCS system. These units must meet an average of 1,800 lbs/MWh each year for the first ten years from issuance of the rule and an average of 600 lbs/MWh each year for the remaining 20 years of the 30-year compliance period. The unit must meet 1,000 lbs/MWh over the 30-year averaging period.[23]

Current CO_2 sequestration and utilization technologies have an uneven demand that prevents a carbon capture plant from achieving a predictable schedule of geologic disposition of its captured carbon. For example, the CO_2 demand and capacity at enhanced oil recovery production facilities is likely to vary over the period of recovery operations. An oil field's demand for CO_2 from a dedicated CO_2 capture plant will be highest during the early years of operation and fall off as CO_2 emerges and the recycling of CO_2 increases. Enhanced oil recovery operations also will typically alternate usage of water and CO_2 to optimize recovery and CO_2 storage capacity. Absent the option for an extended compliance averaging period, EGUs or combined heat and power (CHP) EGUs will not have flexibility to continue revenue-generating operation while remaining in compliance.

Because of these practical, real world constraints, EPA should provide the option for flexible compliance periods that are:

[23] 77 Fed. Reg. at 22,436 (Proposed Rule 40 C.F.R. § 60.5520(b)).

1) based on multi-year commercial arrangements between the CO_2 producer and offtaker; and
2) will meet the lb/MWhr emission standard over the contract period.

For example, such approval should allow for an EGU to operate at a CO_2 emissions intensity lower than proposed 1,000 lb/MWh for an initial portion of the compliance period followed by potential periods of operation at an annual intensity that may exceed 1,000 lb/MWh. This would recognize the injection profiles for enhanced oil recovery projects that exhibit reduced demand as CO_2 recycling increases. For compliance/contractual periods that are less than 30 years, an EGU would be required to enter into additional sequential CO_2 offtake contracts. As new contractual obligations are entered into for the offtake of CO_2, the compliance period will be extended until the end of the 30-year period is reached.

VI. EPA Should Amend the Key Provisions of the Rule to Ensure that IGCC Can Be Used Under the Alternative Compliance Option.

A. EPA should clarify the definition of integrated gasification combined cycle electric generating unit to include the heat recovery steam generator.

The proposed rule defines an IGCC EGU as:

> Integrated gasification combined cycle electric utility means a An electric utility combined cycle gas turbine combined cycle that is designed to burn fuels containing 50 percent (by heat input) or more solid-derived fuel not meeting the definition of natural gas. The Administrator may waive the 50 percent solid-derived fuel requirement during periods of the gasification system construction or repair. No solid fuel is directly burned in the unit during operation.[24]

This definition may be read to refer only to the gas turbine and not the integrated HRSG and steam turbine. Excluding the steam turbine's power output from IGCC output calculations would reduce gross output of the unit by approximately 35 percent resulting in an increased rate of CO_2 emissions in lb/MWh without increasing *actual* CO_2 emissions. This would result in artificially low efficiency numbers for IGCC gas turbines units that share a common steam turbine. The definition of IGCC should be corrected to read:

> Integrated gasification combined cycle electric utility means an electric utility ~~combined cycle~~ gas turbine *combined cycle* that is designed to burn fuels containing 50 percent (by heat input) or more solid-derived fuel not meeting the definition of natural gas.

[24] 77 Fed. Reg. at 22,440 (Proposed Rule 40 C.F.R. § 60.5580).

> The ~~Administrator may waive the~~ 50 percent solid-derived fuel requirement is waived during periods of ~~the~~ gasification system startup, construction, or repair and during periods when the transport and storage systems for captured CO_2 are not available. No solid fuel is directly burned in the unit during operation.

Gas turbines employed in IGCC plants have dual fuel capability. This means they are able to fire on either 100% coal-derived synthesis gas (syngas) or natural gas, or combinations thereof (co-firing) from 10% to 100% of either natural gas or syngas. With respect to startup, IGCC turbines require that only natural gas be used up to approximately 30% of full load before commencement of firing on syngas. This operational restriction is necessary to prevent damage from combustor flashback and flame-holding at the combustor head that can occur due to the hydrogen in syngas.

The capability of IGCC turbines to use 100% natural gas also provides a unique ability for an IGCC plant to continue power generation in the event that disposition of its captured CO_2 to either sequestration or enhanced oil recovery facilities is either significantly curtailed or interrupted. When operating on natural gas, the IGCC combined cycle is able to achieve the CO_2 standard for conventional natural gas combined cycle units. Including this as an acceptable mode of operation in the rule will help to mitigate some of the risks of CCS that are external to the IGCC plant itself while assuring compliance with the rule's performance standard.

The IGCC definition may also be read to refer to only one turbine. IGCC turbines, similar to NGCC units, are commonly configured to have multiple gas turbines sharing a common steam turbine. Under Subpart KKKK, emissions from multiple gas turbines sharing a common steam turbine are combined for compliance determinations. The proposed rule should contain a similar provision for IGCC and NGCC units. A section should be added to 40 C.F.R. § 60.5520 stating:

> Multiple gas turbines with separate exhaust stacks sharing a common steam turbine shall determine compliance with the standard by measuring the combined emissions from their stacks, or fuel usage.

B. EPA should also amend the applicability requirements for the alternative compliance option under proposed § 60.5520(b) to specifically allow IGCC units as they are defined in the rule to qualify.

As currently drafted, the alternative 30-year compliance option under proposed § 60.5520(b) would make IGCC units, as proposed to be defined, ineligible for this alternative compliance option. IGCC is defined under proposed

§ 60.5575 as a unit "designed to burn fuels containing 50 percent or more solid *derived* fuel not meeting the definition of natural gas." The preamble refers to IGCC as an option that may be used to meet the standard for the first ten years of the 30 year compliance period that use solid derived fuel or that burn natural gas along with coal and solid derived fuels.[25] This statement, however, is not consistent with the provisions in the proposed rule governing the 30-year option. Specifically, the alternative compliance option provided under proposed § 60.5520(b) would only allow IGCC utilizing CCS if the affected EGU uses "*coal or petroleum coke* for fuel and is designed to allow installation of a CCS system."

As noted above, this applicability requirement conflicts with the definition of IGCC as a unit that is "designed to burn fuels containing 50 percent or more solid derived fuel not meeting the definition of natural gas." As a result, many IGCC units that burn some natural gas or solid derived fuels would seem to be ineligible for the 30-year alternative compliance option. Proposed § 60.5520(b) should therefore be revised to allow IGCC units that burn *solid derived fuel* and allow for the use of up to 50 percent natural gas.

VII. The Final Rule Should Include a Cumulative Rolling Sum That Will Accurately Represent Emissions and Proportionately Weigh Periods of High Emissions and Low Generation.

The proposed rule requires sources to sum the hourly CO_2 emissions for the operating month and divide by the total hourly gross energy output for that month. A more accurate representation of the CO_2 emission performance of an EGU is calculated through a rolling 12 month sum that measures compliance at the end of each month by summing all emissions (lbs CO_2 emitted) over the prior 12 months, and dividing by the total generation (MWh) over the same period. This calculation method will provide a true representation of the annual performance of an EGU by appropriately weighting periods of lower generation output.

As proposed, the monthly quotient is added to the previous 11 operating month quotients and divided by 12 to determine a 12 month rolling average.[26] This proposed calculation will weight each monthly average evenly and potentially result in significant distortions to the emissions performance of the EGU by giving disproportionate weight to high emission/low generation periods. For example, a plant may run for only 2 hours in a given month with a CO_2 emission level of 1200 lb/MWh CO_2 and the following month run continuously each day for a total of 720 hours of operation and have an emission level of 950 lb/MWh. Under the proposed rule, this would result in an inaccurate average of 1075 lb/MWh for that 2 month period. If the average were calculated by adding the total lbs of CO_2 and dividing by the total MWh over the two month period, the emission rate would be 951 lb/MWh. This value represents the true average of

[25] 77 Fed. Reg. at 22,406.
[26] 77 Fed. Reg. at 22,438 (Proposed Rule 40 C.F.R. § 60.5540).

this operating period. The 12 monthly rolling CO_2 average must be revised to be calculated based on the total CO_2 emissions divided by the total MW-hrs of generation calculated on a monthly basis.

VIII. A Gross Output Standard Should Be Adopted Over a Net Output Standard.

EPA proposes the use of a gross output based emission standard, but solicits comments on a net output based standard. EPA should adopt a gross output standard over a net output standard for several reasons: With respect to reducing regulatory reporting burden, a net basis would be inconsistent with the gross output reporting requirements for CO_2 under 40 C.F.R Part 75. Also, at this stage of CCS development preceding first-of-a-kind deployment of integrated carbon capture in coal plants, there are many candidate technologies and process configurations that will have varying net-to-gross output ratios. If it were to adopt a net output standard and not jeopardize the advancement of CCS, EPA would need to accommodate the various capture technologies, types of coal, types of coal plants and other environmental factors that determine net output. Given that there are no coal plants in operation with integrated carbon capture, there is no data to fully validate net-to-gross corrections or especially how these will change over time.

Differences in basic technology and process configurations will require either a burdensome case-by-case determination of net-to-gross output corrections to derive appropriate net-based standard levels, or alternatively, identifying and segregating auxiliary loads between those that are, or are not, used to generate additional output or enhance performance. An example of the latter would be the apportionment of oxygen separation load to a Claus unit producing sulfur or sulfuric acid as a useful byproduct in an IGCC plant. Difficulty in apportionment will be compounded in cases where IGCC is configured as a poly-generation unit producing a saleable fuel or chemical product in addition to providing electrical output to the grid. Moreover, the gross methodology does not factor into the emissions rate added parasitic loads from emissions control retrofits. In addition to avoiding the complexity and cost of installing and maintaining remote power metering equipment, gross output is conveniently measured, monitored and consistent with reducing regulatory reporting burden.

IX. Because Fuel Monitoring Meets Clean Air Act Compliance Requirements and Does Not Involve the Measurement Uncertainties and Costs of Continuous Emission Monitors, the Rule Should Adopt Fuel Sampling as an Independent Compliance Method.

Proposed § 60.5540 provides two options for demonstrating compliance and determining excess emissions with the CO_2 emissions limit. Under proposed § 60.5540(a) a facility may use a CO_2 continuous emissions monitoring system (CEMS) and under proposed § 60.5540(b), a facility may use “fuel sampling” to

demonstrate compliance using a monthly F factor and monthly fuel consumption. EPA seeks comment on whether the use of CO_2 continue emission monitoring systems (CEMS) including stack gas flow rate monitoring should be required for all new affected facilities, including those burning exclusively natural gas and/or distillate oil.[27]

The fuel sampling approach should be maintained as an option in the final rule. Fuel sampling is an accurate alternative to CEMs and should be adopted. In its *Mandatory Reporting of Greenhouse Gases* rulemaking, EPA found that CEMS were not required to provide sufficiently accurate data, stating that the rule provided a "relatively high degree of certainty" while also taking "advantage of existing practices at facilities."[28] Thus, not requiring CEMS for all units subject to this rule would be consistent with EPA's practice under other regulations. Moreover, the determination of CO_2 emissions through monitoring of fuel combustion and periodic fuel sampling is actually far superior to CEMS for several reasons. The calculation of CO_2 emissions through the measurement of fuel consumption is far more accurate than corresponding measurements using a CEMs system because it measures fuel flow and assumes all carbon in the fuel is oxidized to CO_2. The calculation of CO_2 emissions is a stoichiometric calculation of each carbon entering the equipment in the fuel will be emitted from the stack as CO_2. In addition, plant owners and operators have a strong incentive for accuracy in measuring fuel because plants are charged for fuel consumption.

In contrast, with CEMs there are inherent calculation uncertainties, especially during periods of transient operation (*i.e.,* starts, shutdowns, and rapid load changes). To develop an accurate mass emission rate estimate, CEMs must measure CO_2 concentration and volumetric flow rate of the gas in the exhaust stack. Most commercially available CEMS systems generate data on a one-minute average basis, and under current EPA CEMS Performance Specifications, only one valid reading is required every fifteen minutes. Plant operational parameters, especially for NGCC plants, vary significantly within a 15 minute, or even 1 minute period, data generated during these events will be highly suspect and could have significant, and unquantifiable, uncertainty. Use of CO_2 CEMS also adds another monitoring system which results in additional cost and equipment to maintain and routinely certify. The measurement of CO_2 based on fuel flow is simpler and inherently more accurate because there are less sources of uncertainty.

We also note that proposed § 60.5535(c) needs clarification. It reads:

> If you determine the your affected EGU's CO_2 mass emissions rate by monitoring fuel combusted in the affected EGU and periodic fuel

[27] 77 Fed. Reg. 22,430.
[28] *Mandatory Reporting of Greenhouse Gases, Proposed Rule,* 74 Fed. Reg. 16,448, 16,475 (Apr. 9, 2010).

> sampling as allowed under § 60.5525(c)(2), you must use the procedures specified in 40 CFR part 75, appendix G.[29]

Although this section seems to allow fuel consumption monitoring, for authority it refers to § 60.5525(c)(2) which does not exist in the proposed rule. EPA should clarify this section of the rule to confirm that fuel consumption monitoring is an acceptable approach.

X. EPA Should Adopt an Exemption for Combustion of Waste Fuels Such as Blast Furnace Gas and Refinery Fuel Gas.

Included in the definition of "gaseous fuel" are refinery fuel gas, process gas, and coke oven gas.[30] Given the extensive programs the agency has adopted to encourage the recovery of such gases and use for power generation, it would be inappropriate for EPA to subject these fuels to the requirements of this rule. EPA should adopt an exclusion for any process byproduct gases that are not produced for the purpose of electrical generation, including, but not limited to refinery fuel gas, process gas, blast furnace gas, landfill gas, and coke-oven gas.

These "waste" gases are generated as part of industrial processes or from natural decomposition in landfills and, if not combusted for energy, would be alternately disposed of in some manner—most likely through flaring. The utilization of this same fuel in a gas turbine to generate electricity would result in the same CO_2 emissions as alternate combustion but instead provides the benefit of utilizing this thermal capacity produce energy. Further, this generation would displace the need for other thermal electric generation resulting in a net reduction in CO_2 emissions.[31]

We note that process gases are commonly co-fired with natural gas. Installations in which there is not a sufficient supply of process gas, or, where the process gas alone does not have sufficient energy density. Alternately, a process gas may be fired in supplemental duct burners to enhance steam production. EPA could allow for the exemption of process gas during co-firing and provide for compliance demonstration through fuel sampling. Compliance of CO_2 emissions during co-firing should be based solely on the natural gas usage and could be readily demonstrated through natural gas fuel consumption. As noted, such an approach would promote beneficial use of an otherwise waste fuel, consistent with historic EPA's policies on waste fuels.

[29] 77 Fed. Reg. at 22,437 (Proposed Rule 40 C.F.R. § 60.5535(c)).
[30] 77 Fed. Reg. at 22,439 (Proposed Rule § 60.5580).
[31] Fuels specifically created from a process for the purpose of generating electricity, such as in the case of IGCC, would be included.

XI. EPA Should Provide for Compliance Calculated as an Average of All New Electric Generating Units at a Single Plant.

GE recommends the emission limitation be applied as an average of all electric generating units at a single installation. The average emission limit across units would provide additional compliance flexibility. A unit average will also simplify the determination for combined cycle installations in which multiple gas turbines with their associated heat recovery boilers supply steam to a single steam turbine. For these installations, the total site electrical output would be the combined output from each gas turbine and the steam turbine. The limit must apply to the average of all gas turbine stacks to simplify the allocation of the steam turbine output in determining a per unit emission compliance value.

XII. CHP Facilities Where Useful Thermal Output Accounts for 20 Percent of the Total Useful Output Should Be Excluded from This Rule.

The proposed exemption of CHP units would recognize the environmental benefits of CHP. CHP units are environmentally beneficial and this exemption would encourage new units without adversely affecting CO_2 emissions. CHP plants operate in a similar manner to the NGCC units. The thermal energy from CHP plants can be diverted to either energy production (kWh) or to thermal loads (heating and cooling). The regulatory challenge of quantifying the equivalence of the thermal energy used in terms of kWh to determine compliance with the proposed NSPS would be immense and impractical. Because of that complexity, CHP and cogeneration facilities should be exempt.

XIII. The Pollution Control Project Exclusion Should Not Be Eliminated.

EPA solicits comment on eliminating the pollution control project exclusion under the NSPS, 77 Fed. Reg. at 22,421, in light of a D.C. Circuit decision under the New Source Review/PSD programs, *New York v. EPA*, 413 F.3d 3, 40 (D.C. Cir. 2005). EPA should not eliminate this exclusion for NSPS purposes. As the Supreme Court has noted, the purposes of the NSPS and NSR/PSD programs are different from one another, *Environmental Defense v. Duke Energy Corp*., 549 U.S. 561, 576-81 (2007), and the term *modification* can be defined differently in these programs. The exclusion ensures that changes that reduce emissions and provide significant environmental benefits are not discouraged because of a minor collateral increase in another pollutant.

The *New York* case did not indicate that the Court there even considered the NSPS program and its purposes and no one challenged the exclusion in the Part 60 General Provisions or in numerous NSPS rules. Such challenges needed to be brought within 60 days from promulgation or from the date that new grounds arose. No one brought such a challenge and industry has relied on this exclusion for many years. Because this provision exclusion remains sound both from a policy and from a legal perspective. It should not be changed.

XIV. The Proposed Rule should be Revised to Include Language Clarifying that the Final Standard Included in this Rule for NGCC Does Not Apply to PSD Permits for Simple Cycle Units.

NSPS standards are generally considered the "floor" for PSD permits. EPA should include language in the rule to ensure that the regional permitting authorities are not interpreting the standard as a limit for simple cycle turbines. The comments regarding simple cycle turbines have created ambiguity in the marketplace, leading to uncertainty about what standards will apply for simple cycle. EPA needs to state clearly that simple cycle turbines are excluded from this rule.

XV. EPA Should Include Explicit Regulatory Language in Part 52 PSD Regulations to Clarify that Regulation of CO_2 Under Section 111 Triggers the Tailoring Rule GHG Emission Thresholds.

The proposed rule regulates GHG for the first time under CAA § 111. Under EPA's current interpretation of the CAA, this action triggers the applicability of PSD to GHG emissions and potentially cancels the increased GHG applicability thresholds enacted under the Tailoring Rule. PSD regulations define the term "major stationary source" as a "stationary source of air pollutants which emits, or has the potential to emit, 100 [or 250] tons per year or more of *any regulated NSR pollutant."*[32] The regulatory definition of NSR pollutant contains four triggers: 1) any pollutant or precursor with a NAAQS; 2) *any pollutant subject to a standard promulgated under § 111*; 3) any Class I or II substance under Title VI; and 4) any pollutant *subject to regulation*.[33] Only the fourth trigger incorporates the Tailoring Rule "subject to regulation" language raising the GHG threshold to 100,000/75,000 tpy of GHG.

EPA believes that a statement included in the preamble to the Tailoring Rule extends the increased GHG thresholds to the § 111 trigger. This statement explains that the Tailoring Rule thresholds apply to all "major stationary source[s]" not just the fourth prong of the NSR pollutant definition.[34] While EPA proposes to revise the NSPS regulations to confirm this interpretation, these regulations were not included in the proposed GHG NSPS standard.[35] EPA advises states with approved GHG SIPs to take the position that their current SIP incorporates EPA's Tailoring Rule interpretation. Just in case, EPA expects to proceed with a separate rulemaking to narrow approval of SIPs to exclude GHGs below the 100,000/75,000 tpy threshold.[36]

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[32] 40 C.F.R. 51.166(b)(1)(i)(a).
[33] 40 C.F.R. 51.666(b)(49).
[34] 77 Fed. Reg. at 22,429 (Citing *Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule; Final Rule,* 75 Fed. Reg. 31,514, 31582 (Jun. 3, 2010)).
[35] *Id.* at 22,429.
[36] *Id.*

To remove any legal uncertainty regarding the application of the Tailoring Rule, EPA should include regulatory language in the Part 52 PSD regulations that the Tailoring Rule thresholds apply to the regulation of CO_2 triggered by CAA § 111.

CONCLUSION

GE appreciates the opportunity to provide these comments and seeks to work with the Agency to achieve a final rule that promotes efficient electric generation using advanced technologies that meet the full range of the country's electric generation needs. Please contact Larry Boggs at larry.boggs@ge.com or 202.637.4126 with any questions regarding these comments.