

PROPOSED GREENHOUSE GAS REGULATIONS FOR POWER PLANTS

**NSPS SUBPART TTTT_a
AND SUBPART UUUU_b**



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Agenda

- 1** Introduction
- 2** Proposed Rule for New Sources (TTTTa) Highlights
- 3** Proposed Rule for Existing Sources (UUUUb) Highlights
- 4** Next Steps with the Regulations
- 5** Q&A



NSPS SUBPART TTTT_a

New EGUs



NSPS Subpart TTTT a – Applicability



Combustion Turbines



Commence construction or reconstruction after:

May 23, 2023

Has a baseload of fossil fuel greater than:

250 MMBtu/hr

Serves a generator capable of selling electricity greater than:

25 MW

Commenced per 40 CFR 60.2 is defined as:



"...an owner or operator has undertaken a continuous program of construction or modification or that an owner of operate has entered into a contractual obligation to undertake and complete...a continuous program of construction or modification."



*Reconstruction:
modifications that
that cost more than
50% the cost of a
whole new emission
unit*

Subpart TTTT Categories for Turbines



- ▶ EPA defined three categories for combustion
 - Rule does not define the three categories as “baseload, intermediate and low load,” but only defines them specifically with the definitions provided.
- ▶ Definitions relate to annual and 3-year rolling capacity
- ▶ Utilizes a similar definition as existing Subpart TTTT regulation



Combustion Turbine Categories



“Baseload”

- “Supplies more than its efficiency on both a 12-operating month and 3-year rolling average basis”
- Capacity **greater** than:
 - ~45-55% Combined cycle
 - ~30-35% Simple cycle

“Intermediate”

- Capacity more than 20%, AND
- Capacity **less** than:
 - ~45-55% Combined cycle
 - ~30-35% Simple cycle

“Low Load”

- Less than 20% capacity factor

Subpart TTTTa Limits for Turbines – Low Load



*Low
Load*

<20%
capacity

- ▶ **120-160** lb/MMBtu CO₂
- ▶ No CO₂ monitoring requirements
- ▶ Compliance via fuel records
- ▶ Similar to current Subpart TTTT rules



*Intermediate
Load*

>20% to ~35%
capacity
Simple Cycle

>20% to ~50%
capacity
Combined Cycle

OPTION 1 (co-combustion of hydrogen):

- Before January 2032
 - ▶ **1,150** – 1,530 lb CO₂/MWhr gross (12-operating month averages); AND
- After December 2031
 - ▶ **1,000** – 1,290 lb CO₂/MWhr gross (12-operating month averages)
- Does not specifically require co-combustion of hydrogen

Subpart TTTTa Limits for Turbines – Baseload



Baseload

OPTION 1 (carbon capture option):

- *Before January 2035*
 - **770**-1,200 lb CO₂/MWh gross
- *After December 2034*
 - **90**-130 lb CO₂/MWhr gross

OPTION 2 (co-combustion of hydrogen option):

- *Before January 2032*
 - **770** to 1,200 lb CO₂/MWhr gross
- *After December 2031 and before January 2038*
 - **680** – 1,100 lb CO₂/MWhr gross
- *After December 2037*
 - **90**-130 lb CO₂/MWhr gross
- **All are 12-operating month averages**

> 50%
capacity

Combined Cycle

> 35%
capacity
Simple Cycle

Subpart TTTTa Limits for Turbines - Notes



- ▶ Only the limits (lb CO₂/MW-hr) are listed as requirements (along with monitoring, etc)
 - No requirements to install carbon capture or to co-combust hydrogen
- ▶ ONLY low-GHG hydrogen is allowed if being used to comply with emission limits.
 - Low-GHG hydrogen <0.45 kg CO₂e/ kg H₂ as
 - Well-to-Gate GHG via GREET
- ▶ Lowest limits are for natural gas combustion
 - Sliding scale limit determined via equations in the rule
 - Not required to include H₂ when co-combusting





NSPS SUBPART UUUUB

Existing EGUs



NSPS Subpart UUUUb – Emission Guidelines for Existing Turbines



► Existing EGUs

- Coal, oil and gas-fired boilers; combustion turbines

► Excluded EGUs

- NG-fired combustion turbines equal to or less than 300 MW
- NG-fired combustion turbines more than 300 MW with capacity factor less than or equal to 50%
- New or reconstructed EGUs subject to NSPS Subpart TTTT
- Modified EGUs commencing modification after the TTTTa applicability date
- Steam generating units subject to limiting net-electric sales to 1/3 or less potential electric output or 219,000 MWh or less on annual basis
- Units less than 25 MW

NSPS Subpart UUUUb – Emission Guidelines for Existing EGUs – Coal



Imminent-term existing coal-fired steam generating units

- ▶ Elected to commit to permanently cease operations **before January 1, 2032**
- ▶ BSER: routine methods of operation
- ▶ Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)



Near-term existing coal-fired steam generating units

- ▶ Permanently cease operations by a date after **December 31, 2031, and before January 1, 2035**
- ▶ Commit to adopt an annual **capacity factor limit of 20 percent**
- ▶ BSER: routine methods of operation
- ▶ Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)

NSPS Subpart UUUUb – Emission Guidelines for Existing EGUs – Coal



Medium-term existing coal-fired steam generating units

- ▶ Permanently cease operations **after December 31, 2031, and before January 1, 2040**
- ▶ Not near-term units
- ▶ BSER: natural gas co-firing at 40% of the heat input to the unit
- ▶ Emission limitation: 16% reduction in emission rate (lb CO₂/MWh-gross)

Long-term existing coal-fired steam generating units

- ▶ No enforceable commitments to cease operations by **January 1, 2040**
- ▶ Best system of emission reduction (BSER): carbon capture and storage (CCS) with 90% capture of CO₂
- ▶ Emission limitation: 88.4% reduction in emission rate (lb CO₂/MWh-gross)

NSPS Subpart UUUUb – Emission Guidelines for Existing EGUs – Categories (Oil)



Baseload continental existing oil-fired steam generating units

- ▶ Oil-fired steam generating units with an annual capacity factor $\geq 45\%$
- ▶ BSER: routine methods of operation and maintenance
- ▶ Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)
- ▶ Presumptive annual emission rate of **1,300 lb/MWh-gross**

Low load (continental + non-continental) existing oil-fired steam generating units

- ▶ Oil-fired steam generating units with an annual capacity factor $< 8\%$
- ▶ No BSER or emission limitation requirements

Intermediate load continental existing oil-fired steam generating units

- ▶ Oil-fired steam generating units with an annual capacity factor $\geq 8\%$ and $< 45\%$
- ▶ BSER: routine methods of operation and maintenance
- ▶ Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)
- ▶ Presumptive annual emission rate of **1,500 lb/MWh-gross**

NSPS Subpart UUUU - Emission Guidelines for Existing EGUs – Categories (Gas-Fired Generating Units)



► **Baseload**

- Annual capacity factor $\geq 45\%$
- BSER: routine methods of operation and maintenance
- Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)
- Presumptive annual emission rate limit of 1,300 lb CO₂/MWh-gross

► **Intermediate load**

- Natural gas-fired steam generating units with an annual capacity factor $\geq 8\%$ and $< 45\%$
- BSER: routine methods of operation and maintenance
- Emission limitation: 0% increase in emission rate (lb CO₂/MWh-gross)
- Presumptive annual emission rate limit of 1,500 lb CO₂/MWh-gross

► **Low load**

- Natural gas-fired steam generating units with an annual capacity factor $< 8\%$
- No BSER or emission limitation requirements

NSPS Subpart UUUUb - Emission Guidelines for Existing EGUs – Categories (Combustion Turbines)



Carbon capture and storage (“CCS”) existing combustion turbine generating units

- ▶ Natural gas fired stationary combustion turbines choosing carbon capture and storage
- ▶ BSER: 90% capture of CO₂
- ▶ Emission limitation: 89% reduction in emission rate (lb CO₂/MWh-gross)



Hydrogen co-fired existing combustion turbine generating units

- ▶ Natural gas fired turbines choosing to co-fire low-GHG hydrogen
- ▶ BSER:
 - Hydrogen co-firing at a level of 30% by volume starting January 1, 2032
 - Hydrogen co-firing at a level of 96% by volume starting January 1, 2038
- ▶ Emission limitation:
 - 12% reduction in emission rate (lb CO₂/MWh-gross) starting January 1, 2032
 - 88.4% reduction in emission rate (lb CO₂/MWh-gross) starting January 1, 2038

NSPS Subpart UUUUb – Emission Guidelines for Existing EGUs – Methodology



▶ Part 75 reporting (CAMD)

- Most representative continuous 8-quarter period within the 5 years immediately prior to final publication date
- Total CO₂ emissions divided by total gross electricity generation (MWh) = baseline CO₂ performance (lb CO₂/MWh, gross)

▶ Remaining Useful Life and other Factors (RULOF)

- May determine that BSER cannot be reasonably applied to achieve the emission limitation
- Unreasonable cost of control resulting from plant age, location or basic process design
 - Must consider cost as \$/ton CO₂ reduced and \$/MWh electricity generated

NSPS Subpart UUUUb - Emission Guidelines for Existing EGUs – Decisions and Notifications



- ▶ Permits must include requirements to shutdown by certain dates to meet category
- ▶ Steam Generating EGUs:
 - **Must notify** the state, EPA and post on Website final subcategory designation and standards of performance by **July 1, 2029**
- ▶ Turbines:
 - **Must notify** the state, EPA and post on Website final subcategory designation and standards of performance by **July 1, 2031**
- ▶ Owners must establish a publicly accessible website and post relevant documents to the website
 - Plans
 - Emissions
 - Increments of Progress
 - Demonstrations of Compliance
 - Deviations



NSPS Subpart UUUUb - Emission Guidelines for Existing EGUs – Increments of Progress



- ▶ Owners must submit final control plan to air pollution agency
 - Analysis for control strategy, design basis for modification at the facility
 - Feasibility and/or front-end engineering and design study (FEED study)
 - Timeline to achieve full compliance
 - Benchmarks
- ▶ Completion of awarding contracts
- ▶ Initiation of on-site construction
- ▶ Completion of on-site construction
- ▶ Commencement of permitting actions related to pipeline construction
 - Must demonstrate that they have commenced permitting actions by a date for natural gas pipeline, CO₂ pipeline or hydrogen pipeline



NSPS Subpart UUUUb - Emission Guidelines for Existing EGUs – General Timeline



State plans due to EPA two years after rule finalized



EPA has 12 months after complete plan is submitted to review approve or disapprove plan



Meaningful engagement with stakeholders



Link to the Proposed Regulations



<https://www.epa.gov/stationary-sources-air-pollution/greenhouse-gas-standards-and-guidelines-fossil-fuel-fired-power>

THANK YOU



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