



Office of Air Quality Planning and Standards

Rulemaking for Greenhouse Gas Emissions from Electric Utility Generating Units

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**NETL CO₂ Capture Technology Meeting
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Agenda

- ▶ Background and Overview of CAA Section 111
- ▶ Electric Power – Generation and Emissions
- ▶ Rule Development – Listening Sessions



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Background

- ▶ On December 15, 2009 (74 FR 66496), EPA published a notice indicating that the EPA Administrator found that the current and projected atmospheric concentrations of GHGs are reasonably anticipated to endanger the public health and welfare of current and future generations (Endangerment Finding).

- ▶ On December 23, 2010, EPA announced that it entered into a proposed settlement agreement to issue rules that will address GHG emissions from certain fossil fuel-fired EGUs.

- ▶ Rules would establish
 - ▶ new source performance standards (NSPS) for new and modified fossil fuel-fired EGUs, and
 - ▶ emission guidelines for existing fossil fuel-fired EGUs.

- ▶ Under the agreement, EPA committed to issuing
 - ▶ proposed regulations by July 26, 2011 (later modified to September 30, 2011), and
 - ▶ final regulations by May 26, 2012.



Definitions

- ▶ *Electric utility generating unit (EGU)* - any electric generating unit that is constructed for the purpose of supplying more than one-third of its potential electric output capacity and more than 25 MWe output to any utility power distribution system for sale.
- ▶ *Fossil fuel* - natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such material for the purpose of creating useful heat.



CAA Section 111 Overview

- ▶ There are two particularly relevant provisions:
 - ▶ CAA section 111(b) requires EPA to regulate new and modified sources
 - ▶ CAA section 111(d) requires EPA to establish emission guidelines under which States will regulate existing sources.
- ▶ EPA may distinguish among classes, types, and sizes within categories of sources for the purpose of establishing standards.



Section 111(b) – New Sources

- ▶ New Source Performance Standards (NSPS) are issued for categories of sources which cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.
- ▶ NSPS are set at the Federal level and States do not have the flexibility to approve less stringent requirements.
- ▶ NSPS reflect the degree of emission limitation achievable through application of the best system of emission reduction which, taking into consideration the cost of achieving such reduction, any non-air quality health and environmental impact, and energy requirements, the Administrator determines has been adequately demonstrated.
 - ▶ Level of control referred to as Best Demonstrated Technology (BDT)
- ▶ NSPS are to be reviewed at least every 8 years and revised if appropriate.



Section 111(d) – Existing Sources

- ▶ Emission guidelines are established for source categories that emit pollutants not regulated under other parts of the CAA and to which an NSPS would apply if such existing source were a new source.
- ▶ Because section 111(d) only applies to pollutants not regulated under other parts of the CAA, it has been used very infrequently.
- ▶ Under section 111(d), EPA does not set explicit emission standards on individual sources, rather it develops emission guidelines.
 - ▶ While called “guidelines,” they go through notice and comment, and are binding on states.
- ▶ States must promulgate rules that are consistent with the emission guidelines.



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GHG Emissions Across Sectors

GHG Emissions in U.S. (million metric tons of CO₂ equivalent)

Gas/Source Type	1990	2000	2009
CO₂	5100.2	5976.2	5508.1
Fossil Fuel Combustion	4741.2	5597.7	5212.0
Non-Energy Use of Fuels	116.2	142.5	122.1
Iron and Steel Production & Metallurgical Coke Production	99.5	85.9	42.6
Natural Gas Systems	37.6	29.9	32.2
Cement Production	33.3	41.2	29.4
Incineration of Waste	8	11.1	12.3
Ammonia Production and Urea Consumption	16.8	16.4	11.8
Lime Production	11.5	14.1	11.2
Cropland remaining Cropland	7.1	7.5	7.8
Limestone and Dolomite Use	5.1	5.1	7.6
Soda Ash Production and Consumption	4.1	4.2	4.3
Aluminum Production	6.8	6.1	3.0
Petrochemical Production	3.3	4.5	2.7
Carbon Dioxide Consumption	1.4	1.4	1.8
Ferroalloy Production	2.2	1.9	1.6
Titanium Dioxide Production	1.2	1.8	1.5
Wetlands remaining Wetlands	1	1.2	1.1
Phosphoric Acid Production	1.5	1.4	1

Source: Table ES-2 of EPA's Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2009, February 15, 2011



GHG Emissions - Energy Sector



Energy Sector GHG Emissions (million metric tons of CO₂ equivalent)

Gas/Source Type	1990	2000	2009
CO₂	4903.6	5781.7	5379.0
Fossil Fuel Combustion	4741.2	5597.7	5212.0
<i>Electricity Generation</i>	1820.8	2296.9	2154.0
<i>Transportation</i>	1485.9	1809.5	1718.9
<i>Industrial</i>	849.3	853.9	738.4
<i>Residential</i>	338.3	370.7	340.2
<i>Commercial</i>	219.0	230.8	218.8
<i>U.S. Territories</i>	27.9	35.9	41.7
Non-Energy Use of Fuels	116.2	142.5	122.1
Natural Gas Systems	37.6	29.9	32.2
Incineration of Waste	8.0	11.1	12.3
Petroleum Systems	0.6	0.5	0.5

Source: Table 2-4 of EPA's Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2009, February 15, 2011

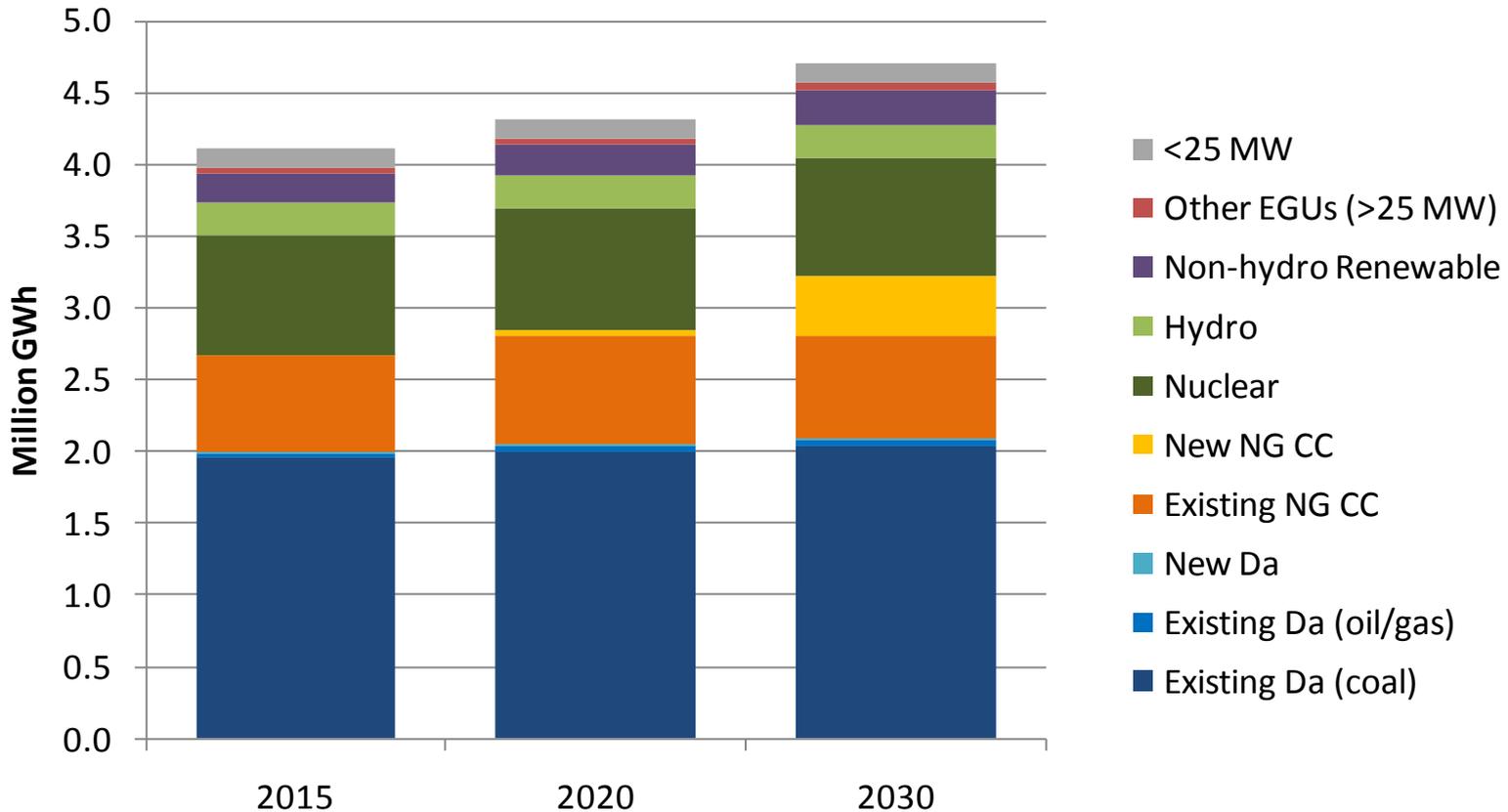
Federal Projections for New Generation



- ▶ Major drivers for new generation projections include:
 - ▶ Low projected electric demand growth
 - ▶ Low projected natural gas prices
 - ▶ Unused natural gas capacity
 - ▶ Projected renewable builds to meet increasing renewable portfolio standards

- ▶ Because of these factors, the only new coal that EPA and EIA project beyond that which is currently being constructed is a small amount of coal with carbon capture and storage incentivized by existing federal programs

Projected Distribution of Generation for New and Existing EGUs

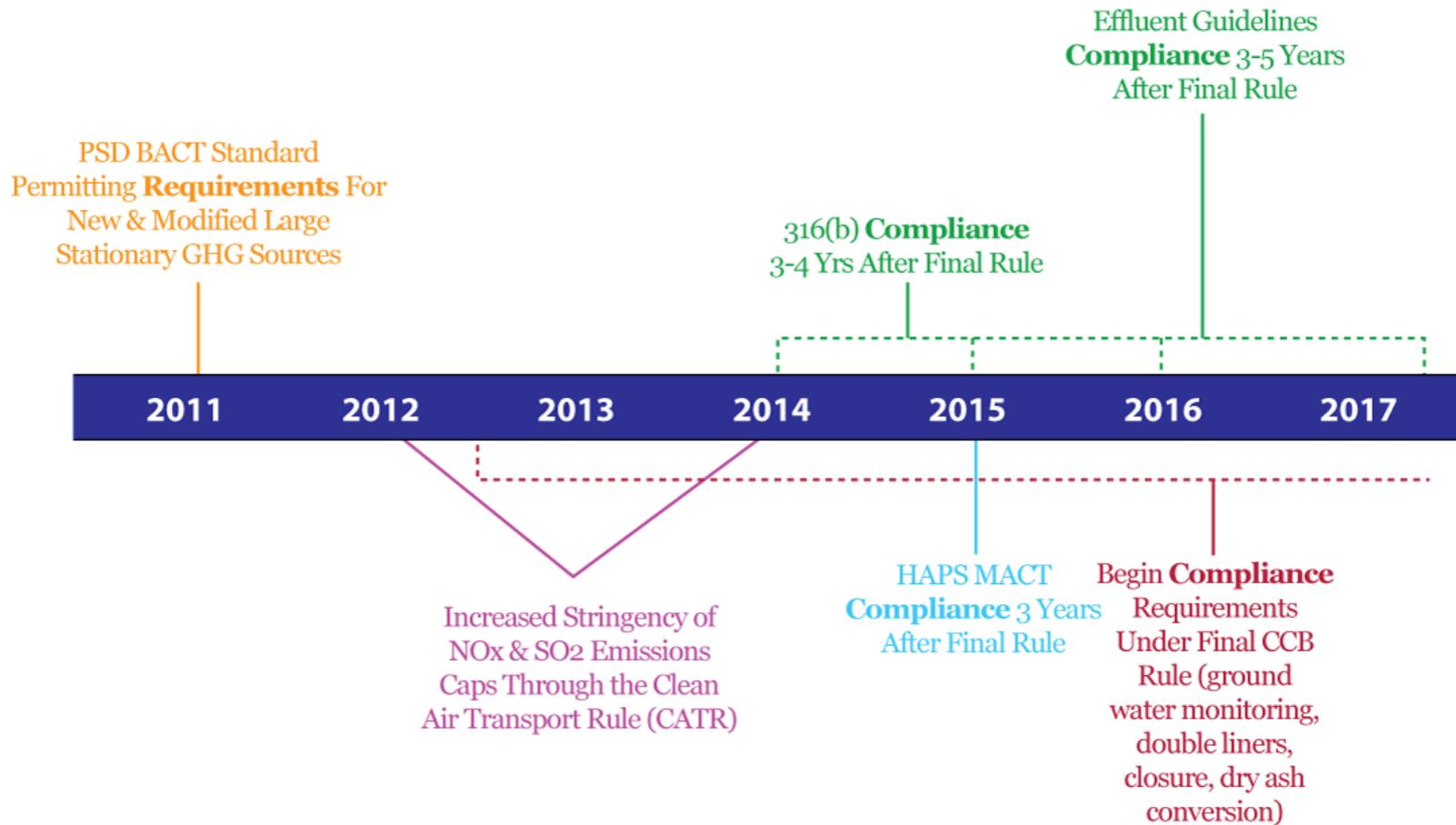


Subpart Da (boilers), combined cycle, nuclear, hydro, and non-hydro renewable generation from units greater than 25 MW.

Source: Integrated Planning Model (IPM) run by EPA, 2011



Regulatory Compliance Obligations for the Utility Industry



Source: WRI Analysis based on Edison Electric Institute 2010, Wegman EPA 2003

OAQPS

NOTE: Clean Air Transport Rule was recently proposed as the Cross State Air Pollution Rule (CSAPR).



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Summary of Listening Sessions



- ▶ **Electric Power Industry**
 - ▶ Allow for fleet wide averaging
 - ▶ Give credit for replacement of older less efficient generation
- ▶ **Coalition Groups**
 - ▶ Allow for State programs to be deemed equivalent
 - ▶ Provide market-based flexibility
 - ▶ Recognize early action
- ▶ **State and Tribal Representatives**
 - ▶ Allow for State programs to be deemed equivalent
 - ▶ Reward the very best possible systems available
 - ▶ Take a multi-pollutant approach
- ▶ **Environmental and Environmental Justice**
 - ▶ Allow for State programs to be deemed equivalent
 - ▶ Recognize environmental benefit of non-emitting technologies
 - ▶ No special considerations for biomass
 - ▶ Aggressive GHG approach will reduce other pollutants as well

CO₂ Emissions Control Technologies



- ▶ General types of control measures for CO₂ emissions:
 - ▶ Energy efficiency
 - ▶ Reduce the amount of fuel used by improving the efficiency of the electrical generation process
 - ▶ Carbon capture
 - ▶ Separate the CO₂ for long-term storage using carbon capture technology
 - ▶ Other measures
 - ▶ Co-firing
 - ▶ Fuel switching

Coal Steam Electricity Generating Units by Size, Age, Capacity and Efficiency (heat rate)

Unit Size Grouping (MW)	# of Units	% of all units	Average Age	Avg Capacity (MW)	Total Capacity (MW)	% of Total Capacity	Avg Heat Rate (Btu/Kwh)
0 to 25	193	15%	45	15	2,849	1%	11,154
>25 to 49	108	9%	42	38	4,081	1%	11,722
50 to 99	162	13%	47	75	12,132	4%	11,328
100 to 149	269	21%	49	141	38,051	12%	10,641
150 to 249	81	6%	43	224	18,184	6%	10,303
250 and up	453	36%	34	532	241,184	76%	10,193
Totals	1266				316,480		



Carbon Capture & Storage

- ▶ There are no insurmountable technological, legal, institutional, or other barriers that prevent carbon capture and storage (CCS) from playing a role in reducing GHG emissions.
 - ▶ Current technologies could be used to capture CO₂ from new and existing fossil energy power plants; however they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application.
 - ▶ CCS retrofits could face challenges at some existing plants due to space and configurational limitations or proximity to a CO₂ pipeline or geologic storage.
- ▶ Federal research, development and demonstration efforts are focused on reducing costs of CCS to facilitate widespread cost-effective deployment after 2020.
 - ▶ Approximately 70–90% of CCS cost is associated with capture and compression.
 - ▶ The cost and performance of CCS technologies will evolve with longer-term testing.



Questions?

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