

# Next Generation Regulations Affecting Stationary Gas Turbines in the U.S., Asia, South America, and Africa

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# Gas Turbine Association (GTA)

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- Founded in 1995
- The GTA Serves as the Unified Voice for the Gas Turbine Industry
  - Advocates for Gas Turbine R&D
  - Advocates for Rational and Achievable Emissions Regulations
- Committees
  - Government Affairs
  - Environment Affairs
  - Technical Affairs

## GTA Member Companies

Alstom Power - Florida Turbine Technologies - GE Energy

Meggitt Vibro-Meter Inc. - OPRA Turbines - PCC Airfoils

Pratt & Whitney - PW Power Systems - Siemens Energy

Solar Turbines Incorporated - Strategic Power Systems

# Agenda

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- U.S.
  - EGU GHG NSPS – New, Modified, and Reconstructed
  - EGU GHG NSPS – Existing Source Performance Standard (ESPS)
  - Proposed Revision to 8-hr Ozone Standard
  - 1-hr NO<sub>2</sub> Standard
  - PM<sub>2.5</sub>
- Asia
- South America
- Africa

EGU – Electric Generating Unit

GHG – GreenHouse Gas

NSPS – New Source Performance Standard

# EGU GHG NSPS for New, Modified, and Reconstructed Gas Turbines

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- Proposal Sets CO<sub>2</sub> Performance Standard for Gas Turbines That Supply More Than 1/3 of Their Potential Electric Output and More Than 219,000 MWh (25MW x 8760 hours) Net Electric Output to the Grid Per Year
- 1000 lb/MWh CO<sub>2</sub> if Design Heat Input >850 MMBtu/hr HHV (~100 MW)
  - Equivalent to Thermal Efficiency on Natural Gas of ~43.6%
- 1100 lb/MWh CO<sub>2</sub> if Design Heat Input <850 MMBtu/hr HHV (and >250 MMBtu/hr HHV, ~25 MW)
- Emissions Standards are Based on a 12-month Rolling Average Including All Potential Operating Conditions
- Separate Emissions Level Proposal for Coal Plants
- To Be Finalized in Summer 2015

- EGU – Electric Generating Unit
- GHG – GreenHouse Gas
- NSPS – New Source Performance Standard

# EGU GHG NSPS for New, Modified, and Reconstructed Gas Turbines

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- GTA's Primary Comments to Proposal
  - Suggested a 1,200 lbs CO<sub>2</sub>/MWh Emissions Standard
  - Exclude Simple Cycle Gas Turbines or Adopt a Sliding Capacity Scale Based on the Gas Turbine Efficiency
  - Exempt Startup/Shutdown and Load Operation Below 50%
  - Exempt Combined Heat and Power (CHP) Units
  - Exclude from Compliance Averaging the Emissions That Occur When Alternative Fuels Are During Emergencies, or When Natural Gas Is Curtailed (or Unavailable)

A full copy of the GTA comments are available on [www.gasturbine.org](http://www.gasturbine.org)

# EGU GHG NSPS for New, Modified, and Reconstructed Gas Turbines

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- Other GTA Comments

- Modify The Cut-Point Between Large and Small Gas Turbines to a Level of 1,500 MMBtu/hr HHV (~150 MW)
- Ensure The Regulation Does Not Discourage Adoption of Combined Cycle Gas Turbines
- Determine Compliance With a CO<sub>2</sub> lb/MWh Standard at the Maximum Continuous Rating Point of the Gas Turbine and Steam Turbine During the Initial Performance Testing on Natural Gas
- Simplify the Method for Computing the 12-Month Rolling Average
- Specifically Prohibit the NSPS CO<sub>2</sub> Limit From Being Adopted as the Presumptive CO<sub>2</sub> BACT Level for Simple Cycle Turbines
- Utilize The Option of a New NSPS Subpart TTTT Versus Including Language in Subparts Da or KKKK

# EGU GHG NSPS for New, Modified, and Reconstructed Gas Turbines

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- Impacts to Gas Turbine Markets
  - Potential To Discourage Use of Simple Cycle Turbines
    - Simple Cycle Needed for Grid Stability to Support Deployment of Renewables
    - Risk of Non-Power Generation Simple Cycle Turbines to be Captured
  - Discourages Use of Back-Up Fuels Which are Necessary to Ensure Grid Stability
  - May Promote User to NOT Interconnect to Avoid Regulation
  - Could Favor Non-Affected Combustion Sources
    - Discourage Gas Turbines Compared to Other Cycles
  - Rule Places Unnecessary Regulatory Burden on Combined Heat and Power

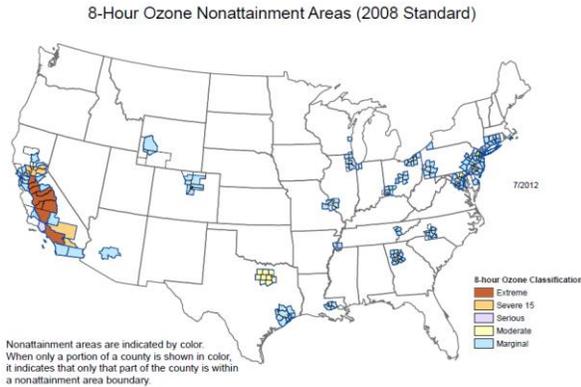
# Existing Source Performance Standard

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- EPA's Proposal to Regulate CO<sub>2</sub> Emissions from Existing Power Plants
- Proposal Establishes State Specific Emissions Targets
- Impetus is on States to Design, Implement, and Comply
- Very Controversial Proposal
- Many Believe Proposal Oversteps EPA's Authority
- Combined Cycle Gas Turbines Can Fill a Gap Due to Lower CO<sub>2</sub> Emissions
- Utilization of Gas Turbines Likely To Increase So States Can Meet Targets
- To Be Finalized in Summer 2015

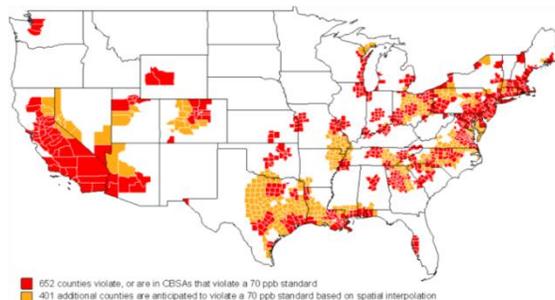
# Proposed Revision to 8-hr Ozone Standard

## CURRENT OZONE STANDARD 75 PPB

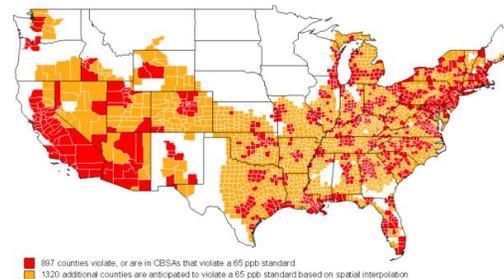


- Ozone Standards at the Levels in EPA’s Proposal Could Push Virtually the Entire Country Into “Nonattainment”
- EPA Proposed a Level Between 65 and 70 ppb
- Final Rule in Late ‘15 or Early ‘16
- Several Years to Implement, Litigation Delays Likely
- GTA Commented to EPA to Maintain Current Standard at 75 ppb and Allow the 2008 Standard to be Fully Implemented
  - 23 States, National Association of Manufacturer’s (NAM), U.S. Chamber, Council of State Governments, and Numerous Trade Organizations Also Commented to EPA to Maintain the Current Standard

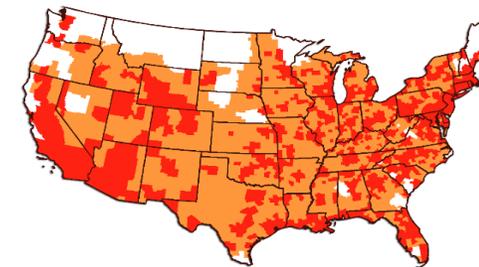
## PROJECTED IMPACT AT 70 PPB



## PROJECTED IMPACT AT 65 PPB



## PROJECTED IMPACT AT 60 PPB



# 1-hr NO<sub>2</sub> Standard

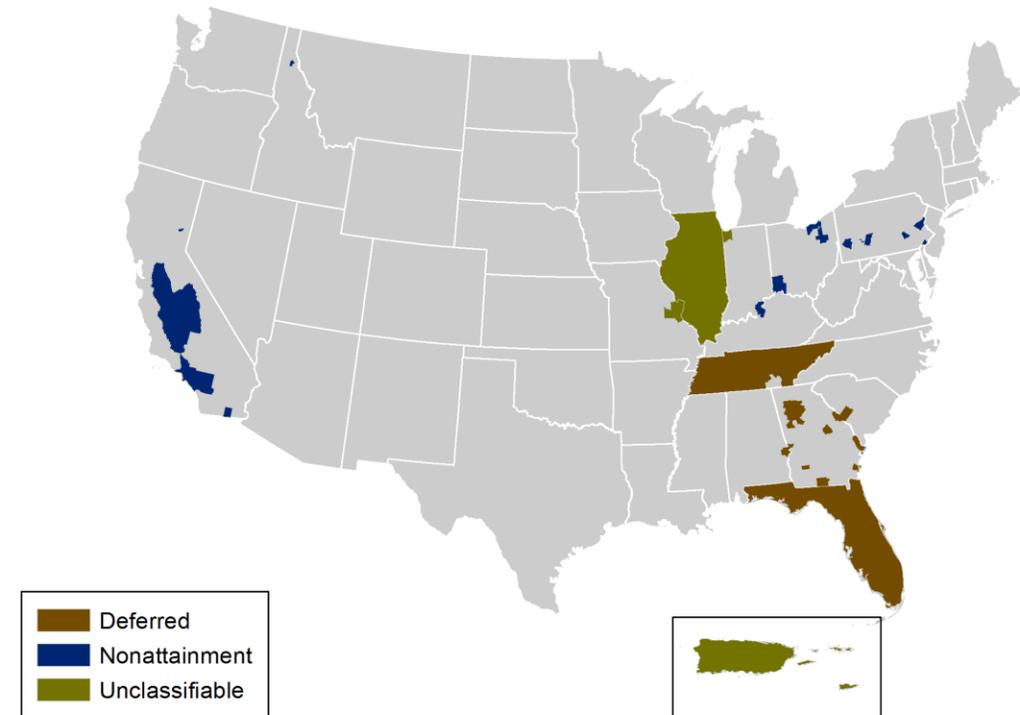
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- Original 1971 ('85 and '96) Annual Standard
- EPA Promulgated a 1-hr NO<sub>2</sub> NAAQS (2010)
  - 100 ppb 1-hr Average Is Much More Stringent Than Long Standing 53 ppb Annual Standard
- New Standard has Significant Impact on Industrial Point Source Air Quality Compliance
- Dispersion Modeling Challenges
  - AERMOD Is Believed to Over Predict By a Factor of 2 Or More
- Challenging for New State-of-the-Art Facilities to Pass Modeling
  - Especially Impacts Gas Turbine Installations During Start-up and Shutdown
  - May Drive Emissions Reductions on Existing Equipment to Pass Modeling
  - Some Will Make It, Others Won't
- Compliance Being Determined by Computer Models vs. Ambient Monitoring

# PM<sub>2.5</sub> Challenges

- Federal Permitting Modification Thresholds Are Low
  - 10 tpy for PM<sub>2.5</sub>
  - 15 tpy for PM<sub>10</sub>
- Annual Ambient Standard is Low
  - 12 mg/Nm<sup>3</sup> (Was 15 mg/Nm<sup>3</sup>)
- Dispersion Modeling Challenges
- Offsets Not Available in Some Non-Attainment Areas
- Testing Error is the Largest Contributor to PM<sub>10/2.5</sub> Emissions Compliance Demonstration

2012 Annual PM<sub>2.5</sub> Designations



# Asia

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- Fuel Flexibility, Not Emissions Control, is Market Driver
- Significant Volumes of LNG Coming On-Line
- Abundant Natural Gas Resources Driving Shift to Natural Gas
- Region Primarily Utilizes Conventional Combustion Design
- Old CHP Being Replaced With Gas Turbines
- Emissions Regulation Levels Often Not Tied to a Specific Combustion Technology Capability



# South America

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- Regulatory Emissions Levels Vary Greatly Country to Country
- Some Countries Regulations Require Dry Low Emissions Levels of NO<sub>x</sub>
- In Other Countries, Higher NO<sub>x</sub> Levels are Acceptable
- Often Inconsistent Application of Regulation Within A Country
- World Bank Thermal Power Plant or General EHS Guidelines Occasionally Referenced on Non-World Bank Financed Projects



# Africa

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- Grid System Is Not Interconnected
  - Patchwork System Drives Smaller Systems
- South Africa Different Scenario Than Rest of Continent
  - Predominately Coal Based
- Vague and Unclearly Written Regulations and Inconsistent Emissions Levels Across Industry Type
- World Bank Thermal Power Plant or General EHS Guidelines Sometimes Referenced Non-World Bank Financed Projects



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# Thank You!

[www.gasturbine.org](http://www.gasturbine.org)